JESUIT STUDIES – *Modernity through the Prism of Jesuit History*

Maximilian Hell (1720–92) and the Ends of Jesuit Science in Enlightenment Europe

Per Pippin Aspaas and László Kontler

BRILL

Maximilian Hell (1720–92) and the Ends of Jesuit Science in Enlightenment Europe

Jesuit Studies

MODERNITY THROUGH THE PRISM OF JESUIT HISTORY

Editor

Robert A. Maryks (*Independent Scholar*)

Editorial Board

James Bernauer, S.J. (*Boston College*)
Louis Caruana, S.J. (*Pontificia Università Gregoriana, Rome*)
Emanuele Colombo (*DePaul University*)
Paul Grendler (*University of Toronto, emeritus*)
Yasmin Haskell (*University of Western Australia*)
Ronnie Po-chia Hsia (*Pennsylvania State University*)
Thomas M. McCoog, S.J. (*Loyola University Maryland*)
Mia Mochizuki (*Independent Scholar*)
Sabina Pavone (*Università degli Studi di Macerata*)
Moshe Sluhovsky (*The Hebrew University of Jerusalem*)
Jeffrey Chipps Smith (*The University of Texas at Austin*)

VOLUME 27

The titles published in this series are listed at *brill.com/js*

Maximilian Hell (1720–92) and the Ends of Jesuit Science in Enlightenment Europe

By

Per Pippin Aspaas
László Kontler

BRILL

LEIDEN | BOSTON

BRILL OPEN

This is an open access title distributed under the terms of the CC-BY-NC-ND 4.0 License, which permits any non-commercial use, distribution, and reproduction in any medium, provided the original author(s) and source are credited.

The publication of this book in Open Access has been made possible with the support of the Central European University and the publication fund of UiT The Arctic University of Norway.

Cover illustration: Silhouette of Maximilian Hell by unknown artist, probably dating from the early 1780s. (In a letter to Johann III Bernoulli in Berlin, dated Vienna March 25, 1780, Hell states that he is trying to have his silhouette made by "a person who is proficient in this." The silhouette reproduced here is probably the outcome.) © Österreichische Nationalbibliothek.

The Library of Congress Cataloging-in-Publication Data is available online at http://catalog.loc.gov

Typeface for the Latin, Greek, and Cyrillic scripts: "Brill". See and download: brill.com/brill-typeface.

ISSN 2214-3289
ISBN 978-90-04-36135-5 (hardback)
ISBN 978-90-04-41683-3 (e-book)

Copyright 2020 by the Authors. Published by Koninklijke Brill NV, Leiden, The Netherlands.
Koninklijke Brill NV incorporates the imprints Brill, Brill Hes & De Graaf, Brill Nijhoff, Brill Rodopi, Brill Sense, Hotei Publishing, mentis Verlag, Verlag Ferdinand Schöningh and Wilhelm Fink Verlag.
Koninklijke Brill NV reserves the right to protect the publication against unauthorized use and to authorize dissemination by means of offprints, legitimate photocopies, microform editions, reprints, translations, and secondary information sources, such as abstracting and indexing services including databases. Requests for commercial re-use, use of parts of the publication, and/or translations must be addressed to Koninklijke Brill NV.

This book is printed on acid-free paper and produced in a sustainable manner.

Contents

Acknowledgments VII
List of Illustrations IX
Bibliographic Abbreviations X

Introduction 1
1 Enlightenment(s) 7
2 Catholic Enlightenment—Enlightenment Catholicism 11
3 The Society of Jesus and Jesuit Science 17
4 What's in a Life? 26

1 Shafts and Stars, Crafts and Sciences: The Making of a Jesuit Astronomer in the Habsburg Provinces 37
1 A Regional Life World 37
2 Turbulent Times and an Immigrant Family around the Mines 44
3 Apprenticeship 53
4 Professor on the Frontier 76

2 Metropolitan Lures: Enlightened and Jesuit Networks, and a New Node of Science 91
1 An Agenda for Astronomic Advance 91
2 Science in the City and in the World: Hell and the *respublica astronomica* 106

3 A New Node of Science in Action: The 1761 Transit of Venus and Hell's Transition to Fame 134
1 A Golden Opportunity 134
2 An Imperial Astronomer's Network Displayed 144
3 Lessons Learned 155
4 "Quonam autem fructu?" Taking Stock 166

4 The North Beckons: "A desperate voyage by desperate persons" 172
1 Scandinavian Self-Assertions 174
2 The Invitation from Copenhagen: Providence and Rhetoric 185
3 From Vienna to Vardø 195

5 He Came, He Saw, He Conquered? The *Expeditio litteraria ad Polum Arcticum* 209
1 A Journey Finished and Yet Unfinished 210

2 Enigmas of the Northern Sky and Earth 220
3 On Hungarians and Laplanders 230
4 Authority Crumbling 256

6 "Tahiti and Vardø will be the two columns [...]": Observing Venus and Debating the Parallax 258
1 Mission Accomplished 260
2 Accomplishment Contested 269
3 A Peculiar *Nachleben* 298

7 Disruption of Old Structures 305
1 Habsburg Centralization and the De-centering of Hell 306
2 Critical Publics: Vienna, Hungary 315
3 Ex-Jesuit Astronomy: Institutions and Trajectories 330

8 Coping with Enlightenments 344
1 Viennese Struggles 344
2 Redefining the Center 366

Conclusion: Borders and Crossings 388

Appendix 1 Map of the Austrian Province of the Society of Jesus (with Glossary of Geographic Names) 394
Appendix 2 Instruction for the Imperial and Royal Astronomer Maximilian Hell, S.J. 398
Bibliography 400
Index 459

Acknowledgments

This book owes its existence to the forms of academic sociability characteristic of the twenty-first-century Republic of Letters. The two authors became aware of each other's work via internet searches. They then further explored mutual interests by email. They first met in person at a conference in Barcelona in 2010, and then at a *dissertatio viva* in Tromsø, Norway, in May 2012 (in the roles of author and reviewer, respectively). Their comradeship was sealed during a trip, in the footsteps of their hero and the protagonist of this book, to the Island of Vardø for the observation of the 2012 transit of Venus. The idea of a jointly written book is yet more recent.

Apart from our indebtedness to one another, we have accumulated a huge debt of gratitude to many institutions and individuals. First among the former are UiT The Arctic University of Norway in Tromsø and Central European University in Budapest, not only as congenial environments to nurture, discuss, and mature the ideas contained in these pages but as sources of generous support for our research, and even the preparation of the manuscript for publication. Special mention must be made of many libraries and archives, in particular the kindness and expertise of librarians and archivists, who have supported our work across Austria, Hungary, Slovakia, Romania, Germany, Denmark, Sweden, Norway, Russia, France, Switzerland, the United Kingdom, and Italy. During the advanced stages of writing, László held a Senior Fellowship at the Lichtenberg Kolleg at Georg August University (Göttingen), a Fernand Braudel Fellowship at the European University Institute (Florence), and a Leverhulme Visiting Professorship at the University of Cambridge, which secured ideal conditions for concentrating on this project. Per Pippin has, for his part, benefited from liberal working conditions at the University Library of Tromsø, with grants from the EU COST Action "Reassembling the European Republic of Letters" led by Howard Hotson (Oxford) facilitating the occasional research trip to archives or conferences. His doctoral thesis, upon which parts of this book are modulated, was originally sponsored by the Research Council of Norway, with additional grants from the Nordic Sámi Institute (Kautokeino/Guovdageaidnu) and Tromsø Geophysical Observatory.

Colleagues from whom we drew a great deal of encouragement, inspiration, support, and advice during various stages of working on this project include Hans Erich Bödeker, Wendy Bracewell, Stéphane van Damme, Emese Egyed, Robert Evans, István Fazekas, Maria Firneis, András Forgó, Martin van Gelderen, Dezső Gurka, Rune Blix Hagen, Truls Lynne Hansen, Dominik Huenniger, Catherine Jami, Zsófia Kádár, Eva Kowalska, Anthony LaVopa, Antal

Molnár, István Németh, Krisztina Oláh, András Oross, the late Thomas Posch, William O'Reilly, Antonella Romano, Simon Schaffer, Silvia Sebastiani, Ann Thomson, Zsuzsanna Borbála Török, Nils Voje Johansen, and Richard Whatmore. The manuscript has been read and helpfully commented on, in whole or in part, by Gábor Almási, Piroska Balogh, Daniel Margocsy, Andreas Klein, Katalin Szende, Zsuzsa C. Vladár, Thomas Wallnig, and the two anonymous reviewers commissioned by the publisher. Katalin Pataki expertly produced the maps of Hell's networks, and Tim Page polished our English prose and undertook the unpleasant chore of putting together the bibliography. We are tremendously grateful to them all, while all remaining shortcomings are naturally our sole responsibility.

Both of us have published several articles and book chapters in which topics of this volume figure prominently. These are referred to in the notes and the bibliography. We are grateful to the publishers of these works for the opportunity of piloting our research and our ideas. However, each of these studies has been very substantially reworked, and the material discussed in them has been rearranged, so that textual overlap is minimal, and this book is an independent and original publication.

In keeping with the conventions of the publisher, all quotations from languages other than English have been translated, usually without mention or spelling out of the original wordings. Unless otherwise noted, the translations are by the authors.

As always, a final word of thanks must go to our families and friends, who stood by with patience and understanding, even empathy for our infatuation with a grumpy and conceited character whose ideas and ideals belong to a world other than ours. We can only hope to be ever able to reciprocate.

On the 250th anniversary of our protagonist's observation of the transit of Venus between the Sun and the Earth,

Per Pippin Aspaas and László Kontler
Tromsø and Budapest
June 3, 2019

Illustrations

Figures

1 The astronomer Maximilian Hell. Mezzotint (1771), by Johann Elias Haid (1739–1809). Hungarian National Museum xii

2 Map of source locations of observation reports published in the *Ephemerides* 112

3 Map of Hell's correspondence 115

4 The shift of Venus's path from two sites of observation 139

5 From Hell's manual for the 1761 transit of Venus 139

6 The black-drop effect 158

7 The ship of Hell and his associates approaching Kjelvik, the last harbor before reaching Vardø. Drawing by Hell, published in the Ephemerides of 1791 206

8 Map of the Island of Vardø and with the nearby islands and the coast of Finnmark, by Hell and the engraver M. T. Sallioth (Insula WARDOEHUUS cum Adjacentibus Insulis et Littore Finn marchico, a Maximiliano Hell; M. T. Sallioth fec. [Vienna, 1772]). Hungarian National Library, Map Department, TR 8 116 207

9 The house of Hell and Sajnovics at Vardø, with the observatoriola on the left. Drawing by Hell, published in the Ephemerides of 1791 208

10 Maximilian Hell. Copperplate by the Augsburg miniature artist Johann Esaias Nilson (1721–88), based on a drawing by Wenzel Pohl (1720–90) 219

11 Sámi community, drawing by unknown artist, with annotations by Hell. Universitätssternwarte Wien, Manuscripte Hell 234

12 Prince Árpád acknowledged as principal leader by raising on the shield ("in a Khazarian style") by the Magyar chieftains and their allies. Illustration of a map of ancient Hungary drawn by Hell on the basis of Anonymus's Gesta Hungarorum (Tabula geographica Ungariae Veteris Ex Historia Anonymi Belæ Regis Notarii, a P. Maximiliano Hell S.I. Gabriel Ruderstorffer [Vienna, 1772]). Hungarian National Library, Map Department, TR 378 248

Map

1 Map of the Austrian province of the Society of Jesus 395

Bibliographic Abbreviations

Ephemerides	*Ephemerides Anni* [...] *ad meridianum Vindobonensem jussu Augustorum calculis definitae* [...]. Vienna.
HARS	*Histoire de l'Académie Royale des Sciences*. Paris.
JS	*Journal des Sçavans*. Paris.
KVAH	*Kongliga Vetenskaps Academiens Handlingar*. Stockholm.
NcASIP	*Novi commentarii Academiae Scientiarum Imperialis Petropolitanae*. St. Petersburg.
PTRSL	*Philosophical Transactions of the Royal Society of London*. London
Skrifter Kiøb.	*Skrifter, som udi det Kiøbenhavnske Selskab af Lærdoms og Videnskabers Elskere ere fremlagte og oplæste*. Copenhagen.

FIGURE 1 The astronomer Maximilian Hell in "Lappish garment"
Mezzotint (1771), by Johann Elias Haid (1739–1809). Digitized by the Hungarian National Museum

Introduction

> The letter of America's great son, Franklin, describing his experiments in electricity made in Philadelphia, to Collinson in London, is dated October 19, 1752. The same was also pursued in Europe by a few men, among whom Beccaria particularly distinguished himself. Hell, too, was occupied exactly during this time by similar physical experiments and thoughts, but he never made them public. Several souls may possess the power of inventing the same thing, but the circumstances do not assist the one as they do the other. […] The indefatigable Frantz appointed there [at the Viennese university observatory] Hell as director, and the tower owes its shape and arrangement to him. Why can such sons of the fatherland not have scope for their labors in their field here at home? Even if great minds are born to us, it is other lands that benefit from them. When Hell gave lessons in mechanics, so as to raise skilled and clever artists and craftsmen for Vienna, it was not our people who made progress.
>
> GÁBOR DÖBRENTEI, "Hell Maximilián élete" (The life of Maximilian Hell), in *Erdélyi Muzéum* (Pest: Trattner, 1817), 8:90, 91–92

• • •

> In the life of this man, we see a happy coincidence of circumstances under which his faculties and powers could be developed and perfected, and which earned him reputation among the mathematicians and astronomers of our times. The future preoccupations of his mind were presaged early on; his mind received a clear direction already in his tender youth, and the various situations in which Hell was later placed provided him with an opportunity to pursue this unhindered, and to earn himself everlasting merits with the perfection of his science.
>
> "Maximilian Hell," in *Nekrolog auf das Jahr 1792: Erhaltend Nachrichten von dem Leben merkwürdiger in diesem Jahre verstorbener Personen*, ed. Friedrich Schlichtegroll (Gotha: Perthes, 1793), 1:282–283

∴

In the image on the opposite page, a man is sitting in a composed, elegant, yet casual posture in front of his desk. His right elbow is resting on the desk; sheets

© PER PIPPIN ASPAAS AND LÁSZLÓ KONTLER, 2020 | DOI:10.1163/9789004416833_002
This is an open access chapter distributed under the terms of the CC-BY-NC-ND 4.0 License.

of paper on the desk and in his left hand, and a quill in an inkpot identify him as a man of letters; his two fingers gently touching the visible parts of a quadrant also point to expertise in using instruments of astronomical observation. In the picture hanging on the wall behind him, a shining celestial body in the dark sky is shedding bright light on a wooden building; the stark silhouettes create a sense of cold freshness—a contrast with the coziness of the interior, intimated by the grandfather clock in the background on the right, and the graceful fall of the drapery on the desk. The central figure may be past the prime of his life, but an upright back and muscular legs reveal him to be in a good physical condition: while a scholar, he is agile, not averse to exertion. His look, too, is lively, confident, and penetrating, yet benign. His cheeks seem slightly frostbitten, as if he had just rushed across the chilly space that separates the small house from his present seat. He has still not shed the outfit that protects him from a hostile climate and helps him get around: pointed footwear, to facilitate easy movement in thick snow, warm socks and scarf, a full-length fur coat, and an all-round fur cap that can be fastened under the chin.

As the inscription tells the viewer, the sitter is

> the reverend father Maximilian Hell of the Society of Jesus, royal and imperial astronomer, in his Lappish garment, having felicitously carried out the observation of the transit of Venus before the Sun's disc on June 3, 1769 at Vardøhus in Lapland, at the behest of Christian VII of Denmark and Norway.

The box-like structure attached to the wooden house in the picture is actually Maximilian Hell's (1720–92) and his associates' makeshift "observatory," its image being reproduced from Hell's own sketches. This mezzotint was executed, on the basis of a drawing by Wenzel Pohl, in 1771 by the Augsburg artist Johann Elias Haid (1739–1809)[1]—a keen and accomplished portraitist of contemporary celebrities from Alessandro Cagliostro (1743–95) through Jean-Jacques Rousseau (1712–78) and Voltaire (1694–1778) to German scholars like Johann Jakob Moser (1701–85), Johann Stephan Pütter (1725–1807), and Johann Joachim Winckelmann (1717–68)—at what is generally viewed as the climax of Hell's career: right after his return from the Arctic region, having successfully participated, at the helm of an expedition sponsored by the king of Denmark–Norway, in one of the emblematic collaborative ventures of eighteenth-century field

1 The print, at a price of one florin and twenty-five *kreuzers*, was recommended as "a nice present to the enthusiasts of Haid's works, and to scholars who appreciate the services of Mr. Hell" in the *Kayserlich königlich allergnädigst privilegirte Realzeitung* (hereafter: *Realzeitung*), no. 34 (August 17, 1771): 539–40.

science. Apart, perhaps, from the striking gaze of the protagonist and the reference in the inscription, it is hardly possible to identify him as a prominent Jesuit. The picture, while following iconographic traditions of representing "great men of science," is unusual in representing the full body of the sitter. It marks, in a generic manner, the triumph of metropolitan science and civility, reinforced by an ability to accommodate to the circumstances of a rough field, and to adopt from local interlocutors the means of overcoming its adversity.

From visual representation, let us now turn to the written testimonies on Hell cited above, not as contemporaneous as the portrait, but excerpted from assessments conceived within a generation of his death, in the style of the academic *éloge* established a century earlier by Bernard le Bovier de Fontenelle (1657–1757) as permanent secretary of the Académie Royale des Sciences in Paris. The first one was written by the Transylvanian Hungarian poet Gábor Döbrentei (1785–1851), and published in one of the locally important serial publications of the time dedicated to the cultivation and refinement of manners and letters, arts and sciences in a Hungary perceived as backward, edited by Döbrentei himself. While the account focuses on Hell's character, career, and achievements, and is generally imbued with appreciation and enthusiasm, the pessimistic tenor and substance of the selected passage conveys a sense of resignation deriving from such a perception of backwardness. "Circumstances" (*környülmények*) are alleged to set a major barrier for scholars from a marginal country, lagging behind in progress, which tends to prevent them from making a mark in the learned world. When they manage to rise to a recognized status, this supposedly occurs despite Hungary's circumstances, and frequently with the result that the "benefits" they produce do not have any fertilizing effect in their homeland.

The notions informing Haid's portrait and Döbrentei's eulogy are readily discernible in several strands of literature discussing Hell's life and work. Internationally, Hell has figured prominently in historical accounts of the "Venus transit enterprise," and generally in histories of astronomy in the eighteenth century and more broadly. These are predominantly "internalist" histories of science, preoccupied with the accuracy of measurements, the peculiarities of instrumentation, and other features that enable contemporary practitioners to enter into a meaningful professional dialogue with figures they identify as their predecessors.[2] These studies faithfully record Hell's contribution, as the

2 The Arctic expedition figures as an episode in Harry Woolf's (1923–2003) standard *The Transits of Venus: A Study of Eighteenth-Century Science* (Princeton: Princeton University Press, 1959), as well as several more recent surveys, in no small measure occasioned by the 2004 and 2012 transits. Eli Maor, *Venus in Transit* (Princeton: Princeton University Press, 2004); William Sheehan and John Westfall, *The Transits of Venus* (Amherst: Prometheus Books, 2004); Christophe Marlot, *Les passages de Vénus: Histoire et observation d'un phénomène astronomique*

leader of one of more than two dozen expeditions committed to the same task and scattered all over the globe, to the 1769 Venus transit observations and the ensuing calculations of the solar parallax (and, by implication, the distance between the Earth and the Sun). They also dwell on the dispute the results occasioned between Hell and several colleagues, particularly the Parisian astronomer Joseph Jérôme de Lalande (1732–1807), as well as the subsequent accusations that Hell had falsified data, and his "vindication" from these charges several decades later. These accounts are marked by generally sound scholarship, a fine eye for detail, and, sometimes, excellent story-telling and hilarious anecdotes, a sense for the drama and heroism, the hope and despair, the triumph and failure involved in the cultivation and progress of scientific knowledge, especially in field expeditions. However, they usually capture their subjects in static moments rather than in the dynamics of their movement across temporal and spatial boundaries, in real and symbolic terms. Apart from gestures toward the perceived need of paying attention to factors of patronage and institutional setting, they fail, or make little effort, to systematically acknowledge the character of scientific knowledge production as a social and cultural practice, one thoroughly intertwined with other similar practices, determined by and determining agendas other than deriving from the desire to advance the disciplines. The premises on which they rest are different from this book, and they are insufficiently contextualized.

The other thrust of modern scholarship, in which Hell is not merely a supporting cast member but takes center stage, and in which the attitude of Döbrentei may be traced, is even more pronouncedly conceived in the heroic mold, although the framing is different. In this literature, Hell has been hailed as the first[3] practitioner in his field in his home region who not only successfully adopted and applied the most recent—Newtonian—advances in the discipline but also made original and substantial contributions to its further development. As a statement of fact, this is not at all mistaken. What is noteworthy, however, is that this claim is combined not only with the sentimentalized

(Paris: Vuibert/Adept, 2004); Andrea Wulf, *Chasing Venus: The Race to Measure the Heavens* (New York: Penguin, 2012); Mark Anderson, *The Day the World Discovered the Sun: An Extraordinary Story of Scientific Adventure and the Race to Track the Transit of Venus* (Cambridge, MA: Da Capo Press, 2012).

3 Or, at any rate, one of the first: the Ragusan Ruggiero Giuseppe Boscovich/Ruđer Josip Bošković (1711–87) is a (more) famous contemporary counterpart. For overviews of his life and contributions, see Piers Bursill-Hall, "Introduction," in *R.J. Boscovich: Vita e attività scientifica; His Life and Scientific Work*, ed. Piers Bursill-Hall (Rome: Istituto della Enciclopedia Italiana, 1993), v–xxiii; Jonathan A. Wright, "Ruggiero Boscovich (1711–1787): Jesuit Science in an Enlightenment Context," in *Enlightenment and Catholicism in Europe: A Transnational History*, ed. Jeffrey D. Burson and Ulrich Lehner (Notre Dame: University of Notre Dame Press, 2014), 353–70.

image of a savant arising from a peripheral environment and heroically defying perceived marginality in order to advance mainstream Western science. It also implies the patriotic appropriation of Hell, by Hungarian and Slovak authors, for their own respective national scientific canons—based on the shaky foundation of his having been born and raised in a geographic territory then comprising the northern fringe of the Kingdom of Hungary, but transferred after the First World War to the new Czechoslovak state, and being part of Slovakia since the disintegration of Czechoslovakia in 1992.[4]

As a stepping stone for transcending the anachronism involved in such representations it is helpful to invoke the second quote introducing this introduction. The Thuringian teacher and scholar Anton Heinrich Friedrich Schlichtegroll (from 1808 von Schlichtegroll [1765–1822]) is best known for his short life of Wolfgang Amadeus Mozart (1756–91), published in the first volume of his obituaries on famous people who died in 1791, which was so successful that he launched a series (apparently, no longer writing the lives himself, but "collecting" them).[5] The passage quoted from the biography of Hell, contained in the second volume, is remarkable on account of its strikingly different use of "circumstance" from Döbrentei, where it serves to denote limiting conditions or constraints. Here, by contrast, we learn of "a happy coincidence of circumstances" (*Umstände*) and "various situations in which Hell was later placed," all providing him, as enabling conditions or stimulating provocations, with "opportunities" to exert active agency in "earning merits with the perfection of his science"—in negotiating and maintaining (if sometimes also losing) positions amid temporal and spatial transitions, in a career spanning half a century of significant political, intellectual, and cultural change, and traversing back and forth between local, regional, imperial, and global realms of experience.

Valuable contextualized historical studies of Hell have since been published, locating him more firmly and at the same time with greater plasticity in his contemporary milieux. Hell's "scientific environment in Vienna" has been explored in a great deal of detail, looking not merely to Vienna but the

4 A two-volume work devoted to "the memory of Maximilian Hell," a concise monograph on Hell as "an important figure of Slovak science," a host of relatively short Hungarian- and Slovak-language articles, and references in survey histories of Hungarian and Slovak astronomy belong here. See mainly Ferenc Pinzger, S.J., *Hell Miksa emlékezete*, 2 vols. (Budapest: Magyar Tudományos Akadémia, 1920 and 1927); Elena Ferencová, *Maximilián Hell významná osobnosť slovenskej vedy a techniky* (Bratislava: Asklepios, 1995). Both of these make available a respectable number of sources. A comprehensive bibliography on Hell and his fellow Jesuit Venus observer János (Joannes) Sajnovics, listing over six hundred titles, is also available; see Sándor Hadobás, *Hell Miksa és Sajnovics János bibliográfiája* (Rudabánya: Érc- és Ásványbányászati Múzeum Alapítvány, 2008).

5 Bernhard Ebneth, "Schlichtegroll, Friedrich von," in *Neue Deutsche Biographie* 23 (Berlin: Duncker & Humblot, 2007), 72–73.

Habsburg monarchy as a whole, especially in regard of the activities of the Society of Jesus and other Catholic orders.[6] Even more pertinently, the simplistic historiographical representations summarized above have also been challenged in a trans-regional study of Hell, looking at him in Central European and Scandinavian contexts, resorting to a combination of biographical reconstruction and the "relocation" of European and global astronomical knowledge as pursued in relation to the 1761 and 1769 transits of Venus.[7] The ambition of this book is different from, and perhaps larger than both. It cannot aspire to be a biography in the ordinary sense: the scarcity of available "ego-documents" and other sources that may shed light on Hell as a person with a "self" requires caution in this regard. Rather, it proposes to utilize Hell's embeddedness, simultaneously or in turns, in several eighteenth-century life worlds of differing scales, both real and symbolic, and the apparent facility with which he moved among them, for testing the permeability of the boundaries construed as separating them. By doing so, it hopes to reveal something interesting, from a non-metropolitan perspective, about the eighteenth-century European processes of shaping and exchanging knowledge. These worlds and "worlds" include the multi-ethnic and multi-confessional, small but prosperous and self-conscious urban centers of northern Hungary and Transylvania, with their traditions of mines, manufactures, good education, and self-government; the imperial metropoles of the Habsburgs and the Oldenburgs, both ambitious to consolidate their realms as empires and to enlist science in the service of this endeavor (and the staunch resistance it met in the case of the former from the elite of the Hungarian parts of the monarchy); the icy wilderness of the Arctic, with the opportunities it offered for scientifically penetrating unusual natural phenomena as well as human diversity; the cosmopolitan and Catholic hierarchy of the Society of Jesus; and the cosmopolitan and apparently non-hierarchical Enlightenment Republic of Letters. The "circumstances" that affected the ups and downs of Hell's career, presenting him with chances and raising barriers that challenged him to develop ever new strategies of accommodation and self-assertion, arose from the changes—some of them gradual, others abrupt, all of them significant—in the relation between these "worlds" over the half century of his active life. A consideration of the *jeux d'échelles*,

6 Nora Pärr, "Maximilian Hell und sein wissenschaftliches Umfeld im Wien des 18. Jahrhunderts" (PhD diss., University of Vienna, 2011; published Nordhausen: Bautz Verlag, 2013).

7 Per Pippin Aspaas, "Maximilianus Hell (1720–1792) and the Eighteenth-Century Transits of Venus: A Study of Jesuit Science in Nordic and Central European Contexts" (PhD diss., University of Tromsø, 2012); http://hdl.handle.net/10037/4178 (accessed April 8, 2019).

"scalar games"[8]—"trickster travels," one might say[9]—pursued by Hell among these poles highlights hitherto unappreciated dimensions of the dynamics of science, state-building, Enlightenment, and Catholicism in the Habsburg monarchy and beyond, in a period of dramatic transformations.

Before delving into the depths of this saga, the remainder of this introduction briefly examines the relevance to our subject of recent developments in Enlightenment studies, especially with regard to their integration with the study of Catholicism (the literature on the "Catholic Enlightenment"), including the Jesuit order and Jesuit science, and with the processes of state-building and cultural realignment known as enlightened absolutism. Next, while this is not a biography, the "life" of an individual is central to its argument to an extent that it is pertinent to ask how the present account may benefit from the recent emergence of a new style of historical biography. The engagement with both of these topics is not meant to be exhaustive: rather, it is confined to the aspects that seem relevant to the present undertaking.

1 Enlightenment(s)

It is helpful to continue by turning to yet another appreciation of Hell, this time cited from a piece of modern scholarship on the Society of Jesus in the Eastern European periphery: "While Hell's academic and scientific accomplishments place him firmly within the Enlightenment, he was also a product of the late Counter-Reformation culture of Hungary and one of several Jesuits who became identified with the development of Hungarian national consciousness."[10] Hell is only one, and by no means a central, figure in this analysis of "the politics of religious pluralism in eighteenth-century Transylvania." Nevertheless, this brief characterization raises interesting questions about the relationship that an eminent mid- to late eighteenth-century Jesuit scientist of Hell's peculiar background may have had to the various aspects, strains, and manifestations of the Enlightenment, and to the budding movements of national awakening in Central Europe that both incorporated the intellectual agendas of the Enlightenment and arose in response to them.

8 Cf. Jacques Revel, ed., *Jeux d'échelles: La micro-analyse à l'expérience* (Paris: Gallimard-Seuil, 1996).

9 The expression is borrowed, of course, from Natalie Zemon Davis, *Trickster Travels: A Sixteenth-Century Muslim between Worlds* (New York: Hill and Wang, 2006).

10 Paul Shore, *Jesuits and the Politics of Religious Pluralism in Eighteenth-Century Transylvania: Culture, Politics, and Religion, 1693–1773* (Aldershot: Ashgate, 2007), 105.

Our notion of the Enlightenment as a formative cultural and intellectual movement of European modernity is still very largely, and rightly, determined by Immanuel Kant's (1724–1804) famous 1784 essay "Answer to the Question: What Is Enlightenment?" As is well known, Kant defined Enlightenment as "daring to know" (*sapere aude*)—in broader terms, having the courage to rely solely on one's reason in making responsible moral decisions, to the exclusion of guidance by any real or supposed external authority—and as the pursuant "emancipation of humanity from its self-incurred immaturity."[11] As such, the Enlightenment is supposedly predicated on a character and set of values that are universally human and "cosmopolitan," as well as essentially secular and anti-authoritarian[12] (even though some interpretations have stressed its tendency to assume a specific kind of intransigent dogmatism, capable of lapsing into an authoritarianism worse than had ever been known before[13]). According to textbook knowledge, while cosmopolitan, the set of cultural and intellectual attitudes styled as "enlightened" seems to have been specifically bred (after some English and Dutch antecedents) within the confined milieu of French, particularly Parisian, literary and philosophical ambiences, from which they were disseminated elsewhere: as far as "diversity" in the European Enlightenment[14] emerged as a research question, it was explored in terms of the proximity achieved, or the distance still retained, vis-à-vis the Parisian model in a process of reception, the outcome of which was more or less predictable according to the level of overall social and cultural "development" in the recipient environment.[15]

Thanks to the more intense involvement of historians and in general contextually more sensitive scholars in academic work on the Enlightenment over the past two generations, this monolithic and "obvious" notion has undergone a series of important modifications. Overall, these changes amount to the extension of the very idea of the Enlightenment from a social and moral

11 Immanuel Kant, "Answer to the Question: What Is Enlightenment? [1784]," in *What Is Enlightenment? Eighteenth-Century Answers and Twentieth-Century Questions*, ed. James Schmidt (Berkeley: University of California Press, 1996), 58–64.

12 Peter Gay, *The Enlightenment: An Interpretation*, 2 vols. (New York: Knopf, 1967–69).

13 Theodor Adorno and Max Horkheimer, *Dialectic of Enlightenment* (Stanford: Stanford University Press, 2002 [1944/47]).

14 Roland Mortier, "Diversité des Lumières," in *Unité et diversité de l'empire des Habsbourg à la fin du XVIIIe siècle*, ed. Roland Mortier and Hervé Hasquin (Brussels: Editions de l'Université de Bruxelles, 1988), 15–24.

15 László Kontler, "The Enlightenment in Central Europe?," in *Discourses of Collective Identity in Central and Southeast Europe (1745–1945)*, vol. 1, *Late Enlightenment*, ed. Balázs Trencsényi and Michal Kopeček (Budapest: Central European University Press, 2006), 33–44.

philosophy of emancipation (and its literary manifestations) into a set of intellectual, cultural, and social practices. The goal of such practices was the accumulation and systematization of knowledge about man's natural, moral, and social environment, for the sake of improving this environment and thereby achieving happiness for humans—in this world, irrespective of beliefs held about the next one.[16] Besides allowing a more directly meaningful engagement, from the vantage point of Enlightenment studies, of areas from legislation, government, and policymaking through manners and sociability to the arts and sciences (pursuits governed by agendas deriving from beyond their narrowly conceived boundaries), this has also led to the rise of a new notion of the Enlightenment's much-vaunted "secularism," one less militant and dogmatic and more compatible with cultivating Christian belief and worship. To some, this seemed to be a dilution of the concept of Enlightenment, while to others it was an opportunity to understand the phenomenon in a dynamic, elastic, and perhaps historically more authentic manner. The emerging "plurality of Enlightenments" has been understood and analyzed from several perspectives, including "national,"[17] ideological ("radical" versus "conservative"),[18] and religious[19] contexts. It has been suggested that while the questions that exercised the minds of "the enlightened" were the same or at least very similar across the European continent and its colonial extensions, the answers depended on a broad variety of local or regional considerations and

16 See the overviews in John Robertson, *The Case for the Enlightenment: Scotland and Naples 1680–1760* (Cambridge: Cambridge University Press, 2005), 1–51; László Kontler, "Introduction: What Is the (Historians') Enlightenment Today?," *European Review of History/Revue d'histoire européenne*, special issue, "Enlightenment and Communication: Regional Experiences and Global Consequences," ed. László Kontler, 13, no. 3 (2006): 337–55.

17 Roy Porter and Mikuláš Teich, eds., *The Enlightenment in National Context* (Cambridge: Cambridge University Press, 1981)

18 J.G.A. [John Greville Agard] Pocock, "Clergy and Commerce: The Conservative Enlightenment in England," in *L'età dei lumi: Studi storici in onore di Franco Venturi*, ed. R. [Raffaello] Ajello, E. Cortese and Vincenzo Piano Mortari (Naples: Iovene Editore, 1985), 1:523–62; Pocock, *Barbarism and Religion*, 5 vols. (Cambridge: Cambridge University Press, 1999–2011); Jonathan Israel, *Radical Enlightenment: Philosophy and the Making of the Modern World* (Oxford: Oxford University Press, 2001); Israel, *Enlightenment Contested: Philosophy, Modernity, and the Emancipation of Man 1670–1752* (Oxford: Oxford University Press, 2006); Israel, *A Revolution of the Mind: Radical Enlightenment and the Intellectual Origins of Modern Democracy* (Princeton: Princeton University Press, 2009); Israel, *Democratic Enlightenment: Philosophy, Revolution, and Human Rights 1750–1790* (Oxford: Oxford University Press, 2011).

19 David Sorkin, *The Religious Enlightenment: Protestants, Jews, and Catholics from London to Vienna* (Princeton: Princeton University Press, 2008).

allegiances—while it is also true that subsequently they were again capable of assuming broader significance.[20]

What this leads us to acknowledge is that we need to pay more attention to the multilayered intellectual gravitation, cultural loyalty, social experience, and realms of existence or "life worlds" (*Lebenswelten*) of individual actors who move among these (national as well as sub- and supra-national; religious, professional, institutional, socio-cultural) realms with considerable ease.[21] In other words, it points to the recognition that if we want to understand springs of action, actions, and agents in the Enlightenment as they *were*, in and of themselves both "national" and "trans-national" frameworks of interpretation are inadequate, and we need one that takes account of the possibility and the reality of shifting accents and flexible adaptability between the one and the other of these "realms." Two metaphors are especially helpful in elucidating such a framework. One is the idea of the Enlightenment Republic of Letters as an "echo chamber."[22] In it, thanks to the medium of print culture and the proliferation of review journals, a plurality of voices would be rendered almost cacophonic by the near-inevitability of one's own utterances being critically responded to by a commentator with whom one was personally unacquainted. At the same time, and for the same reason, in this space it was always possible to appeal to an authority beyond one's immediate environment. As a matter of fact, this is inseparable from the larger phenomenon of "the rise of the public (sphere)" in eighteenth-century Europe, with its myriad venues and vehicles of polite and scholarly sociability.[23] Second, it is also useful to approach the Enlightenment as a "system" in a sense similar to Immanuel Wallerstein's

20 Franco Venturi, *Settecento riformatore*, 6 vols. (Turin: Einaudi, 1969–90); John Robertson, "Franco Venturi's Enlightenment," *Past and Present* 137 (1992): 183–206; Robertson, "The Enlightenment above National Context," *Historical Journal* 40 (1997): 667–97.

21 Cf. "The Enlightenment is perhaps best framed as a transnational process characterized by secular and religious motives and implications, and by which a constantly evolving series of movements dynamically intersect and dialectically constitute one another." Jeffrey D. Burson, "Introduction," in Burson and Lehner, *Enlightenment and Catholicism*, 1–37. On the centrality of spatial dimensions to the Enlightenment's concerns and contents, see Charles W.J. Withers, *Placing the Enlightenment: Thinking Geographically about the Age of Reason* (Chicago: University of Chicago Press, 2007).

22 Lorraine Daston, "Afterword: The Ethos of Enlightenment," in *The Sciences in Enlightened Europe*, ed. William Clark, Jan Golinski, and Simon Schaffer (Chicago: University of Chicago Press, 1999), 495–504.

23 The concept derives from Jürgen Habermas, *The Structural Transformation of the Public Sphere: An Inquiry into a Category of Bourgeois Society* (Cambridge, MA: MIT Press, 1989 [1962]). See the joint review of the English edition of Habermas's book with Reinhart Koselleck's *Critique and Crisis*, Anthony LaVopa, "Conceiving a Public: Ideas and Society in Eighteenth-Century Europe," *Journal of Modern History* 64, no. 1 (1992): 79–116; also

"capitalist world system." According to Wallerstein, while capitalism as a peculiar set of relations of production continued to be confined to portions of the Western world in the sixteenth and seventeenth centuries, thanks to the special dynamism it assumed during this period, it was capable of drawing into its orbit and turning to its own purposes regions where those relations were not capitalist, to an extent that, complementing the West as the "core," they all formed parts of the same global system as "semi-peripheries" and "peripheries."[24] One may not need to agree with the Wallersteinian analysis of the capitalist world system, nor even adopt the language of center and periphery, in order to conceive of the Enlightenment, by the same token, as a "system" of eighteenth-century culture and thought possessing its own intellectual and ethical priorities and agendas as well as more or less clear boundaries, while at the same time capable of involving, affecting, enlisting, or even swallowing entities whose own logic and mode of operation was not necessarily altogether or pervasively "enlightened."

2 Catholic Enlightenment—Enlightenment Catholicism

One obvious candidate for the role of such an ambiguously located entity in the Enlightenment world is the Christian church and religion, especially its Catholic version, which according to classic accounts so thoroughly imbued the structures of tradition and authority that were the prime target of critique by the eighteenth-century's "little flock of philosophers."[25] Renaissance humanism and the Protestant Reformation have long been credited with preparing the ground for the enlightened assault on dogma, superstition, and fanaticism, but Catholicism, with its continued attachment to devotional practices such as the adoration of saints and belief in miracles, its maintenance of armies of apparently idle monks, ostentatious baroque pomp, and universal monarchy as the appropriate form of ecclesiastical government, was deemed antithetical to the ideals of emancipation, utility, and progress associated with the Enlightenment. It is true that a Catholic Enlightenment was discovered in German scholarship as long ago as the beginning of the twentieth century, as part of a more comprehensive attempt to deliver the Enlightenment from the

James van Horn Melton, *The Rise of the Public in Enlightenment Europe* (Cambridge: Cambridge University Press, 2001).

24 Originally developed in Immanuel Wallerstein, *The Modern World System: Capitalist Agriculture and the Origins of the European World-Economy in the Sixteenth Century* (New York: Academic Press, 1976).

25 For this famous epithet, see Gay, *Enlightenment*, 1:3–8.

conservative-ultramontanist charge of complicity in bringing about the revolutionary tide. Already at that time, the Roman Catholic Church of the eighteenth century was claimed to have included significant forces that relied on enlightened tools in their endeavor to implement reforms aiming at adaptation to the requirements of modern times.[26] However, while the subject assumed a special significance in the post-*Kulturkampf* intellectual and political milieu of Germany and gained some currency in German scholarship,[27] from the point of view of international Enlightenment research it has remained an undercurrent—and "Catholic Enlightenment" as a compound looked to most mainstream specialists a contradiction in terms—until the past generation.

This more recent thrust of scholarship—initially also dominated by Germanophone historians, with the incrementally more intense involvement of other scholars—has been marked by significant debates, even fissures, but one can eventually discern a rough consensus in the treatment of some major themes. Still acknowledging Enlightenment and Catholicism to be strange bedfellows, some have preferred the term Reform Catholicism, but others objected that this obliterates the palpable enlightened influences on the reform processes.[28] Somewhat inversely, "enlightened Catholicism," which has also been proposed, met resistance, especially on the part of French historians because in their view it drew emphasis on the secularizing momentum gaining ground in the church at the expense of the aspect of religious renewal.[29] Another fault line concerned the question of the reconcilability of the Enlightenment with Catholicism (and religion more generally). A negative answer to this question implied, first, a wedge between the mainstream Enlightenment and

26 Sebastian Merkle, *Die katholische Beurteilung des Aufklärungszeitalters* (Berlin: Curtius, 1909).

27 Burson, "Introduction," 3–5.

28 Bernhard Schneider, "Katholische Aufklärung: Zum Werden und Wert eines Forschungsbegriffs," *Revue d'histoire ecclésiastique* 93 (1998): 354–97; Rudolf Schlögl, "Secularization: German Catholicism at the Eve of Modernity," *German Historical Bulletin* 25, no. 1 (2003): 5–21.

29 Louis G. Rogier, "L'*Aufklärung* catholique," in Louis G. Rogier, Guillaume de Bertier de Sauvigny and Joseph Hajjar, *Nouvelle histoire de l'église*, vol. 4, *Siècle des Lumières, révolution, restauration* (Paris: Seuil, 1966), 137–61; Bernard Plongeron, "Wahre Gottesverehrung und das Problem des Unglaubens: Debatten um Inhalte und Wege von Religiosität und Seelsorge," in *Die Geschichte des Christentums*, vol. 10, *Aufklärung, Revolution, Restauration* (*1750–1830*), ed. Bernard Plongeron (Freiburg: Herder, 2000), 233–93. See, however, albeit on a different context, Richard Butterwick, "Between Anti-Enlightenment and Enlightened Catholicism: Provincial Preachers in Late-Eighteenth-Century Poland–Lithuania," in *Peripheries of the Enlightenment*, ed. Richard Butterwick, Simon Davies, and Gabriel Sánchez-Espinosa (Oxford: Voltaire Foundation, 2008), 201–28.

the Catholic Enlightenment as altogether different species; and second, the inevitable failure of the latter.[30]

Yet, as hinted above, the broader, comparative, and transnational studies of the Catholic Enlightenment have been pointing toward a more synthetic picture. A central motif of this picture is the continuity established between the reform movement within the Catholic Church initiated by the Council of Trent (1545–63) and the Catholic Enlightenment, on the grounds that the Tridentine spirit—in full force at the turn of the seventeenth and eighteenth centuries, thanks to the efforts of Popes Innocent XI (1611–89, r.1676–89) and Innocent XII (1615–1700, r.1691–1700) to revive it—contained elements that were congenial to the Enlightenment and received a new impetus from it.[31] One of these elements was a more rational, utilitarian, and practical understanding of the essence and the role of the Christian religion, with a view to enabling it to penetrate the capillaries of society, to attain a more intense and intimate presence in believers' everyday lives and to genuinely improve their spiritual well-being. To be sure, one of the means was the awe-inspiring aesthetic offensive of baroque. But from the outset, these goals were also pursued by an appeal to the understanding: greater concern with education for the clergy and the laity, and some liberality in religious practices, such as the use of the vernacular in the

30 Peter Hersche, *Der Spätjansenismus in Österreich* (Vienna: Verlag der Österreichischen Akademie der Wissenschaften, 1977), 390–405; Karl Otmar von Aretin, "Katholische Aufklärung im Heiligen Römischen Reich," in von Aretin, *Das Reich: Friedensgarantie und europäisches Gleichgewicht 1648–1806* (Stuttgart: Klett-Cotta, 1986), 403–33. Cf. Harm Klueting, "'Der Genius der Zeit hat sie unbrauchbar gemacht': Zum Thema Katholische Aufklärung; Oder; Aufklärung und Katholizismus im Deutschland des 18. Jahrhunderts; Eine Einleitung," in *Katholische Aufklärung: Aufklärung im katholischen Deutschland*, ed. Harm Klueting, with Norbert Hinske and Karl Hengst (Hamburg: Meiner, 1993), 1–35, where the "irreconcilability" claim is combined with a forceful statement of the continuity between the Trent reform and the Catholic Enlightenment.

31 On the stretch of Tridentine reform into the late seventeenth and eighteenth centuries, see Owen Chadwick, *The Popes and the European Revolution* (Oxford: Clarendon Press, 1981), esp. 94–95; Mario Rosa, *Cattolicesimo e lumi nel settecento italiano* (Rome: Herder, 1981), esp. 1–48; Bernard Dompnier, "Die Fortdauer der katholischen Reform," in *Die Geschichte des Christentums*, vol. 9, *Das Zeitalter des Vernunfts (1620/30–1750)*, ed. Bernard Plongeron (Freiburg im Breisgau: Herder, 1998), 211–300; Derek Beales, "Religion and Culture," in *The Eighteenth Century: Europe 1688–1815*, ed. Tim C.W. Blanning (Oxford: Oxford University Press, 2000), 131–77; Plongeron, "Wahre Gottesverehrung," 268; Peter Hersche, *Muße und Verschwendung: Europäische Kultur und Gesellschaft im Barockzeitalter* (Freiburg: Herder, 2006), 1:152–211; Ulrich L. Lehner, "Introduction: The Many Faces of the Catholic Enlightenment," in *A Companion to the Catholic Enlightenment in Europe*, ed. Ulrich L. Lehner and Michael Printy (Leiden: Brill, 2010), 1–62, here 18–21; Burson, "Introduction," 6–9. Most contributions to these two latter volumes also underline the continuity between Trent and Enlightenment Catholicism.

liturgy. These were regarded just as instrumental in enhancing the accessibility of theological truths as the renewed emphasis on the priestly duty of pastoral care. Such objectives could well be understood as consonant with the Enlightenment's pursuit of happiness; in turn, eighteenth-century Catholics engaged in that pursuit could well understand the preservation of the moral vitality of their church as fundamental to it.[32] Catholic clergymen of sound learning and virtue, like their Protestant counterparts, would then also emerge as, more than spiritual leaders, also providers of authentic guidance to their flock on other aspects of conducting their lives, from hygiene through child-raising to farming.

It has also been argued that it is reductive to conceive of the pursuit of happiness via the accumulation and critical examination of knowledge as a purely secular one, and that it was far from alien to the religious, including Catholics. This claim has been combined with the reminder that the theology of the Catholic Reform was permeated by Molinist notions asserting free will, and its accompanying anthropology was optimistic about the capacity of humankind to attain moral as well as intellectual improvement.[33] The Protestant Reformation and Catholic Reform of the sixteenth and seventeenth centuries are now seen as having together inaugurated a new era in the full Christianization of Europe, implying a war on superstitious beliefs and practices of a popular culture in which the remnants of heathen tradition allegedly still survived. Roman Catholicism itself was perceived as in need of purging itself of superstitious elements, even by subjecting accounts of miracles and other interventions of the supernatural to the test of modern advances in natural knowledge, based on empiricism, experiment, and observation.[34] Though canonization was perhaps the area of the greatest intransigence, human virtue, besides martyrdom and the performance of miracles, assumed greater importance among its criteria.[35] Physico-theology in the style of Isaac Newton (1643–1727)—with the new science highlighting the status of God as the creator of the most harmonious system imaginable—had many Catholic followers, especially in Italy.[36] The tradition of the church itself came under scrutiny with the stringent

32 Cf. Burson, "Introduction," 14.

33 Lehner, "Introduction," 17–18.

34 Francis Young, *English Catholics and the Supernatural, 1553–1829* (Aldershot: Ashgate, 2013), 74; Ulrich L. Lehner, *The Catholic Enlightenment: The Forgotten History of a Global Movement* (Oxford: Oxford University Press, 2016), 16, 126–53.

35 Lehner, *Catholic Enlightenment*, 155–79.

36 Vincenzo Ferrone, *The Intellectual Roots of the Italian Enlightenment: Newtonian Science, Religion, Politics in the Early Eighteenth Century* (Atlantic Highlands: Humanities Press, 1995); Lehner, *Catholic Enlightenment*, 42–43.

methods of historical and philological criticism,[37] one of the outcomes being the assertion that the ever greater scarcity of miraculous events recorded in that tradition is proof that while in the remote past God resorted to such devices in order to convince a primitive folk about the truth of the Gospel, in a more progressive era these give way to rational demonstration.

The other outcome of historical criticism was the reinforcement of existing initiatives that challenged the tradition of authority and hierarchy in the Roman Catholic Church. Even apart from the Protestant Reformation and the secession of national Lutheran, Calvinist, or other churches from Rome, these important precedents included the late medieval conciliarist movement that urged a collegiate form of ecclesiastical government, the humanist critiques that unveiled the impostures on which old claims for papal supremacy were founded, and the rise of a Gallican church that remained Catholic in matters of doctrine and worship, but over which the pope had to cede a substantial part of his jurisdictional control to the king of France. The 1648 compromise peace settlement of Münster and Osnabrück, which put an end to the Thirty Years' War (1618–48) and made the demise of the vision of a unitary Christendom under papal sovereignty irrevocable, gave further encouragement to the voices within Catholicism itself that expressed dissatisfaction with the interference of the curia in diocesan affairs. Jansenism and later especially Febronianism—the former insisting on the legal autonomy of parishes, the latter explicitly calling for the emancipation of national churches, both formally condemned by the curia on several occasions, but retaining their influence throughout Catholic Europe—supplied solid intellectual and theological ammunition to the repudiation of monarchical government in the church.[38] Such efforts within the church, aiming to make parishes the centers of religious activity and bishops the genuine pastoral and administrative supervisors of that activity, found powerful political support among the enlightened rulers of the age, who also regarded any degree of extraneous intervention, including papal intervention,

37 This was especially prominent among the Benedictines of St. Maur and their followers elsewhere. See Ulrich L. Lehner, *Enlightened Monks: The German Benedictines 1740–1803* (Oxford: Oxford University Press, 2011).

38 Bernard Plongeron, "Recherches sur l'Aufklärung catholique en Europe occidental, 1770–1830," *Revue d'histoire moderne et contemporaine* 16 (1969): 555–605; Plongeron, *Théologie et politique au siècle des Lumières* (Geneva: Droz, 1973); Ulrich L. Lehner, "Johann Nikolaus von Hontheim and His *Febronius*: A Censored Bishop and His Ecclesiology," *Church History and Religious Culture* 88 (2008): 93–121; Dale K. van Kley, "Jansenism and the International Suppression of the Jesuits," in *Enlightenment, Reawakening, and Revolution, 1660–1815*, ed. Stewart J. Brown and Timothy Tackett (Cambridge: Cambridge University Press, 2006), 302–28.

in the affairs of their legal subjects and their resources as a barrier to their endeavors of overhauling their regimes and countries as territorial sovereigns. Thus, if this governmental aspect of the Catholic Enlightenment was, on the one hand, firmly established on scholarly advances in several fields of knowledge, it was also politically bonded, in a sometimes uneasy alliance, with the absolutist reformers of the Iberian and Italian Peninsulas, the Habsburg monarchy, and the Catholic states of the Holy Roman Empire.[39]

Admittedly, this is an all too "unproblematic" representation, as if everything fell neatly in place in a symbiotic relationship between Enlightenment and Catholicism. In the given space, it is impossible to do justice to the complexities, indeed tensions, that, according to the now sizeable literature, characterized this relationship—so let these be acknowledged here generically. We have also avoided a roll call of more or less celebrated names whose bearers can be associated with the diverse trends, endeavors, and groups within the Catholic Enlightenment, which could have given these tensions sharper relief. The aim of this deliberately smoothly drawn, concise summary has instead been to emphasize features of seventeenth- and eighteenth-century Catholicism that made it a cultural entity[40] not merely exposed to enlightened stimuli in response to which, somewhat reluctantly, it performed the modicum of accommodation necessary for survival or reacted defensively,[41] but one that

39 The case of France, where "the monarchy found itself set against the conciliarist, regalist, or Jansenist strain of Enlightenment Catholicism," was unique. See Burson, "Introduction," 24. For the other regions, see Anton Schindling, "Theresianismus, Josephinismus, katholische Aufklärung," *Würzburger Diözesansgeschichtsblätter* 50 (1988): 215–24; Elisabeth Kovacs, "Katholische Aufklärung und Josephinismus," in Klueting, *Katholische Aufklärung*, 246–59; Michael Printy, "Catholic Enlightenment in the Holy Roman Empire," in Lehner and Printy, *Companion to the Catholic Enlightenment*, 165–214, here 181–92; Gabriel Paquette, *Enlightenment, Governance, and Reform in Spain and Its Empire, 1759–1808* (Basingstoke: Palgrave Macmillan, 2008), 70–78; Andrea J. Smidt, "*Luces por la fe*: The Cause of Catholic Enlightenment in 18th-Century Spain," in Lehner and Printy, *Companion to the Catholic Enlightenment*, 403–52, here 423–32.

40 Brian Young, "Religious History and the Eighteenth-Century Historian," *Historical Journal* 43 (2000): 849–68.

41 Such defensive reactions supposedly comprised the "Counter-Enlightenment" that, according to some scholars, is the inevitable outcome of Enlightenment Catholicism. See Israel, *Democratic Enlightenment*, 1–35. But see also others, who have stressed the creativity of Catholic conservative thought, and the difficulties created by a much too stark dichotomy between Enlightenment and Counter-Enlightenment. Darrin McMahon, *Enemies of the Enlightenment: The French Counter-Enlightenment and the Making of Modernity* (Oxford: Oxford University Press, 2001); James Schmidt, "Introduction," in Schmidt, *What Is Enlightenment?*, 5–28; Carolina Armenteros, *The French Idea of History: Joseph de Maistre and His Heirs, 1794–1854* (Ithaca: Cornell University Press, 2011).

offered positive inroads for those stimuli to take effect, and even participated in preparing the ground for some aspects of the Enlightenment to strike roots.

3 The Society of Jesus and Jesuit Science

Yet, there is one aspect of the seventeenth- and eighteenth-century Catholic world that has quite stubbornly resisted integration in the "smooth" picture, and is described in most of the literature as standing apart from—indeed, in antagonism to—the Enlightenment trend in Catholicism: the Society of Jesus (somewhat ironically, an organization whose close association with the Tridentine church has also been widely acknowledged). To contemporary reformers within and outside the Roman Catholic Church, as well as to posterity, the Jesuits seemed the major obstacle to achieving Enlightenment in Catholicism and more broadly. The order's expulsion from various European countries beginning in 1759 and the general papal suppression of 1773 was even hailed as a major triumph for the cause of the Catholic Enlightenment (although subsequently the polarization of European thought into more radical trends and anti-*philosophie* made the integration of secular and Catholic Enlightenment discourse complicated indeed).[42]

Anti-Jesuitism came to be regarded as an almost defining feature of the Catholic Enlightenment for three main reasons. The first was internal: the need for ideological and rhetorical tools to be employed—such as the alleged laxity of Jesuit moral theology and spirituality, for example[43]—by rivals jealous of the Jesuits' excessive control over the sinews of power and resources within the church. The second was political: given the Society's quasi-autonomous global organization, and the mechanism of its management strongly centralized in Rome, it was seen as an embodiment and the main supporter of papal universalism, thus a barrier both to the ideals and the program of decentralization pursued at that time by nearly all other religious orders and many in the secular clergy and the chief tool of Roman intervention in affairs increasingly understood as pertaining to the sovereigns and the administrative personnel of secular states. One of these was schooling, and indeed the third reason for widespread resentment toward the order was its alleged "near-monopoly" in the

42 Burson, "Introduction," 18; cf. Dale K. van Kley, "Religion and the Age of Patriotic Reform," *Journal of Modern History* 80 (2008): 252–95.

43 Richard van Dülmen, "Antijesuitismus und katholische Aufklärung in Deutschland," in van Dülmen, *Religion und Gesellschaft: Beiträge zur einer Religionsgeschichte der Neuzeit* (Frankfurt: Fischer, 1989), 141–71.

field of education, combined with its reluctance to modernize the curriculum enshrined in the *Ratio studiorum* (in full: *Ratio atque institutio studiorum Societatis Jesu* [Method and system of the studies of the Society of Jesus [1599]), with Scholastic theology as its centerpiece.[44] This, scholars suggested, set the Jesuits apart in an era when Benedictines, for instance, were integrating in their own work the ideas of Nicolas Malebranche (1638–1715) and John Locke (1632–1704), Christian Wolff (1679–1754), and Gottfried Wilhelm Leibniz (1646–1716), and the methods of empirical science and critical scholarship, while enlightened monarchs sought to reform universities by upgrading or introducing subjects more closely related to the goals of efficient governance and the public good: law, state sciences, finance and economics, and medicine.

It is only relatively recently that scholars have begun to diversify this picture.[45] They have pointed out that Jesuit scientists, in particular, were met with a great deal of appreciation and support among the enlightened, while in turn not a few Jesuits themselves were sympathetic to certain Enlightenment ideas and contributed significantly to crucial debates about them.[46] The notion of a "Jesuit Enlightenment" has even been proposed, on the basis of the centrality of a synthesis of Locke, Malebranche, and Newton to Sorbonne apologetics in the first half of the eighteenth century, and to the defense of Catholic theology against the radical Enlightenment.[47] These developments in the assessment of

44 For the text itself, see the excellent bilingual edition by Claude Pavur, trans., *The* Ratio studiorum: *The Official Plan for Jesuit Education* (St. Louis, MO: Institute of Jesuit Sources, 2005).

45 As an exception, see Robert Palmer, "The French Jesuits in the Age of Enlightenment," *American Historical Review* 45 (1939): 44–58.

46 Thanks to their "cultural modernity," and despite their theological conservatism, "the Jesuits were participants in, rather than enemies of, the Enlightenment." Joan-Pau Rubiés, "The Jesuits and the Enlightenment," in *The Oxford Handbook of the Jesuits*, ed. Ines G. Županov (Oxford: Oxford University Press, 2019), 855–90. Cf., for the French context, Jeffrey D. Burson, "Between Power and Enlightenment: The Cultural and Intellectual Context of the Jesuit Suppression in France," in *The Jesuit Suppression in Global Context: Causes, Events, and Consequences*, ed. Jeffrey D. Burson and Jonathan Wright (Cambridge: Cambridge University Press, 2015), 40–63.

47 Antonio Trampus, *I gesuiti e l'Illuminismo: Politica e religione in Austria e nell'Europa centrale (1773–1798)* (Florence: Olschki, 2000); Jeffrey D. Burson, *The Rise and Fall of the Theological Enlightenment: Jean-Martin de Prades and Ideological Polarization in Eighteenth-Century France* (Notre Dame: University of Notre Dame Press, 2010). Cf. Lehner, "Introduction," 31–32; Burson, "Introduction," 10, 17; Burson, "The Catholic Enlightenment in France from the *Fin de siècle* Crisis of Consciousness to the Revolution," in Lehner and Printy, *Companion to the Catholic Enlightenment*, 63–125, passim; and Burson, "Refracting the Century of Light: Alternative Genealogies of the Enlightenment in Eighteenth-Century Culture," in *Let There Be Enlightenment: The Religious and Mystical Sources of*

the relationship between the Enlightenment and the Jesuits have not been explicitly linked with the overall, massive, and consequential re-evaluation, seen in the past generation, of the character and contributions of the Society of Jesus during the early modern period. It is nevertheless instructive to sketch such longer-term lineages, in whose light the affinities between even Jesuitism and the Enlightenment seem less of an anomaly.

The revisionist literature has emphasized the extent to which the Jesuit order was "distinctive" within Catholicism,[48] so that internal suspicion and resentment toward it was quite widespread from the very beginning: the theological faculty of the Sorbonne condemned it in 1554 as "a danger to the Faith, a disturber of the peace of the Church, destructive of monastic life, and destined to cause havoc rather than edification."[49] Jesuit distinctiveness consisted partly in the Society's manner of governance, not by provincial and general chapters but by a superior general with expansive authority. This was a combination that led to an uncommon degree of international outlook and mobility, especially important when it came to the staffing of overseas missions: it enabled Italian, German, Bohemian, or other Jesuits from Europe's landlocked regions to obtain first-hand experience of Spanish and Portuguese colonial possessions in a measure way beyond the means of their fellows from other orders, and thanks to the peculiar network for reporting and the mechanism for storing information at the Society's headquarters, these experiences were molded into a stock of global knowledge controlled by the Jesuits.[50] Next, it must be stressed that the three Jesuit ministries of preaching, confession, and teaching envisaged by the order's founders were to be performed "in the world," a trait accentuated by the Jesuits' refusal to wear a distinctive habit, and retaining their family names. The explicit commitment of the famous *Formula vivendi* (1539)—a thoroughly reasoned plan, true to the character of the founders of the order as university-educated men—to serve, besides the glory of

Rationality, ed. Antony M. Matytsin and Dan Edelstein (Baltimore: Johns Hopkins University Press, 2018), 227–46, esp. 229–32.

48 John W. O'Malley, "The Distinctiveness of the Society of Jesus," *Journal of Jesuit Studies* 3, no. 1 (2016): 1–16.

49 John W. O'Malley, *The First Jesuits* (Cambridge, MA: Harvard University Press, 1993), 289.

50 Steven J. Harris, "Confession-Building, Long-Distance Networks, and the Organization of Jesuit Science," *Early Science and Medicine: A Journal for the Study of Science, Technology, and Medicine in the Pre-modern Period*, special issue, "Jesuits and the Knowledge of Nature," 1, no. 3 (1996): 287–318. On the "cultural effort" behind the rise of Jesuit bureaucratic governance based on the production, recording, and exchange of information, see Markus Friedrich, *Der lange Arm Roms. Globale Verwaltung und Kommunikation im Jesuitenorden 1540–1773* (Frankfurt: Campus Verlag, 2011).

God, the "common good," rests not on theological but philosophical foundations, and it has been demonstrated that the sources of the qualities and virtues listed in Ignatius of Loyola's (*c*.1491–1556) *Constitutions* as necessary to succeed in this undertaking include secular ones like Cicero's *De officiis* (Of duties).[51] It is owing to the all-inclusive character of the common good that while the *Constitutions* are firm in defining certain goals, in the pursuit of these goals they provide for expediency and ways of procedure "according to times, places and circumstances," from which the famous bent of Jesuits to flexibility and adaptability—criticized by adversaries as concessions to the profane and other sorts of opportunism—derives.[52]

Finally, in searching for Jesuit distinctiveness, it is worth looking more closely at the third ministry mentioned above, that of teaching, which rose to special prominence thanks to a 1560 decree of Ignatius's successor as general, Diego Laínez (1512–65, in office 1558–65), requiring all Jesuits to teach at some point in their career. Being a teacher thus became fundamental to Jesuit identity.[53] The Society created and maintained an international public education system, consisting in the mid-eighteenth century of around seven hundred schools of various kinds in Europe and around an additional one hundred in other continents, everywhere based on the same curriculum, texts, and pedagogy. The schools broadened and redefined the mission of the Society of Jesus as cultural and, indeed, as civic: located in cities, they served the burghers who might be indifferent to liturgy, but were concerned about the education of their offspring, and were willing to make donations.[54] As the purposes of Jesuit education were attuned to the larger aspirations mentioned above—saving souls and helping neighbors while contributing to the common good, including that of civil society as well as the church, understood in unison—it is little surprise that while the *Ratio studiorum* actually imposed limitations of philosophical and theological speculation in teaching, the curriculum had a strong "unclerical" component in the *studia humanitatis*, implying a dedicated study and emulation of Latin and Greek classics as recommended by Renaissance

51 Kevin Spinale, "The Intellectual Pedigree of the Virtue of Magnanimity in the Jesuit Constitutions," *Journal of Jesuit Studies* 2, no. 3 (2015): 451–69.

52 "Few religious superiors can have told members of their order so firmly to forget the rules and do what they thought best." John Bossy, "Editor's Postscript," in H. Outram Everett, *The Spirit of the Counter-Reformation*, ed. John Bossy (Cambridge: Cambridge University Press, 1968), 126–45, here 130. Cited in O'Malley, "Distinctiveness of the Society of Jesus," 5.

53 O'Malley, *First Jesuits*, 200–1; Paul F. Grendler, "Jesuit Schools in Europe: A Historiographical Essay," *Journal of Jesuit Studies* 1, no. 1 (2014): 7–25; Grendler, "The Culture of the Jesuit Teacher 1548–1773," *Journal of Jesuit Studies* 3, no. 1 (2016): 17–41.

54 O'Malley, "Distinctiveness of the Society of Jesus," 14.

pedagogical humanists. Jesuit education, which has been described as highly competitive, aimed to prepare students for leadership roles in the church, state, and society to the benefit of all, so that some have found it justified to style its conceptual foundation as "Jesuit civic humanism."[55] Having said this, it must be admitted that while mathematics (also with a view to its applications) had a strong foothold in schools and universities controlled by the Jesuits, they were slow in adjusting the dominant Aristotelianism of the philosophy curriculum to new currents in natural philosophy, and staunchly resistant to any temptation to introduce the teaching of law or medicine.

As a matter of fact, utility was a prime and hardly concealed consideration from another point of view, too: by providing good education and more generally sound learning as a social good to the rising elite, Jesuits could ingratiate themselves with the culturally powerful—including not only the *virtuosi* (i.e., the mostly aristocratic patrons of the arts and sciences) but also the *cognoscenti* (the citizens of the Republic of Letters)—and thus promote the goal of confessionalization.[56] In this way, the matter of Jesuit education leads us to consider the topic that, even amid the general efflorescence of Jesuit studies, has received a disproportionate amount of attention: the intriguing field of Jesuit science.[57] As the thrust of a great deal of recent work on the Enlightenment has been to assert the centrality of the "new science" to its gestation,[58] this topic is of crucial importance to this section; and similarly to this thrust, the more contextualized approach to Jesuit science owes its existence to the larger revisionism in the history of science, particularly with regard to the "scientific revolution." Even in the traditional narrative, the sixteenth- and seventeenth-century revolution in science, with its discoveries in physics and astronomy that reaffirmed the idea of a heliocentric cosmos and with its inauguration of an altogether mathematized nature, figured as the twin brother of the Enlightenment drive to emancipation and toleration in bringing about the modern world.[59] This account of early modern science was largely conceived

55 Grendler, "Culture of the Jesuit Teacher," 31–36; cf. John W. O'Malley, "Jesuit Schools and the Humanities Yesterday and Today," *Studies in the Spirituality of Jesuits* 47, no. 1 (2015).

56 Harris, "Confession-Building," 292.

57 For a concise overview, see Sheila J. Rabin, "Early Modern Jesuit Science: A Historiographical Overview," *Journal of Jesuit Studies* 1, no. 1 (2014): 88–104. For a comprehensive account, see Agustín Udías, *The Jesuit Contribution to Science: A History* (Cham: Springer, 2015).

58 Cf. William Clark, Jan Golinski, and Simon Schaffer, eds., *The Sciences in Enlightened Europe* (Chicago: University of Chicago Press, 1999), especially the editors' "Introduction," 3–31.

59 For classic examples of this interpretation, see Herbert Butterfield, *The Origins of Modern Science, 1300–1800* (London: G. Bell and Sons, 1950); Alexandre Koyré, *From the Closed*

as a series of heroic intellectual exertions by a select group of visionaries, resulting in disembodied theorems thrown out into a socio-cultural void or, at best, mechanically associated with other acknowledged forces of progress. The more recent departures in the field have, instead, questioned the very idea of a revolution in science.[60] They established their inquiry into the production, circulation, and certification of knowledge in the early modern period on the premise that it is one of so many social and cultural practices influenced, besides the pure striving for discoveries of truths about nature, by personal and institutional ambition, networks of communication and patronage, political leverage, and religious affiliation—to mention but a few crucial factors whose exploration has thrown the casting of heroes and villains, protagonists and supporting roles in the familiar story (indeed, the very logic of such a casting) into disarray.

In this climate of research, it has become possible to acknowledge the relevance of studying areas of early modern natural philosophy that fall outside "science" as (anachronistically) defined in the old master narrative, as well as the contributions of individuals or institutions that clung to, or were slow in abandoning, Aristotelian physics and Ptolemaic astronomy—including the Society of Jesus, which "stands out of all others as the scientific order without rival in seventeenth-century Catholicism."[61] A typical example of the adoption of a more contextually sensitive approach is the treatment accorded to that *cause célèbre* of the history of heliocentrism: the Galileo affair. Jesuits, formerly unequivocally condemned as the story's villains, have been shown to have cultivated relations with Galileo Galilei (1564–1642) that were conducive to the development of the new sciences[62] (and were particularly close between him and the "modern Euclid," Christoph Clavius [1538–1612], who established

World to the Infinite Universe (Baltimore: Johns Hopkins University Press, 1957). For a critical overview of the literature, see H. Floris Cohen, *The Scientific Revolution: A Historiographical Inquiry* (Chicago: University of Chicago Press, 1994).

60 For a few synthetic attempts, see (despite its title) Steven Shapin, *The Scientific Revolution* (Chicago: University of Chicago Press, 1996); Margaret J. Osler, ed., *Rethinking the Scientific Revolution* (Cambridge: Cambridge University Press, 2000); Katherine Park and Lorraine Daston, eds., *The Cambridge History of Science*, vol. 3, *Early Modern Science* (Cambridge: Cambridge University Press, 2006). But see also Peter Dear, *Revolutionizing the Sciences: European Knowledge and Its Ambitions, 1500–1700* (Princeton: Princeton University Press, 2009), where the new approach is employed while keeping the label.

61 William B. Ashworth Jr., "Catholicism and Early Modern Science," in *God and Nature: Historical Essays on the Encounter between Christianity and Science*, ed. David C. Lindberg and Ronald L. Numbers (Berkeley: University of California Press, 1986), 133–66, here 154.

62 William A. Wallace, *Galileo and His Sources: The Heritage of the Collegio Romano in Galileo's Science* (Princeton: Princeton University Press, 1984).

mathematics as a key part of the Jesuit curriculum[63]). Some of Clavius's students also flirted with Copernican cosmology, and after its firm condemnation in 1616 did not revert to Ptolemy but compromised on the "geo-heliocentric" system advanced by Tycho Brahe (1546–1601). Most interestingly, internal conflicts between Jesuits and Dominicans are proposed to be as important for the denouement of 1633 as the (far from unanimous) Jesuit hostility to Galileo.[64]

Somewhat similarly to, or as a counterpart of the cautious feelers toward Copernicanism, while seventeenth-century Jesuit natural philosophy in general firmly remained on Aristotelian grounds, not only did Aristotelianism mean a commitment to an ideal of public demonstration of scientific knowledge but this also entailed meaningful participation in developing the concept and practices of experiment.[65] Jesuit men of science went "public" in a different sense, too: as any other savant, they keenly and openly engaged in the discussions that excited the contemporary Republic of Letters.[66] Perhaps no individual figure exemplifies this more strikingly than "the last man who knew everything": Athanasius Kircher (1602–80), whose interests and works ranged across virtually all known disciplines, and under whose leadership the Collegio Romano emerged as the major hub of a network for collecting and filtering scientific information as well as displaying it in objectified form to a select public.[67] If Jesuit science was, in this sense, sociable, it also put an emphasis on utility. Mathematics as conceived by Clavius and his colleagues was a practical discipline, with applications in chronology (as in the case of the calendar reform of 1582, associated with his name), astronomy, geography, navigation, surveying, hydraulics, and military technology. This was, of course, strongly tied to curricular needs as mentioned above. Thus, many Jesuits became not only poets, historians, and artists but also astronomers, physicists, cartographers, and—most peculiarly of all—military architects and hydraulic engineers, advising governments on the building of fortresses and on flood control

63 Antonella Romano, *La Contre-Réforme mathématique: Constitution et diffusion d'une culture mathématique jésuite à la Renaissance* (Rome: École française de Rome, 1999).

64 Rivka Feldhay, *Galileo and the Church: Political Inquisition or Critical Dialogue?* (Cambridge: Cambridge University Press, 1995).

65 Peter Dear, *Discipline and Experience: The Mathematical Way in the Scientific Revolution* (Chicago: University of Chicago Press, 1995), 32–62; Marcus Hellyer, *Catholic Physics: Jesuit Natural Philosophy in Early Modern Germany* (Notre Dame: University of Notre Dame Press, 2005).

66 Mordechai Feingold, ed., *Jesuit Science and the Republic of Letters* (Cambridge, MA: MIT Press, 2003).

67 Paula Findlen, *Possessing Nature: Museums, Collecting, and Scientific Culture in Early Modern Italy* (Berkeley: University of California Press, 1994); Findlen, ed., *Athanasius Kircher: The Last Man Who Knew Everything* (New York: Routledge, 2004).

projects.[68] In addition, thanks to the nature and dimensions of their missionary activity, Jesuits played a pre-eminent role in integrating the natural and human-cultural universe of the overseas world into European knowledge structures, as well as in the processes of negotiation between European and non-European forms of knowledge.[69]

At the end of this overview of Jesuit science in the early modern period, a final issue that needs brief consideration is raised by the scholarly preoccupation with the sixteenth and especially the seventeenth century. The question of how much vitality Jesuit science preserved in the Age of Enlightenment, when Jesuits were supposedly regarded with ever greater hostility as obstacles to progress, is of particular relevance to the subject of this book. After the consolidation of the decades between 1620s and the 1680s, when Jesuit science represented a "well-defined intellectual alternative on the European cultural map," a growing marginalization ensued because of the inability to integrate elements of the new science, such as Cartesian analytical geometry or Johannes Kepler's (1571–1630) laws.[70] Yet, while a great deal of work remains to be done, it is safe to assert that "flexibility and adaptability," identified as characteristic Jesuit traits, continued to operate reasonably well. The Jesuits were particularly adept in facilitating the circulation and wider appeal of scientific achievements: the *Mémoires pour l'histoire des sciences et des beaux-arts* (Memoirs for the history of the sciences and the fine arts, commonly known as the *Journal de*

68 Denis De Lucca, *Jesuits and Fortifications: The Contribution of Jesuits to Military Architecture in the Baroque Age* (Leiden: Brill, 2012); Geert Vanpaemel, "Jesuit Mathematicians, Military Architecture, and the Transmission of Technical Knowledge," in *The Jesuits and the Low Countries: Identity and Impact* (*1540–1773*), ed. Rob Faesen and Leo Kenis (Leuven: Peeters, 2012), 109–28; Alessandra Fiocca, "Ferrara e i gesuiti in materia d'acque," in *Gesuiti e università in Europa* (*secoli XVI–XVIII*), ed. Gian Paolo Brizzi and Roberto Greci (Bologna: CLUEB, 2002), 339–59; Fiocca, "I gesuiti e il governo delle acque del basso Po nel secolo XVII," in *Giambattista Riccioli e il merito scientifico dei gesuiti nell'età Barocca*, ed. Maria Teresa Borgato (Florence: Olschki, 2002), 319–70.

69 Of the extensive literature, see Steven J. Harris, "Mapping Jesuit Science: The Role of Travel in the Geography of Knowledge," in *The Jesuits: Cultures, Sciences, and the Arts 1540–1773*, ed. John W. O'Malley et al. (Toronto: University of Toronto Press, 1999), 1:213–40; Florence C. Hsia, *Sojourners in a Strange Land: Jesuits and Their Scientific Missions in Late Imperial China* (Chicago: University of Chicago Press, 2009); Andrés I. Prieto, *Missionary Scientists: Jesuit Science in Missionary South America, 1570–1810* (Nashville: Vanderbilt University Press, 2011); Antonella Romano, *Impressions de Chine: L'Europe et l'englobement du monde* (*XVI^e–XVII^e siècle*) (Paris: Fayard, 2016).

70 Rivka Feldhay, "The Cultural Field of Jesuit Science," in O'Malley et al., *Jesuits*, 107–30. Feldhay also emphasizes the dynamics of the nexus of scientific discourse, institutional setting, and wider political context in circumscribing the "field" (in the sense introduced by Pierre Bourdieu [1930–2002]) of Jesuit science.

Trévoux, launched in 1701) and the various editions of the *Dictionnaire de Trévoux* (1704–71) were fundamental Jesuit contributions to the Enlightenment.[71] In terms of substantive matters of science, the key breakthrough of the removal of books defending the motion of the Earth from the Index—apparently on the initiative of Ruggiero Giuseppe (Ruđer Josip) Boscovich (1711–87)—did not come about until 1757.[72] However, the heliocentric system and Newtonian astronomy, which Boscovich was also the first Jesuit fully to embrace and develop, had gained a foothold in Jesuit colleges already in the first half of the eighteenth century, in tandem with the rise of algebra besides geometry, in the style of René Descartes's (1596–1650) idea of a mathematically based universal science. In Jesuit mathematics, this notion, known as *mathesis universalis*, also implied an openness to incorporating Newton's and Leibniz's integral and differential calculus in their teaching (though not yet publications) by Jesuit professors.[73] The same holds for the introduction of modern physics in the courses on mathematics as well as natural philosophy,[74] including even atomism (with Boscovich again playing an important role[75]). The analysis of the "macro structures" of the Jesuit scientific tradition also demonstrates the unbroken continuity of this tradition into the eighteenth century, up to the suppression of 1773—a revival that needs to be viewed as part of the overall acceleration of scientific work in mid-eighteenth-century Europe. After a decline in Jesuit scientific publications in the first decades of the eighteenth century, there was substantial and sustained growth after about 1730, together with a marked shift from Aristotelian subjects toward the mathematical and physical sciences, as well as a change in patterns of authorship: a smaller scientific elite within the order contributed a considerably larger number of works, undoubtedly thanks to the expansive internal control over the allocation of talent and duties. The institutional setting also continued to develop dynamically, with a large number of chairs in mathematics and experimental physics, physical cabinets, and no fewer than twenty-five astronomical observatories

71 Rubiés, "Jesuits and the Enlightenment," 7.

72 Jesuits had long acknowledged the uses of Copernicanism for calculations but refused to accept its cosmological implications because of their incompatibility with notions of Aristotelian physics such as the incorruptibility of the heavens.

73 Udías, *Jesuit Contribution to Science*, 23–40.

74 Marcus Hellyer, "Jesuit Physics in Eighteenth-Century Germany: Some Important Continuities," in O'Malley et al., *Jesuits*, 1:538–54; Hellyer, *Catholic Physics*, 165–80, 221–27.

75 Gordon G. Brittan, "The Role of the Law of Continuity in Boscovich's Theory of Matter," and Henk K. Kubbinga, "La théorie de la matière de Boscovich: L'atomisme de points et le concept d''individu substantiel,'" in Bursill-Hall, *R.J. Boscovich*, 211–24, 281–306; Hans Ullmaier, *Puncta, particulae et phaenomena: Der dalmatinische Gelehrte Roger Joseph Boscovich und seine Naturphilosophie* (Hannover-Laatzen: Wehrhahn Verlag, 2005)

added to the existing stock of Jesuit or Jesuit-staffed facilities between 1700 and 1773.[76] To venture a pun on the title of this book, the Society of Jesus pursued its scientific ends with perseverance and vigor until the very end.

4 What's in a Life?

At this point, it is appropriate to revert to the central character of this book, who directed one of these new observatories over a period of thirty-seven years, almost exactly half of it stretching beyond the suppression of the Society of Jesus. Hell was hyper-active in the creation and dissemination of "Catholic knowledge," employing a wide range of strategies and practices to represent and assert in the public space the agendas, interests, and values of science and the scientist. As that space was fluid and changeable, subject to the impact of power relations and socio-cultural dynamics, the study of such practices is at the same time the study of so many attempts at accommodation and negotiation at each of the levels and spaces mentioned previously.[77] Before a sketch of these attempts is drawn as a means of laying out the specific agenda of the chapters of this book, we also need to ask, by interrogating recent approaches to historical biography, what lessons such accommodations as revealed by the life of a single individual may hold about the relations of those levels and spaces.

Biography is one of the oldest genres of historical rendition, which enjoyed a decent amount of popularity with the general public even at times of disparagement among professional historians.[78] It is only quite recently that it has re-emerged from the latest of such periods,[79] when the main objection against it was the untenability of the idea of the self as a singular, coherent entity, and of the individual self as an autonomous being capable of acting in accordance with its own will. While this might still have looked an adequate framework for interpreting the historical role of important political leaders, the long eclipse in the prestige of political history itself altogether relativized the interpretative value of biography during the ascendancy of large-scale, quantitative,

76 Steven J. Harris, "Boscovich, the 'Boscovich Circle,' and the Revival of Jesuit Science," in Bursill-Hall, *R.J. Boscovich*, 527–48.

77 Cf. above, 6.

78 For a helpful overview, see Barbara Caine, *Biography and History* (Basingstoke: Palgrave Macmillan, 2010).

79 On the first phases of this revival, see Lloyd Moote, "New Bottles and New Wine: The Current State of Early Modernist Biographical Writing," *French Historical Studies* 19 (1996): 911–26; Hans Erich Bödeker, ed., *Biographie schreiben* (Göttingen: Wallstein Verlag, 2003).

structural analysis hallmarked by the *Annales*. "Inside every historian there lies a biographer struggling to come out," a distinguished historical biographer wrote during this period, acknowledging that "the biographer [...] has become a deplorable example any historian should avoid."[80] Biography was dismissed as the rearguard-fight of (German) historicism, based on a dogmatic principle of individuality, risking heroization and mythicization, and as an obstacle to a theory-oriented historical science.[81] The subsequent, poststructuralist emphasis on language and cultural encoding led not only to new ways of thinking about (literally and metaphorically) texts, writing, and reading and the "death of the author"[82] as the creator and the owner of meaning but generally to the reduction of scope for individual agency from yet another angle.

As a matter of fact, these tendencies in later twentieth-century historical scholarship were indifferent, rather than outright hostile, to biography, and they did contain elements that were instrumental in its recent recovery. Such was the interest of some of the *Annalistes* in the psychological and emotional components of the collective mentalities of past societies,[83] or the acknowledgment that languages as paradigms, and cultures as systems are far from being fixed and rigid: while imposing certain constraints on members of the communities whose expressive performances they contextualize, they are sufficiently flexible to offer opportunities of creative adaptation and even boundary-testing.[84] In addition, partly as a response to the inadequacy of large-scale structural analysis to deal with "the negotiations, circulations, and

80 A.J.P. [Alan John Percivale] Taylor, "The Historian as Biographer," in *Biographie und Geschichtswissenschaft: Aufsätze zur Theorie und Praxis biographischer Arbeit*, ed. Grete Klingenstein, Heinrich Lutz, and Gerald Stourzh (Munich: Oldenbourg, 1979), 254–61, here 254–55.

81 The low appreciation of biography among historians has been detectable ever since the nineteenth-century ambition of framing their discipline on the model of the natural sciences, with seriality and "laws" superseding the individual and the contingent. Sabina Loriga, "La biographie comme problème," in Revel, *Jeux d'échelles*, 209–31; Loriga, "Biographical and Historical Writing in the 19th and 20th Centuries," Transitions to Modernity Colloquium, the MacMillan Center, Yale University, February 18, 2008.

82 Roland Barthes, "The Death of the Author," in Barthes, *Image, Music, Text* (New York: Hill and Wang, 1977), 142–48.

83 This is a trait as old as Lucien Febvre's (1878–1956) *Un destin: Martin Luther* (first published 1928, Paris: PUF, 1968) and his *Le problème de l'incroyance au 16e siècle: La religion de Rabelais* (Paris: Albin Michel, 1947).

84 See concise statements by the classics of "linguistic contextualism." J.G.A. Pocock, "Introduction: The State of the Art," in *Virtue, Commerce, and History: Essays on Political Thought and History, Chiefly in the Eighteenth Century* (Cambridge: Cambridge University Press, 1985), 11–34, here 4–15. Quentin Skinner, "General Preface," in Skinner, *Visions of Politics*, vol. 1, *Regarding Method* (Cambridge: Cambridge University Press, 2002), vi–viii, here vii.

appropriations that go into the molecular foundations of power and social relations,"[85] micro-history arose as a trend that refocused attention on lived experience at ground level. Thus, while micro-history itself is not conceived as biographical—if anything, it resorts to biography as a procedure in its quest to explain culture[86]—it provided a great deal of inspiration and impetus to historical biography in a new key.

With the exhaustion and the dwindling self-confidence of quantitative, structurally, and functionally arguing social history—a "history without humans"—pre-eminent *Annalistes* themselves began to speak out in favor of a resuscitation of biography in which, however, the individual was to be "historicized."[87] In the same vein, almost simultaneously it was one of the classics of micro-history that called attention to the fundamental "ambivalence" of biography, in some cases employed to demonstrate the futility of explaining individuals and their behavior with reference to normative systems, while in others, conversely, the life story appears as a terrain to assess the value of hypotheses about the practical operation of social rules and regularities.[88] In this regard, the chief concern of biographical research is with the degree of freedom an individual has in making choices and decisions, and the kind and degree of rationality she or he is capable of asserting in the face of the prevailing social norms and web of institutional power, assuming that these, while more or less solid, are never fully devoid of gaps and contradictions that enable individual actors to consciously interpret, manipulate, or negotiate constraining rules and structures.[89] The emphasis on both the possibilities and the limitations of the scope of agency and individual rationality, and the additional implication that these scopes are subject to temporally and spatially changeable contexts, amounts to a compelling response to the critique of biography as a genre with reference to the "biographical illusion": the assumption that life *is* a history, "a coherent and finalized whole, which can and must be seen as a unitary expression of a subjective and objective 'intention' of a project."[90] The

85 Lynn Hunt, "Jacques Revel and the Question of Scale," in *La forza delle incertezze: Dialoghi storiografici con Jacques Revel*, ed. Antonella Romano and Silvia Sebastiani (Bologna: Il Mulino, 2016), 35–45, here 42.

86 Jill Lepore, "Historians Who Love Too Much: Reflections on Microhistory and Biography," *Journal of American History* 88, no. 1 (2001): 129–44, here 133.

87 Jacques Le Goff, "Comment écrire une biographie historique aujourd'hui," *Le débat* 54 (1989): 49–53.

88 Giovanni Levi, "Les usages de la biographie," *Annales ESC* 44, no. 6 (1989): 1325–36, here 1325.

89 Levi, "Les usages de la biographie," 1335–36.

90 Pierre Bourdieu, "The Biographical Illusion [1986]," in *Identity: A Reader*, ed. Paul de Gay, Jessica Evans, and Peter Redman (London: Sage, 2000), 299–305, here 299. Of course, the

response to this critique has also implied the redefinition of the object of biography: the historical person is no longer understood as an individual, morally expressed, stable self closed in itself and divorced from the social–cultural environment shaping, and shaped by, her or him. The concept of historical personality is an open one, enabling an insight into the social constitution of identity at any point: it presupposes an individual with different manifestations over time, reacting to the requirements and opportunities presented by diverse spaces of action—s/he is the subject of her or his own life story and the constructor of her or his own biography. The existence of a person is not conceived as "given" but as emerging continuously—but by no means in a linear fashion—in reactive processes, day-to-day transactions between the subject and the complex influences of the surrounding world.[91]

These transformations have given occasion to a wide array of incisive "life studies" in historical scholarship. Some of these—in avowed opposition to "modal" biographies, chiefly interested in the common and measurable traits in individual lives that may shed light on the relationship between individual and group *habitus*—were dedicated to "liminal" case studies highlighting the margins of the social and cultural horizons within which all other cases are imaginable.[92] Others have used the prism of individual lives for re-inserting peculiar manners of procedure into the context of the cultural practices and forms of behavior characteristic of their age, and making each more intelligible.[93] Conversely, such contextualization has been employed—remarkably, long before the recent surge—to fill gaps in the information gleaned from the available sources, like in the case of the life of the young Denis Diderot (1713–84), reconstructed by his biographer from examples taken from parallel career

"illusion" faulted by Bourdieu was recognized long ago: eighteenth-century novelists were fully aware of the difficulties posed by the fragmentation of personal life paths, and the resulting difficulties for narrative representation.

91 Hans Erich Bödeker, "Biographie: Annäherungen an die gegenwärtigen Forschungs- und Diskussionsstand," in Bödeker, *Biographie schreiben*, 9–64, here 19–22, 27–28. Cf. Peter André Alt, "Mode ohne Methode? Überlegungen zu einer Theorie der literaturwissenschaftlichen Biographik," in *Grundlagen der Biographik: Theorie und Praxis des biographischen Schreibens*, ed. Christian Klein (Stuttgart: Metzler, 2002), 23–40. For lives as "processes" rather than "units" specifically in the history of science, see Mary Jo Nye, "Scientific Biography: History of Science by Other Means?," *Isis* 97 (2006): 322–29; Marianne Klemun, "'Living fossil'—'Fossilized life'? Reflections on Biography in the History of Science," *Earth Sciences History* 32, no. 1 (2013): 121–31.

92 Carlo Ginzburg, *The Cheese and the Worms: The Cosmos of a Sixteenth-Century Miller* (Baltimore: Johns Hopkins University Press, 1980 [1976]).

93 Daniel Roche, ed., *Journal de ma vie: Jacques-Louis Ménétra, compagnon vitrier au 18e siècle* (Paris: Montalba, 1982); Natalie Zemon Davis, *The Return of Martin Guerre* (Cambridge, MA: Harvard University Press, 1983).

paths and other circumstantial material.[94] Yet others have asked disturbing questions about personhood, whether regarding the "existence" of a medieval royal figure whose identity has been obliterated by tradition,[95] or the level of continuity that can be established between a young seventeenth-century Dutch orphan suffering from mental and physical paralysis and the high-handed minister of New Amsterdam that the same individual became in later life.[96] In intellectual history, the biographer of Johann Gottlieb Fichte (1762–1814) has appealed to the historical sociology of knowledge (as against the previous preoccupation with language) as a source of new conceptual and methodological rigor, employing the notion of the intellectual field—"the realm of the culturally preconscious, of tacit beliefs and cognitive dispositions"—as a non-reductionist way to take account of social context: not a simple cause-and-effect mechanism, but "mediation and refraction."[97]

Philosophers have worried that attempts at recovering the historical meaning of their predecessors with reference to the contextual origins of their thought jeopardizes the very status of philosophical ideas as transcending such contexts. This kind of skepticism might look even more pertinent in the case of scientists: critical commentary on scientific biography appeared to be in need of beginning with a "defense."[98] On this reckoning, science is defined by rigorous methods leading to verified results and tested theories, and the accumulation of scientific knowledge as a steady process of incrementally adding particular truths to the larger edifice of established truths; as soon as such additions have been completed, those particular truths become detached from the past, rendering the process of discovery uninteresting, and the advances of science impersonal.[99] To both philosophers and scientists, it can be objected

94 Franco Venturi, *Jeunesse de Diderot* (*de 1713 à 1753*) (Paris: Albert Skira, 1939).

95 Jacques Le Goff, *Saint Louis* (Paris: Gallimard, 1996).

96 Willem Frijhoff, *Fulfilling God's Mission: The Two Worlds of Dominie Everardus Bogardus 1607–1647* (Leiden: Brill, 2007 [1995]). Cf. Frijhoff, "Experience and Agency at the Crossroads of Culture, Mentality, and Contextualization: *The Biography of Everhardus Bogardus* (*c.1607–1647*)," in Bödeker, *Biographie schreiben*, 65–105.

97 Anthony La Vopa, "Doing Fichte: Reflections of a Sobered (But Unrepentant) Contextual Biographer," in Bödeker, *Biographie schreiben*, 107–72, a meta-discussion of the same author's *Fichte: The Self and the Calling of Philosophy, 1762–1799* (Cambridge: Cambridge University Press, 2001).

98 Thomas L. Hankins, "In Defence of Biography: The Use of Biography in the History of Science," *History of Science* 17, no. 1 (1979): 1–16.

99 For an early, magisterial departure from this position, and an attempt (although not conceived biographically) to understand and reconstruct scientific discovery as a process consisting of equally relevant episodes, see I. Bernard Cohen, *Introduction to Newton's* Principia (Cambridge, MA: Harvard University Press, 1978).

that while contextual reconstruction does not necessarily deny the possibility of more lasting truth value, the point of properly historical inquiry into past intellectual performances is not finding something familiar (or to dismiss it as unfamiliar in order to confirm our position), but being challenged by its historical alterity.[100]

As part of the overall recovery of historical biography—of which only a partial and impressionistic sketch could be provided here, in the hope that it nevertheless suffices for the present purposes—historians of science have turned to biography as a theoretically and empirically rewarding form of exploration and expression. Naturally, this turn is also indebted to the general opening up of the history of science toward a more expansive cultural history of knowledge. Especially striking is the emphasis on each scientist's struggle for "existential authenticity" in the face of social, political, and other constraints: the "ability to handle the enabling conditions of self-assertion lies at the heart of the life and work of every scientist."[101] With this in mind, it is also possible to avoid the schematism of earlier contextualist endeavors, in which the individual is reduced to a "sampling device" that helps us understand the culture and the time:[102] otherwise excellent "social biographies" of scientific practitioners like Charles Darwin (1809–82), in which the parallel currents of history are tied together "at the level where the events and ideas occur."[103]

Imbued with the recently conceived premises, but still close to the ideal of pure "existential" biography, we find those of Francis Bacon (1561–1626) and Descartes. These have shown that the philosophical and scientific achievement of Bacon and Descartes is indissolubly wedded to their reflection of what it means, among the significantly altered circumstances of their day, to be a natural philosopher: no longer an individual seeker after arcane mysteries of the natural world, employing an esoteric language and protecting the discoveries from others, but a public figure in the service of the public good in the one case, and an *honnéte homme* using his natural faculty of clarity and distinctness

100 La Vopa, "Doing Fichte," 153–57.

101 Thomas Söderqvist, "Existential Projects and Existential Choice in Science: Science Biography as an Edifying Genre," in *Telling Lives in Science: Essays in Scientific Biography*, ed. Michael Shortland and Richard Yeo (Cambridge: Cambridge University Press, 1996), 45–84, here 66. Cf. Söderqvist, "Introduction," in *The History and Poetics of Scientific Biography*, ed. Thomas Söderqvist (Aldershot: Ashgate, 2007), 1–16.

102 Charles Rosenberg, "Woods or Trees? Ideas and Actors in the History of Science," *Isis* 79 (1988): 565–70.

103 Söderqvist, "Existential Projects," 51. Cf. Adrian Desmond and James Moore, *Darwin* (Harmondsworth: Penguin, 1992); Desmond and Moore, *Darwin's Sacred Cause: Race, Slavery, and the Quest for Human Origins* (Chicago: University of Chicago Press, 2011).

to the highest degree in the other. Both cases highlight the transformation of traditional humanist concerns into a natural philosophical context via a study of the type of *persona* as shaped by the protagonists in their work.[104] It must be added that according to the author of these accounts, the studying of this type is not, strictly speaking, biography, but closer to biography than the history of philosophical or scientific discovery and doctrine.[105] It is helpful to invoke here another "non-biography" of a crucial figure of the early modern Republic of Letters: the great seventeenth-century facilitator of communication and collection in the world of learning, Nicolas-Claude Fabri de Peiresc (1580–1637).[106] Peiresc's life—corresponding to a period of relative calm in Europe, marked by openness to learning and a confidence in the ability of reason to solve problems—is used as a means of "summoning" this lost world via the answers it gave to questions like "what is a scholar and why be a scholar?"[107] The answers were based on the combination of values from skepticism, stoicism, and sociability: precision of observation and suspension of judgment; humility, tranquility of mind, and constancy of endeavor; conversation and friendship. Peiresc's persona was widely regarded as embodying these values and virtues associated with scholarship, and the answer to the "why" question was nothing less than the indispensability of these as bonds of human society.

In the recent thrust of contextualized science biography, two deserve special mention here as dedicated to characters with whose careers that of Maximilian Hell intersected in different ways. One of these is the biography of the French mathematician, physicist, and *philosophe* Pierre-Louis Moreau de Maupertuis (1698–1759), endeavoring to illuminate the place of science in the cosmopolitan Republic of Letters, and the role of science in making the protagonist's persona.[108] Below, the uses to which Maupertuis turned the experience of his memorable Lapland journey of 1736 will briefly be compared with those of Hell with regard to the 1768–69 Venus transit expedition. In another recent revisionist study, the "self-invention" of a figure working in the same

104 Stephen Gaukroger, *Descartes: An Intellectual Biography* (Oxford: Oxford University Press, 1995); Gaukroger, *Francis Bacon and the Transformation of Early Modern Philosophy* (Cambridge: Cambridge University Press, 2001).

105 Stephen Gaukroger, "Biography as a Route to Understanding Early Modern Natural Philosophy," in Söderqvist, *History and Poetics*, 37–50, here 47.

106 Peter N. Miller, *Peiresc's Europe: Learning and Virtue in the Seventeenth Century* (New Haven: Yale University Press, 2000). Cf. Miller, *Peiresc's Mediterranean World* (Cambridge, MA: Harvard University Press, 2015).

107 Miller, *Peiresc's Europe*, 4, 14.

108 Mary Terrall, *The Man Who Flattened the Earth: Maupertuis and the Sciences in the Enlightenment* (Chicago: University of Chicago Press, 2002).

environment as the protagonist of this book, the Viennese botanist and chemist of French Dutch background, Nikolaus Joseph von Jacquin (1727–1817), has been presented with an explicit attempt at redefining the principles of science biography. Preoccupation is with the shaping of von Jacquin's "scientific persona"[109] through unraveling his "communicative actions" and self-representation in the shifting contexts of places and spaces—geographic locations and institutional and other zones of acting and interacting—relationships with persons, communities as well as objects, and strategies that include self-positioning vis-à-vis trends in contemporary scientific thought and practice, transactions with wielders of political, administrative, and academic authority, and activities of organizing and networking.[110] Key to this was von Jacquin's high-level of public visibility from the moment he appeared on the Viennese scene and the consequent possibility for contemporaries and posterity to "grasp" him. The careers of Hell and von Jacquin, the Jesuit astronomer's junior by a mere seven years, and just like him central to the project of transforming Vienna into a capital of science from the 1750s, may offer more parallels and comparative possibilities than hitherto attempted, even in the pages that follow.[111] Besides their eminent role on the local scene, the two men were also distinguished as *the* mid-eighteenth-century Habsburg expeditionists, even though the status of von Jacquin's voyage to the Caribbean in the 1750s in the making of his scientific persona was very different from that of Hell's northern journey: while in the case of the latter, the invitation to lead the Venus transit observation was the acknowledgment of his already-established reputation, for von Jacquin the expedition was a breakthrough, marking his transformation from *botanophilus* (lover of plants) to *verus botanicus* (genuine botanist).[112] The extent to which a research and narrative agenda similar to Maupertuis the libertine and the also quite flamboyant von Jacquin can be pursued in the case of a Jesuit father is limited: for instance, "ego-documents" in the strict sense are scarce, similarly to "private" relationships, which nevertheless substantially

109 For a now classic study of an emblematic figure of a different period from this perspective, see Mario Biagioli, *Galileo Courtier: The Practice of Science in the Culture of Absolutism* (Chicago: University of Chicago Press, 1993). See also Lorraine Daston and H. Otto Sibum, "Introduction: Scientific Personae and Their Histories," *Science in Context* 16, nos. 1–2 (2003): 1–8, and the whole thematic issue it introduces, dedicated to the application of the notion of "anthropological persona" (Marcel Mauss [1872–1950]) to situations in the history of science.

110 Marianne Klemun and Helga Hühnel, *Nikolaus Joseph Jacquin (1727–1817): Ein Naturforscher (er)findet sich* (Göttingen: V & R unipress, Vienna University Press, 2017).

111 Hell is not mentioned at all in the magisterial study cited in the previous note.

112 Klemun and Hühnel, *Nikolaus Joseph Jacquin*, 111–28.

contributed to the shaping of the central figure's public persona in both of the other two cases. Still, as much as possible, a similar endeavor has guided us in writing this book.

The present venture is thus also conceived as both less and more than a biography. Let us now provide a brief sketch of our protagonist's life—more details will naturally follow in the ensuing chapters—and then assess its possible broader implications that we hope to highlight. Maximilian Hell was one of the foremost Jesuit scholars in eighteenth-century Central Europe. He was the scion of a family of German mining engineers of Bohemian or Bavarian descent, born in Štiavnické Bane[113] (Szélakna, Windschacht), a suburb of Banská Štiavnica (Selmecbánya, Schemic[z]ium, Schemnitz), a prosperous chartered town in northern Hungary (now Slovakia). Having graduated from the gymnasium at nearby Banská Bystrica (Besztercebánya, Neosolium, Neusohl), he joined the Society of Jesus in 1738 and was ordained in 1751. Between these dates, he spent his novitiate at Trenčín (Trencsén, Trenchinium, Trentschin) and studied philosophy, mathematics, and theology at the University of Vienna. Simultaneously, from 1745, while teaching at a gymnasium and college in Levoča (Lőcse, Leuchovia, Leutschau) and later in Cluj (Kolozsvár, Claudiopolis, Klausenburg) in Transylvania, he participated in the planning or personally directed the construction and equipping of several observatories in the country. Having come to the attention of leading Viennese officials during his student years and attaining some reputation as a scholar, in 1755 Hell was appointed by Empress and Queen Maria Theresa (1717–80, r.1740–80) as imperial and royal astronomer in Vienna. His appointment coincided with the first important wave of systematic attempts at enlightened reform in administration, taxation, education, health, and other spheres initiated by the Habsburg government. In his new capacity, Hell supervised the building of a new university observatory tower and edited the annual *Ephemerides astronomicae ad meridianum Vindobonensem* (Astronomical ephemeris for the Viennese meridian),

113 Geographic names in the territory of the old Kingdom of Hungary and the Habsburg monarchy in general are given as they are currently used in the state where they belong today, regardless of ethnic composition, suzerainty, or any other factor in the eighteenth century (for no other reason than the convenience of the reader in finding them on the map). Historic alternatives are provided on first appearance. The Latin name forms are given as used in Hell's own texts, or in [Michael Bonbardius and Nicolaus Csáky de Keresztszeghy], *Topographia Magni Regni Hungariae olim a quodam Societatis Jesu Sacerdote conscripta, nunc Studio cujusdam ex eadem Societate Sacerdotis emendata et aucta* (Vienna: Joannes Kaliwoda, 1750). See also our list accompanying the map of the Austrian province of the Society of Jesus in appendix 2.

the success of which soon earned him wide respect in the European Republic of Letters and made him a nodal figure in a scholarly network.

It was owing to the renown—the social–cultural capital—established on a carefully constructed career that Hell received an invitation from King Christian VII (1749–1808, r.1766–1808) to lead, with the sponsorship of the Danish–Norwegian monarchy, an expedition beyond the Arctic circle within the context of the grandest collective international enterprise of eighteenth-century astronomy (perhaps field sciences altogether): the observation of the transit of Venus between the Earth and the Sun in 1769. The expedition was highly productive, yielding not only precise astronomical, geomagnetic, and other measurements and calculations but also a wealth of empirical material about the language of the indigenous Sámi[114] people, which associated Hell's name with heated controversies in yet another field of scholarship: Finno-Ugrian linguistic kinship and, by implication, the early history of the Magyars. The suppression of the Society of Jesus in 1773 left Hell's status as a state servant unaffected, and he continued as director of the observatory and editor of the *Ephemerides* until his death, but his overall situation as an ex-Jesuit became more precarious. What has been called the breakthrough of the Enlightenment in Austria in the 1780s, both in its top-down form known as Josephism and other manifestations, as well as responses to these by various stakeholders (especially the Hungarian political elite), further complicated this situation. He nevertheless—or precisely for this reason—remained highly active as a networker and a man of science, dedicating his energies to various institutional projects as well as to research and writing on diverse fields from astronomy through magnetism to language and history.

This summary points, first, to the anachronism of attempts to appropriate and highlight Hell as a member of the Hungarian and the Slovak national scientific pantheon (as "Miksa" and as "Maximilián," respectively). Upon enrolment in the gymnasium, Hell seems to have known (besides German and Latin) the "Slavic" (obviously, Slovak) language, and later on he claimed to have picked up Hungarian, but his personal attachments can hardly be styled as "national" in any modern sense. His identity can instead be located in four, partially overlapping spaces, which include: (1) loyalty to the house of Habsburg and the Viennese court, (2) commitment to the Society of Jesus and Catholic universalism, (3) status enjoyed as a citizen of the also international Republic of Letters, and finally (4) veneration of the Latinate, "Hungarus" cultural

114 Throughout this book, in accordance with current usage, this is the designation used in the authors' own discussion. In quotations from sources and references, however, eighteenth-century alternatives (Lapp, Lappish) have been retained.

heritage of the historic, multi-ethnic and multi-confessional Kingdom of Hungary. The harmony or disharmony of these four poles—a highly unstable relationship—hugely influenced Hell's scope of action, the prospects of asserting the species of knowledge he represented, and the strategies he chose to achieve this. From a different perspective, Hell's choices, the development and turning-points of his career, and his movement among these poles throws light on the peculiar Habsburg/Central European version of the unity and diversity of the Enlightenment, together with its cleavages and the possibilities and limits of transgressing them. This is because these poles of loyalty roughly correspond to, and raise the issue of, Hell's engagement with the following: (1) bureaucratic-governmental Enlightenment, intending to enhance the infrastructural effects and efficacy of the state in permeating the capillaries of society; (2) Catholic Enlightenment, which, as a renewal of the tradition of confessionalization in the sixteenth and seventeenth centuries, set the same goals with regard to strengthening religious sentiment and loyalty toward the church; (3) mainstream Enlightenment, with universal progress and human solidarity on its banner; and (4) the aspirations of the "national awakening" among the elites of the Habsburg monarchy—in this case, the Hungarian one—to preserve and strengthen the status of their leadership through modern knowledge practices. The steadily upward trend in Hell's early career may be interpreted as being thanks to, and illustrates the relative harmony among, these trends until the 1770s, while his subsequent frustrations, carefully planned or improvised attempts at accommodation and adjustment, point to the disruption of this harmony. The successes and failures of his strenuous efforts to maintain and advance himself and the cause of Jesuit science by moving among, even simultaneously existing in "life worlds" that can be described as local, regional, imperial, and global, and especially exploiting and transferring the capital of recognition and connections accumulated between them, throw a uniquely interesting light on the dynamics of power and knowledge, continuity and change, metropolis and provinces in Central Europe in the era of enlightened reform.

CHAPTER 1

Shafts and Stars, Crafts and Sciences: The Making of a Jesuit Astronomer in the Habsburg Provinces

1 A Regional Life World

Almost in the geometric center of present-day Slovakia, nestled among the green hills south of the majestic peaks of the Tatra Mountains, scattered along the valley of the winding Hron (Granus, Garam) River, seven towns arose under the sovereignty of the kings of Hungary from the eleventh century onward. In the fifteenth century, they became collectively known as "the mining towns of Lower Hungary," an appellation based on their geographic position as compared to the Spiš (Szepes, Scepusium, Zips) mining region from the perspective of Vienna and Bratislava (Pozsony, Posonium, Pressburg), the seats of the imperial and royal governmental offices of Hungary in the early modern period.[1] The protagonist of this book was born just outside one of these seven towns, Banská Štiavnica, in the village of Štiavnické Bane (Szélakna, Windschacht), on May 15, 1720 and baptized at the Catholic parish church as Maximilianus Rudolphus Höll.[2]

1 Somewhat confusingly, the lands that now comprise Slovakia as a whole are, up to 1918, often referred to as "Upper Hungary" (or "Upper Region": Felvidék), given their overall position in the Kingdom of Hungary. The seven towns are, besides Banská Štiavnica, already mentioned, Pukanec (Bakabánya, Baka-Banya, Pukkhanz); Banská Bystrica (Besztercebánya, Neusolium, Neusohl); Banská Belá (Bélabánya, Bela-Banya, Dilln); Kremnica (Körmöcbánya, Cremnicium, Kremnitz); L'ubietová (Libetbánya, Libetho-Banya, Libethen); and Nová Baňa (Újbánya, Uj-Banya, Königsberg). The overview in the next few paragraphs is based on the following works. Kálmán Demkó, *A felső-magyarországi városok életéről a XV–XVII. században* (Budapest: Magyar Tudományos Akadémia, 1890); Oszkár Paulinyi, "Tulajdon és társadalom a Garam-vidéki bányavárosokban," *Történelmi Szemle* 5, no. 2 (1962): 173–88; Richard Marsina, ed., *Banské mestá na Slovensku* (Žiar nad Hronom: Okresný národný výbor, 1990); Gábor Máté, "Az alső-magyarországi bányavárosok etnikai képének történeti és földrajzi vizsgálata," *Földrajzi Értesítő* 56, nos. 3–4 (2007): 181–204. Bratislava became the main administrative center of the residual kingdom as a result of the fall of the medieval capital Buda to the Ottomans in 1541.

2 The change of the orthography of the name has been the subject of some speculation. In official records of the Society of Jesus, for several years after his entering the order Hell appears as "Höll," and he even published his first works under this name in the 1740s and early 1750s. His biographer surmised that the motivation was to avoid association with the German word "Hölle" (hell)—certainly bizarre for a Jesuit father. Cf. Pinzger, *Hell Miksa*, 1:9. While there is

© PER PIPPIN ASPAAS AND LÁSZLÓ KONTLER, 2020 | DOI:10.1163/9789004416833_003
This is an open access chapter distributed under the terms of the CC-BY-NC-ND 4.0 License.

The tradition of the mining of copper and precious metals in the region goes back to the ancient Celts, and although continuity is hard to establish, the Slavic inhabitants of the area also seem to have cultivated the mines well before their incorporation into the Kingdom of Hungary. From the late twelfth and early thirteenth century, a relatively regular influx of Germans from Thuringia, Tyrol, Saxony, and Northern Bohemia, encouraged by monarchs, not only added to the region's ethnic diversity; the migrants also brought with them new expertise, as well as experience in and triggers to urban autonomy. Royal control via appointed officials (*comites et urburarii*) was strong, especially in the wealthier and more productive towns. The region's rugged topography also enabled the towns to exist as "life capsules" and to resist the influence of nobles, initially giving protection in times of war or political instability. The first charters of privileges—granting exemption from jurisdiction by the nobility that dominated the county administration, and recognizing the rights to self-government of the local entrepreneurial elite—were conferred on Banská Štiavnica between 1238 and 1255 and on Banská Bystrica in 1255. The other towns achieved the same during the decades of prosperity enjoyed under Hungary's fourteenth-century Angevin rulers.[3] These urban communities were bound to one another by geographic proximity, similar histories of settlement and incorporation as autonomous entities, similar legal provisions and practices (the code of Banská Štiavnica was adopted more or less everywhere in the area), and shared interests in both business and self-defense. This resulted in the rise of a league among the seven towns, superficially resembling more famous precedents like the Hanseatic League or the league of the Rhineland towns, and more closely others much nearer, like the league of the Spiš towns or those of northeastern Hungary. The league was usually an efficient tool of asserting the interests of the towns at diets, though less a means of resisting military harassment during the conflicts of the late sixteenth and seventeenth centuries, whether by Ottoman forces or the troops of Transylvanian princes, or occasionally the troops of the Habsburg rulers who inherited the Hungarian crown in 1526.

---

no conclusive evidence for this, it may be added that in contemporary references in documents of the Imperial Court Chamber, and elsewhere to his father and brother, the forms "Höll" and "Hell" alternate. Cf. Jenő Faller, *A magyar bányagépesítés úttörői a XVIII. században: Hell Máté Kornél és Hell József Károly főgépmesterek élete és munkássága* (Budapest: Akadémiai Kiadó, 1953), 18–19, 34. Below, Maximilian will be consistently referred to as Hell, as he used it in most of his mature publications, and other family members in the original form as Höll.

3 See Boglárka Weisz, "Mining Town Privileges in Angevin Hungary," *Hungarian Historical Review* 2, no. 2 (2013): 288–312.

Despite fluctuations, there was a significant amount of economic prosperity, especially in the golden age of Hungarian mining—the only important branch of industry in a predominantly agrarian country—between the fourteenth and sixteenth centuries. The volume of silver production, concentrated around Banská Štiavnica, was the greatest on the European continent (together with the Erzgebirge and Kutná Hora, about twenty-five to thirty percent), and became somewhat eclipsed only after the cultivation of the fields discovered in Potosí in the New World started in 1545. Gold was also found near Kremnica in the early fourteenth century, and it is estimated that in the ensuing period the region supplied eighty percent of the European output and one-third of the total global gold yield. In better times—like under the Angevins, or Matthias Corvinus (1443–90, r.1458–90)—the royal monopoly on the purchase of precious metals and coinage, and the resulting community of interest between the burgher elite of the towns and the court, favored urban growth, as did the attractiveness of the mines (including, in this case, especially those of copper, around Banská Bystrica) for wealthy investors like the Fuggers of Augsburg and their local allies, the aristocratic Thurzó family. The region survived the tripartite division of the kingdom after the 1526 Battle of Mohács in relative economic health, but once the Fifteen Years' War (1591/93–1606) had thrown the economy of the country into disarray, the mining towns suffered, too, and periods of growth alternated with those of decline.

Yet, centuries of relatively steady accumulation bred an appetite, and created the means, for cultural consumption and recognition for the value of good education among the well-to-do burghers that were not stamped out by more or less severe recessions. Studies of last wills and inventories[4] have revealed the dwellers of especially Banská Štiavnica, Banská Bystrica, and Kremnica to have been eager collectors of art objects and books. Between 1550 and 1750, 2,808 paintings were held in 138 collections, the largest of them boasting as many as 146, and the owners including not only prominent burghers (among whom the mining entrepreneurs or Waldbürger deserve special mention) and officials but also priests, teachers, and even some artisans. Though the regional centers of book printing lay elsewhere—mainly in Bratislava, Trnava (Nagyszombat, Tyrnavia, Tyrnau), and Košice (Kassa, Cassovia, Kaschau)—many households in the mining towns contained quite impressive private libraries. For Banská Štiavnica in the sixteenth century, twenty-four inventories list a

4 The overview below follows Viliam Čičaj, "Stredoslovenské meštianstvo a výtvarné umenie v období neskorého feudalizmu," in Marsina, *Banské mestá*, 249–60; Čičaj, *Bányavárosi könyvkultúra a XVII–XVIII. században* (*Besztercebánya, Körmöcbánya, Selmecbánya*) (Szeged: n.p., 1993).

total of over one thousand titles, with the richest collection (held by the teacher and later chief magistrate Johann Haunold [dates unknown]) alone consisting of 334 items; his Banská Bystrica contemporary, merchant, mint master, diplomat, and humanist scholar Hans Dernschwam (1494–1568/69) possessed a library of 1,062 volumes (but in which over 2,100 separate works were bound together).[5] This was, of course, exceptional. The average number of books in larger burgher collections grew from 162 in the sixteenth century to 243 in the eighteenth, when libraries of three hundred to five hundred items, noteworthy by general European standards, were not uncommon. Besides the social and intellectual elite of the towns—entrepreneurs, city magistrates, priests, teachers—a wide array of artisans and craftsmen from butchers and shoemakers through locksmiths and saddlers to tanners, bell-founders, and others had small libraries too. By and large, throughout the period Latin and German alternated as the dominant language of the books in the collections, with a small—but slowly increasing—proportion of titles in Czech and Slovak, and a handful of titles in Hungarian. Most of the books, between fifty-five and sixty percent, addressed secular topics, with a preponderance of historical works and ancient classics, but—probably thanks to the practical and technological interests of many possessors in a mining district—an unusually high proportion of them can be associated with the "new science."

Turning to schools, one needs to pay attention to the confessional landscape. As everywhere in Hungary,[6] the Protestant reform took quick and great strides in the mining towns, where its advance was facilitated by the fact that, as chartered communities, their councils enjoyed the right of patronage and thus the privilege of freely electing their parish priests. Hussite influences and incursions in the area during the fifteenth century and strong business ties with German provinces may also have prepared the ground for the reception of Martin Luther's (1483–1546) ideas. These seem to have been widely circulating and followed in the region in the immediate aftermath of 1517. Already in 1521, the town council of Banská Štiavnica received orders from King Louis II (1506–26, r.1516–26) to ensure the safety of the local Dominican friars from harassment

5 Čičaj, *Bányavárosi könyvkultúra*, 11; for details, see Jenő Berlász, *Dernschwam János könyvtára* (Budapest: Akadémiai Kiadó, 1964).

6 According to the generally accepted estimate, by 1570 around seventy-five to eighty percent of the population of Hungary had converted to one of the Protestant creeds, leaving Catholics a minority of twenty to twenty-five percent. By the early eighteenth century, the situation was almost the exact reverse. For an overview of the beginnings of the Reformation in Hungary, see Zoltán Csepregi, "Die Anfänge der Reformation im Königreich Ungarn bis 1548," in *Die Reformation im Mitteleuropa/Reformacija v srednji Evropi*, ed. Vincenc Rajšp et al. (Ljubljana: Založba ZRC, 2011), 127–47.

by "heretics."[7] Although the first parish priest of Lutheran leanings soon left the town, and the *Ordo divinorum* (Order of divine services) adopted in 1528 does not reflect much change in the liturgy, Pál Várdai (1483–1549), the archbishop of Esztergom (Strigonium, Gran), reiterated the warning about heresy in a letter to the councilors in 1531—not without ground, as from 1529 the local gymnasium used Luther's catechism as the basis of religious instruction, and the new priest, Sigmund (Zsigmond) Staudacher (dates unknown), got married in 1531.[8] From then on, one royal decree after another was arranged by the archbishop to forbid and sanction similar developments, and generally to counter the tide of the Reformation in Banská Štiavnica, Banská Bystrica, and Kremnica—for the time being, all in vain.[9] The town councilors coordinated the responses of their communities, which culminated in the adoption of the *Confessio montana* (Confession of the mines [1559]), the expression of their joint commitment to the cause of Protestantism.[10] By this time, the parish schools of the towns naturally also came under Lutheran control, and in the 1560s to the 1580s their curricula underwent thorough reform established on the priorities of the *studia humanitatis*.[11]

In this regard, there was actually little difference between Protestant schools and those of the Jesuits, who were first invited to the Kingdom of Hungary by Archbishop Miklós Oláh (1493–1568)—himself a renowned humanist scholar as Nicolaus Olahus—in 1561, and into Transylvania by Prince István Báthori (1533–86, r.1571–86) in 1579. The Jesuit convent and college founded by the former in Trnava (the temporary archiepiscopal see during the Ottoman occupation of Esztergom) was closed as early as 1567, partly because the first two rectors were arrogant foreigners provoking conflict with the local chapter, and the other members of the crew inexperienced novices. Nor was its re-establishment in Kláštor pod Znievom (Znióváralja) in 1589 lasting. The Jesuit college of Cluj initially fared much better in its rivalry with the Unitarian and Calvinist town schools, but after Báthori's death the Protestant estates prevailed and achieved

7 János Breznyik, *A selmecbányai ágost. hitv. evang. egyház és lyceum története. I. A. XVI. századi események* (Selmecbánya: Joerges Ágost, 1883), 39.

8 Breznyik, *A selmecbányai ágost*, 46, 57, 68.

9 For a comprehensive discussion, see Andrea Cobern (née Fröhlich), "Negotiating the Reformation in Habsburg Hungary, *c*.1520–*c*.1620: A Case Study of Seven Mining Cities" (PhD diss., University of Cambridge, 2014).

10 Andrea Fröhlich, "The *Confessio montana*, 1559: Composition and Aftermath/Confessio montana, 1559: Zostavenie a následky," *Montánna história* 3 (2010): 8–24.

11 István Mészáros, *XVI. századi városi iskoláink és a "studia humanitatis"* (Budapest: Akadémiai Kiadó, 1981), 84–96. On humanism in the region in the sixteenth century, see further Marcell Sebők, *Humanista a határon: A késmárki Sebastian Ambrosius története (1554–1600)* (Budapest: L'Harmattan, 2007).

its closure and, first, the temporary and then the lasting expulsion of the Jesuits from the principality in 1607.[12]

These developments were closely related to the conflicts between the Habsburgs and a part of the Hungarian estates that arose in the context of the turn-of-century Ottoman wars and culminated in the 1604–6 rebellion led by István Bocskai (1557–1606). However, in the ensuing atmosphere of compromise, the extensive re-conversion of Hungarian magnates and well-to-do nobles began. The resources and the legal security ensured by the patronage of this Catholic elite created favorable conditions for the return of the Jesuits—not yet in Transylvania, where it occurred after the expulsion of the Ottomans and the fall of the principality at the end of the seventeenth century, but northern Hungary, including the mining towns, which was a natural and early target for their resettlement. Besides the convents, gymnasia and boarding houses were also established, where fees were waived for poor but talented students. The principal locations were Trnava (1615/16[13])—where Hungary's first permanent university was also launched in 1635, as yet with one single faculty, by the learned archbishop, Péter Pázmány (1570–1637)—Bratislava (1622/27), Győr (Jaurinum, Raab, 1627), Sopron (Sopronium, Ödenburg, 1636) Trenčín (1647/49), Prešov (Eperjes, Eperiesinum, Preschau, 1647/73), Banská Bystrica (1648), Banská Štiavnica (1649), Košice (1650—with another *studium generale* created in 1660), Rožňava (Rozsnyó, Rosnavia, Rosenau, 1656/90), Levoča (1673).[14] During these decades, resources were poured on the Society of Jesus in this new field of operation by the dynasty, by magnates, and—following the example of the latter—by further stakeholders, including town magistrates and other corporate bodies. Records abound in reports about generous cash

12 On the early history of the Society of Jesus in (Upper) Hungary and Transylvania, see András Gyenis, *A jezsuita rend hazánkban* (Budapest: Szalézi Művek, 1941), 4–9; János Péteri [Antal Petruch], *Az első jezsuiták Magyarországon* (Rome: n.p., 1963); Emil Krapka and Vojtech Mikula, *Dejiny Spoločnosti Ježišovej na Slovensku* (Cambridge, ON: Dobrá Kniha, 1990); Antal Molnár, "A jezsuita rend a 16. századi Magyarországon," *Vigilia* 64, no. 5 (1999): 348–59; Molnár, *Lehetetlen küldetés? Jezsuiták Erdélyben és Felső-Magyarországon a 16–17. században* (Budapest: L'Harmattan, 2009). On the Jesuit college of Cluj, see Ágnes Flóra, "Rekatolizáció és provokáció? A kolozsvári jezsuita kollégium alapítása és a városi tanács," in *Szentírás, hagyomány, reformáció: Teológia- és egyháztörténeti tanulmányok*, ed. Beatrix F. Romhányi and Gábor Kendeffy (Budapest: Gondolat, 2008), 287–96.

13 These dates denote the establishment of the convent and the gymnasium, respectively (where only one date is provided, these coincided).

14 For more on some of these foundations, see Zsófia Kádár, "Jesuitische Kolleggründungen im Westungarischen Raum in der ersten Hälfte des 17. Jahrhunderts: Die Beispiele von Raab/Győr und Ödenburg/Sopron," in *Frühneuzeitforschung in der Habsburgermonarchie, Adel und Wiener Hof—Konfessionalisierung—Siebenbürgen*, ed. István Fazekas et al. (Vienna: Institut für Ungarische Geschichtsforschung, 2013), 155–70.

gifts and ambitious construction works, and the inventories list pieces of immovable property, from houses and mansions through mills, arable lands, and vineyards to shops and inns; the convents had the means of employing their own surgeons, apothecaries, masons, carpenters, tailors, shoemakers, butchers, bakers, black- and coppersmiths, and so forth. Municipal councils and mining chambers sometimes provided for the payment of Jesuit schoolmasters.[15] All of this was far from being politically innocent, nor free of severe conflicts. In Banská Štiavnica, for instance, the Jesuit and Catholic revival was largely thanks to the influence of the superior Raimund Decker (dates unknown), formerly the confessor of Emperor and King Leopold I (1640–1705, r.1657–1705), under whom the town's largest church, hospital, and other facilities were transferred by royal gift to the Jesuits. When the town council refused to comply, three hundred Catholics occupied the church, and the presence of seven hundred imperial mercenaries ensured an atmosphere in which, for the first time in a hundred years, Catholics returned to the municipal assembly.[16]

The variegated sources of patronage enabled the Society of Jesus to strike strong roots in the region, and they also demonstrate that, besides the undoubtedly powerful leverage it received from the imperial and the Catholic hierarchy, this was also thanks to the recognition of the value of the services they provided among the local communities. As a result, the number of Jesuits active in Hungary grew—from 149 in 1650 to three times as many by the beginning and six times as many by the middle of the eighteenth century—and so did the number of their students: the Trnava college alone had 440 students in the year of its foundation, but within just a few years this figure had risen to 700.[17] As well as the standard curriculum prescribed in the *Ratio studiorum*, the boarders had the opportunity to receive training in a wide array of other subjects and skills, in response to specific local or social needs. These may have

15 The Acta Jesuitica in the Hungarian National Archives (OL Kam. Lt. Acta Jes.) holds a wealth of relevant material. This brief and impressionistic glance is based on coll. Trench. no. 2151, fasc. 1, fol. 1–8; coll. Leucsov., no. 683, fasc. 7, pp. 185–90. No. 1; coll. Neosol., no. 808, fasc. 7, fol. 343–44. No. 27, fasc. 7, fol. 382–87. Nos. 44–45.

16 Vendelín Jankovič, *Dejiny jezuitov v Banskej Štiavnici: Príspevok k náboženským dejinám mesta od XVI. storočia do konca XVIII. storočia* (Bratislava: Vydava Filozofická Fakulta, 1941), 82–87; Ede Richter and Ernő Király, "Selmeczbánya," in *Magyarország vármegyéi és városai: Hont vármegye és Selmecbánya sz. kir. város*, ed. Samu Borovszky (Budapest: Apolló, 1984), 85–127, here 112; http://www.mek.oszk.hu/09500/09536/html/0011/8.html (accessed April 10, 2019). On the re-Catholicization of towns in general, see István H. Németh, "Unterdrückung oder Reform? Die Rekatholisierung in der ungarischen königlichen Freistädten," in *Město v převratech konfesionalizace v 15. až 18. století*, ed. Václav Ledvinka et al. (Prague: Scriptorium, 2014), 435–50.

17 Gyenis, *A jezsuita rend*, 10.

included extra-curricular instruction in mathematics, geography, polite letters and good manners, contemporary languages from German, French, and Italian to Hungarian and Slovak—but also fencing, dancing, music, and ball games.[18] Some locally produced study tools assisted in catering for these, such as the first Hungarian-language textbook, the *Grammatica linguae Ungaricae* (Grammar of the Hungarian language [1682]) by Pál Pereszlényi (1630–89),[19] or later the *Diarium adolescentis studiosi* (Diary of an adolescent student [1697]), a life conduct book for young nobles by historian Gábor Hevenesi (1656–1717).

2 Turbulent Times and an Immigrant Family around the Mines

It was into this milieu that the mining engineer Matthäus Cornelius Höll (1650–1743) arrived and settled in Banská Štiavnica in 1694. The end of the seventeenth and the beginning of the eighteenth century was a period of upheaval in the history of Hungary and Central Europe. Generally and in its long-term consequences, it was marked by the "Danubian turn" of the Habsburg dynasty.[20] After the 1648 peace settlement of Münster and Osnabrück that put an end to the Thirty Years' War and perpetuated religious pluralism and territorial decentralization in the Holy Roman Empire, the Habsburgs turned their eyes and resources to the consolidation and expansion of their possessions east of the River Leitha. At first, their reluctance to concentrate with full determination on the expulsion of the Ottomans from Hungary evoked resentment, even an abortive conspiracy (1671), among a group of impatient Hungarian Catholic magnates. The Viennese response was an attempt to tighten metropolitan hold over the country through government by decree and enhanced military presence, as well as the persecution of Protestants, which in turn provoked the rebellion led by Imre Thököly (1657–1705). As Thököly received support both from Transylvania and the Ottomans, the Habsburg effort to put down the

18 The Jesuit *seminarium* or *convictus nobilium* was an institution that adapted especially smoothly to local needs. Cf., for instance, the curricula pursued by students in Bologna as described in Gian Paolo Brizzi, *La formazione della classe dirigente nel Sei-Settecento: I seminaria nobilium centro-settentrionale* (Bologna: Il Mulino, 1976), 246; for the same in Cluj in Transylvania, see Shore, *Jesuits and the Politics of Religious Pluralism*, 96–97.

19 Cf. Zsuzsa C. Vladár, "Pereszlényi Pál grammatikája (1682.): Források és párhuzamok," *Magyar Nyelv* 103, no. 3 (2007): 257–70.

20 The best English-language interpretation of these developments is found in R.J.W. [Robert John Weston] Evans, *Austria, Hungary, and the Habsburgs: Central Europe, c.1683–1867* (Oxford: Oxford University Press, 2006), especially 3–98. For a concise overview, see László Kontler, *A History of Hungary* (Basingstoke: Palgrave Macmillan, 2002), 175–90.

rebellion became intertwined with the wiping out of the independent Principality of Transylvania in 1691, as well as with the campaign aimed at finally squeezing the Turks out of Hungary. This began after the failure of the last Ottoman siege of Vienna in 1683, and ended with the peace of Karlovci (Karlóca, Carolovicium, Karlowitz) in 1699. However, a genuine settlement could not commence until a decade and a half later. In 1703, another revolt ensued, this time led by the scion of seventeenth-century Transylvanian princes and one of the wealthiest magnates of the country, Ferenc Rákóczi II (1676–1735), who temporarily managed to unite disgruntled nobles, disbanded fortress soldiers, and well-to-do as well as indigent peasants, and to bring substantial parts of the country under his control. Though the Habsburgs were also kept busy on the western front by the War of Spanish Succession (1701–14), the military odds favored them. The legislation of several diets that followed the 1711 Peace of Satu Mare (Szatmár, Szattmarinum, Sathmar) acknowledged their hereditary claim (even in the female line) to Hungary—though they were obliged to issue coronation charters, convene diets regularly, and respect the privileges of the nobility.

While the main theater of the anti-Ottoman war effort was the triangular territory under Turkish control in the central and southern parts of the country, northern Hungary was not spared by these hostilities. The eastern part of the area was the base of Thököly, who among others occupied and ransomed Banská Štiavnica, Banská Bystrica, and Kremnica in 1678 and 1679, and evicted the Jesuits from Banská Štiavnica in 1679 and from Košice and Levoča in 1682. In turn, an extraordinary court set up in Bratislava in 1674 sentenced a group of Protestant preachers to galley slavery,[21] and another one in Prešov in 1687 had adherents of Thököly tortured and executed. The towns also changed masters several times during the Rákóczi war, resulting in various "calamities" experienced by the Jesuit communities of, for instance, Banská Bystrica and Levoča.[22] As for Hungary as a whole, the vast and potentially fertile area that the "Holy League" of the papacy, Venice, Poland–Lithuania, Russia, Brandenburg, Saxony, Bavaria, and the Habsburgs conquered for the latter was barren and desolate: Hungary's plains were scorched earth, inhabited by fewer souls than two centuries earlier. In order to redress the situation, large-scale plans for the "refurbishment" of the country, informed by cameralist sciences, populationism,

21 On this, see Marcell Sebők, "Victims of Reformations? 16–17th-Century Refugees and Their Impact on Artistic and Cultural Production," in *Expulsion and Diaspora Formation: Religious and Ethnic Identities in Flux from Antiquity to the Seventeenth Century*, ed. John Tolan (Turnhout: Brepols, 2015), 135–48.

22 Paul Shore, *Narratives of Adversity: Jesuits in the Eastern Peripheries of the Habsburg Realms (1640–1773)* (Budapest: Central European University Press, 2012), 173–210.

and natural law,[23] were conceived already during the liberation wars, and spontaneous as well as organized resettlement—mostly of several hundred thousand Balkan Orthodox Serbs, and Catholic German "Swabians"—also took place around the turn of the seventeenth and eighteenth centuries.

Matthäus Höll's marriage certificate of November 22, 1707 at the parish registry of Banská Štiavnica, which refers to him as a *Gen*[*erosus*] *D*[*omi*]*nus*, a man of respectable social standing, identifies him as *natione Bohemus ex Schlackenberg* (i.e., "a Bohemian by nation from Schlackenberg"). There is, however, no place called Schlackenberg in Bohemia. A late descendant has put forward "Schlaggenwerth in Bavaria" as Höll's place of origin, also suggesting that Bohemia may have been but a temporary station in the family's migration.[24] This is contradicted by his identification in the church documents as a Bohemian, which has given rise to speculation about Schlackenwerth, or even Schlaggenwald (in Czech, Ostrov and Horní Slavkov, respectively), both in the Karlovy Vary region in western Bohemia.[25] The union of Höll, a widower, with Julianna Victoria Staindl (1685–?),[26] the daughter of an official auditor (*Überraiter*)[27] in Štiavnické Bane, was his second marriage. In total, his two marriages produced twenty-two sons and daughters, only some of whom are mentioned in any meaningful historical records. Apart from Maximilian, the youngest of the family, the best known is Joseph Karl (1713–89), who, like his father, became a prodigious engineer and inventor. Ignaz Cornelius (1711–82), who allegedly spoke eighteen languages, also filled various functions around the local mines, while a daughter whose name is not known is said to have been as proficient in mathematics as any student of the Banská Štiavnica mining school established in 1735. There are records of other Hölls working in the

23 László Kontler and Balázs Trencsényi, "Hungary," in *European Political Thought 1450–1700: Religion, Law, and Philosophy*, ed. Howell A. Lloyd, Glenn Burgess, and Simon Hodson (New Haven: Yale University Press, 2006), 176–207, here 203–4.

24 Pinzger, *Hell Miksa*, 10.

25 Faller, *A magyar bányagépesítés úttörői*, 18–19; Dušan Janota, "Život Maximiliána Hella/Das Leben Maximilian Hells," in *Maximilián Hell 1720–1792: Zborník prednášok z konferencie o živote a diele Maximiliána Hella*, ed. Ján Novák (Bratislava: ÚRAD pre Slovenské banské múzeum v Ban. Štiavnici, 1970), 45–69, here 45. In each case, the German place names—"slag hill," "slag forest"—refer to mining activity.

26 In an autobiography, preserved in his own hand and dated Vienna, June 9, 1773, Hell spells the name of his mother "Juliana Steindlin." Private collection of copies of documents of the late Magda Vargha (1931–2010) at the Miklós Konkoly-Thege Institute of Astronomy in Budapest (hereafter: Vargha priv.).

27 Überreiter is interpreted by Norbert Weyss, "Maximilian Hell und sein Fernsehen vor 200 Jahren, Part II," *Maria Enzersdorfer Kulturnachrichten* (December 1986): 4 as *kaiserliche*[*r*] *Rechnungskontrollor*; by Pinzger, *Hell Miksa*, 1:10, simply as *ellenőr* (controller).

mines of the region and elsewhere, whose relationship with Matthäus Cornelius cannot be established with full certainty: Georg, mentioned in Baia Mare (Nagybánya, Rivulus Dominarum, Neustadt) in Transylvania in 1737, and Joachim Michael (1724–61), the operator of the water pumps designed by Joseph Karl in Štiavnické Bane in 1751.[28]

Höll senior's relocation to Banská Štiavnica, while coinciding with the major population movements mentioned above, is more helpful to explain in the context of the long-standing tradition of the migration of mining experts into the region in answer to the specific needs of the industry. Many of the new developments in it depended on special expertise. In addition, given the lack of other major industries and persons with relevant skills, mining and metallurgical experts were often also charged with various tasks in general mechanical engineering, construction works, water regulation, and even forestry and wood processing. While mining was a strategic branch for Vienna,[29] it also required permanent attention. The ups and downs in the seventeenth-century fortunes of the mines in the region were not only due to the endemic wars in the territory of Hungary and the competition of the New World. The resources were still plentiful, but in order to reach the ores, deeper and deeper shafts were needed. Explosives were used to develop these in Banská Štiavnica, a pioneer in this respect, as early as 1627.[30] The removal of water also became an increasingly formidable technological challenge, no longer manageable by

28 Information on Hell's family has been culled mainly from Pinzger, *Hell Miksa*, 1:9–13; Faller, *A magyar bányagépesítés úttörői*, 18–20; Anton Pinsker, "Der Astronom Pater Max Hell S.J.," *Freinberger Stimmen* [Linz] 41 (1971): 99–111. Cf. Janota, "Život Maximiliána Hella," 45–47; Ferencová, *Maximilián Hell*, 9–13. Some authors speak of Maximilian Hell as one of twenty-three, not twenty-two, sons and daughters of Matthäus Höll. As the Mining Archive in Banská Štiavnica preserves several accounts signed by Joachim Michael in the same file that also holds plans of machinery and further accounts deriving from Matthäus Cornelius and Joseph Karl, their relationship is quite likely. Štátny ústredný banský archív v Banskej Štiavnici (ŠÚBA BŠ), HKG 2617. The same archives also contain as many as thirty-two contemporary maps of mines and shafts attributed in the catalog to "František Kornel Hell," who, however, is not mentioned in any other source known to us.

29 In the 1770s, thirty percent of the income of the treasury in Hungary (and fifty percent in Transylvania) derived from the mines, while between seventy and eighty-five percent of the value of mining in the Habsburg monarchy came from these two provinces. Sándor Tar and László Zsámbék, eds., *Selmectől Miskolcig, 1735–1985: A magyarországi műszaki felsőoktatás megindulásának 250. évfordulójára* (Miskolc: Nehézipari Műszaki Egyetem, 1985), 7–8.

30 Antal Péch, *Alsó-Magyarország bányamívelésének története* (Budapest: Magyar Tudományos Akadémia, 1884–87), 2:225–31. The innovation was introduced by the Tyrolean immigrant expert Caspar Weindl, invited to Banská Štiavnica by Count Hieronymus Montecuccoli as chief shareholder of the main mining company there.

human or animal power: in 1687, out of the 2,173 workers of the mines in Banská Štiavnica, 720, one-third, were employed in lifting the water, while only 474, less than one-quarter, were employed in the actual production.[31] This could only result in huge deficits, so that many of the smaller mining companies had gone bankrupt by the 1690s, and at times even the overall closing down of the mines was contemplated by the wielder of sovereign control—whoever that might be at the given moment.

Whether Matthäus Höll's move to Banská Štiavnica was directly linked with this critical situation or not,[32] thanks to his qualifications—he is said to have been well versed in mathematics, mechanics, and chemistry—he began to play important roles in meeting the challenges soon after his arrival. As *Oberkunstmeister* (roughly, chief engineer), he prepared plans for replacing horse and human power with water-wheel driven machinery to operate the pumps, and to exploit the topography of the region for developing artificial lakes with a view to ensuring and regulating adequate water supply. He also constructed mechanical devices for the easier delivery of ore from the shafts. These plans were approved in 1699 by the Imperial Court Chamber, the ultimate supervisory authority of the mines, and their implementation began in the following year.

Soon enough, however, this was interrupted by the occupation of the town by the troops of Rákóczi, whose urgent need for resources led to a predatory exploitation of the mines during the years after 1703. Realizing that this was unsustainable, Rákóczi decided to close down the mines altogether and commissioned his close associate, General Miklós Bercsényi (1665–1725), to demolish them. It was Höll who prevented this: in an apparently dramatic scene, he convinced Bercsényi that investing in the further improvement of the machinery would salvage the national assets that the mines represented.[33] While this prediction proved too optimistic in the short run, Höll managed to perform essentially the same feat a few years later. The consequences of the 1708 Battle

31 The data derive from the *Epistolae itinerariae* (1700) of the Dutch scholar Jakob Toll (Jacobus Tollius [1633–96]), who visited the region in 1687. See Johann Kachelmann, *Das Alter und die Schicksal des ungarischen zunächst Schemnitzer Bergbaues* (Bratislava: n.p., 1870), 182.

32 It is not unlikely that before his final relocation, Höll had already visited the town as a young man. Sources like the *Bericht von Wasser-Werken* by the renowned Viennese cameralist Johann Joachim von Becher (1635–82), who also made significant contributions to mineralogy, mention that during the pillage of the town by Thököly's captain, "Pater" István Józsa, in 1679, the first specimen of a type of water pump whose invention is attributed to Höll was destroyed. Cf. Faller, *A magyar bányagépesítés úttörői*, 33.

33 Antal Péch, *A tudományok haladásának befolyása a selmeczvidéki bányaművelésre* (Budapest: Magyar Tudományos Akadémia, 1881), 15.

of Trenčín returned Banská Štiavnica to Habsburg hands, and in 1710 the Imperial Court Chamber ordered the closure of the mines once again. But Höll obtained an audience with Joseph I (1678–1711, r.1705–11), and pleaded with the emperor so successfully that he secured funds for the development of another lake and the construction of a new water pump.[34]

Within a generation—quite literally, as Höll senior's position was later filled by his son Joseph Karl[35]—Höll's perseverance was crowned with significant success. While elsewhere in the region engineers had already experimented with primitive and high wood consumption steam engines (called "fire engines"), the Hölls insisted on further improving the technology based on water. Several new lakes were constructed for power supply, and Joseph Karl replaced traditional water mills with real hydraulic machines. Inundations were at least temporarily contained, and as a result, from the late 1730s the mines of Banská Štiavnica witnessed a new golden age that lasted until the end of the eighteenth century. In 1740 alone, 2,429 marks of gold and 92,267 marks of silver were produced, and the income from the mines over the following two decades was a staggering forty-two million florins; the population of the town around 1750 is estimated at about twenty thousand (six thousand of them working in the mining industry), making it the second largest in northern Hungary, surpassed in the area only by Bratislava.[36] Prosperity and success also stimulated an innovative and "curious" spirit: after long-standing traditions of training qualified staff in the region by guild-like methods, it is no coincidence that in 1735 Banská Štiavnica became the seat of a proper mining school (Montanistiche Schule),[37] established by order of the Imperial Court Chamber.

34 Kachelmann, *Das Alter und die Schicksal*, 191–92.

35 Many of the cunning devices in place in Banská Štiavnica around 1770 are attributed to Joseph Karl, not his father, in Nikolaus Poda, *Kurzgefaßte Beschreibung der, bey dem Bergbau zu Schemnitz in Nieder-Hungarn, errichteten Maschinen* (Prague: Walther, 1771), 51, 54, 57, 61, 66, 70, 74.

36 Figures are taken from Jozef Vlachovič, "Banská Štiavnica—prostredie, v ktorom vyrastal Maximilián Hell/Banská Štiavnica—das Milieu, in dem Maximilián Hell herangewachsen war," in Novák, *Maximilián Hell*, 31–42.

37 The sketch on the development of the school below is based chiefly on Tar and Zsámbék, *Selmectől Miskolcig*, especially 13–17, 31–36, 45–52, 65–66, 90–100. The same volume also includes several sources (in Hungarian translation). On the school in the overall context of academic life in eighteenth-century northern Hungary, see Ján Tibenský, "Pokusy o organizovanie vedeckého života v Habsburskej Ríši a na Slovensku v 18. storoči/Versuche zur Organisierung des wissenschaftlichen Lebens im Habsburgerreich und in der Slowakei in 18. Jahrhundert," in Novák, *Maximilián Hell*, 3–25. See also Peter Konečný, "Die montanistische Ausbildung in der Habsburgermonarchie, 1763–1848," in *Staat, Bergbau und Bergakademie: Montanexperten im 18. und frühen 19. Jahrhundert*, ed. Hartmut Schleiff and Peter Konečný (Stuttgart: Felix Steiner Verlag, 2013), 95–124; Peter Konečný, *250.*

Following the model of the similar school in Jáchymov (Sankt Joachimsthal) in Bohemia, founded in 1716, it offered a two-year curriculum for eight students, focusing on applied mathematics and physics (but, given the intricate legal affairs involved in the mining industry, also law) and supported by a specialized library of up-to-date literature on engineering and natural knowledge. Instruction was free of charge and open to Catholics and Protestants alike, but admission was conditional on passing an exam in arithmetic; students from a poor background received scholarships. This institution was upgraded to a "practical training school" (Praktische Lehrschule) in 1763—with a course of studies in which, despite the name, the emphasis on theoretical background was to be enhanced—until in the year 1770 it was renamed again, to become a mining academy (Bergbauakademie) with a curriculum defined in the *Systema Academiae Montanisticae* (System [of studies] of the Mining Academy) extended to three years.

Some assessments of the impact of the school, especially in the early years when most of the training was done by the mining officers who were all too busy in their main job, are skeptical.[38] However, the institution already boasted some outstanding faculty members in this period, such as Sámuel Mikoviny (1698/1700–50), the renowned mathematician, engineer, and cartographer.[39] Mikoviny is generally regarded as the founder and main theoretical fountainhead of scientific cartography in Hungary, whose formidable legacy in this field—thirty-nine county and district maps[40]—is perhaps thanks to the unique combination of training in engraving as well as mathematics, astronomy, and land surveying at the universities of Nuremberg, Altdorf, and Jena, and subsequently privately in Vienna. It has been conjectured that Mikoviny, besides serving in times of war as an army officer for purposes of military engineering, and from 1735 as supervisor of the engineering sector of the mines as

výročie Banskej a lesníckej akadémie v Banskej Štiavnici: Jej význam pre vývoj montánneho školstva v Rakúsko–Uhorsku, 1762–1919/250. Jubiläum der Berg- und Forstakademie in Schemnitz; Ihre Bedeutung für die Entfaltung des höheren Montanschulwesens in Österreich-Ungarn, 1762–1919 (Košice: Banská agentúra, 2012), 12–53.

38 János Mihalovits, *A selmeci bányászati akadémia alapítása és fejlődése 1846-ig* (Budapest: József Nádor Műszaki és Gazdaságtudományi Egyetem, 1938), 3.

39 On Mikoviny, see Enikő Török, *Mikoviny Sámuel* (Budapest: Magyar Országos Levéltár, 2011).

40 These maps accompanied the five volumes of the *Notitia Hungariae novae historico-geographica* (1735–49) by Mikoviny's master, polymath Mátej Bel or Mátyás Bél (1684–1749). On Bél, Mikoviny, and the beginnings of *Landeskunde* (*honismeret*—roughly, local history, literally "science of the fatherland") in Hungary, see Zsolt Török, *Bél Mátyás, Mikoviny Sámuel és a honismereti iskola* (Budapest: Országos Pedagógiai Könyvtár és Múzeum, 2003).

well as a professor at the Montanische Schule in Banská Štiavnica, also constructed an observatory there as a base for his lectures in astronomy, and inspired the young Maximilian Hell to study the subject. Unfortunately, there are no sources corroborating this attractive assumption.[41] It is certain, however, that Mikoviny taught Hell's brother Joseph Karl, as well as other distinguished figures of the local mining scene, such as Christoph Traugott Delius (1728–79), who would also become a professor at the same school.[42] Another important polymath associated with the school in its early years was the botanist and medical doctor Nikolaus Joseph von Jacquin, appointed as professor of *Bergwissenschaften* (mineralogy and chemistry) in Banská Štiavnica in 1762. Von Jacquin, of French background but a native of Leiden, was invited to Vienna by the Dutch court physician and reformer Gérard van Swieten (1700–72), with whom he finished his studies. He then embarked, on commission from Emperor Francis I (1708–65, r.1745–65), on a long voyage to the West Indies (1755–59), returning with ethnographic objects as well as plant and animal specimens for the Schönbrunn gardens. After a period at the Praktische Lehrschule, von Jacquin became the director of the new Viennese Botanical Gardens, and at the end of his long life he served as rector of the university.[43]

41 Pärr, *Maximilian Hell*, 76, 124. The account of an observatory in Banská Štiavnica seems to be based on a misunderstanding. The source, *Programma de speculis uranicis celebrioribus* [Lecture concerning famous astronomical observatories], was presented by Johann Heinrich Müller (1671–1731) in Altdorf (where Mikoviny later studied) on August 15, 1713 (not 1723, as alleged by Pärr); it was later included in a volume of collected works from 1731. In this *Programma*, Müller explicitly mentions that he has recently built an observatory in Altdorf. There is no mention whatsoever of Banská Štiavnica in this source. See *Joh. Henrici Muelleri, In Universitate Norimbergensium Altorfina Philosophiae Nat. & Mathem. Professoris Publici, Collegium Experimentale: In quo Ars experimentandi, praemissa brevi eius delineatione, Potioribus aevi recentioris Inventis ac Speciminibus, de Aere, Aqua, Igne ac Terrestribus, explanatur ac illustratur, & ad genuinum Scopum Usumque accommodatur* (Nuremberg: Endterus, 1731), 254–67, especially 266–67.

42 Delius's work *Anleitung zu der Bergbaukunst nach der Theorie und Ausübung* (1773), besides Poda's *Kurzgefaßte Beschreibung*, mentioned above, is also the chief primary source from which the devices constructed by Matthäus Cornelius and Joseph Karl Höll are known.

43 On the significant contributions of von Jacquin as a botanist, see Maria Petz-Grabenbauer, "Zu Leben und Werk von Nikolaus Joseph Freiherr von Jacquin," *Wiener Geschichtsblätter* 50, no. 3 (1995): 121–50; Klemun and Hühnel, *Nikolaus Joseph Jacquin*. A friend of von Linné whose system he championed in Austria and applied to the local flora in a series of monumental publications, von Jacquin's chief works also included the *Selectarum stirpium americanarum historia* (1763), which has been made available in a splendid edition with a substantial introduction. See Santiago Madriñán, *Nikolaus Joseph Jacquin's American Plants: Botanical Expedition to the Caribbean (1754–1759) and the Publication of the* Selectarum stirpium americanarum historia (Leiden: Brill, 2013).

The school and the mines in the area had become established as a popular destination for the study trips of aspiring mining engineers from various parts of Europe.[44] Another individual who played an important part in developing the region's appeal was Ignaz von Born (1742–91), a nobleman of Transylvanian Saxon origin and one of the shining lights of the Austrian Enlightenment. An eminent mineralogist and a member of several European scientific academies, in the 1770s he himself organized in Prague the Privatgesellschaft, a "private society" regarded as the predecessor of the Czech Academy of Sciences, and arranged in Vienna the imperial natural history cabinet that was the base of the later Museum of Natural History. As grand master of the Viennese lodge Zur wahren Eintracht (For genuine harmony) in the 1780s, von Born was a leading freemason and the author of radical satirical pamphlets on subjects such as monasticism (as we shall see, with Maximilian Hell as an especial target) and bureaucratization, while also an imperial administrator playing important roles in the department of mines and the mint. In this latter capacity, he had a short spell in Banská Štiavnica in 1769–70 as *Oberstkammergraf* (supervisor of the mines for the imperial chamber) and began collaboration with the professors of the mining academy there. In the 1780s, he returned to nearby Skleno/Sklené Teplice (Szklenó/Turócnémeti, Glashütte/Glaserhau/Glaserhütte) to continue experiments in the amalgamation of metals begun in the laboratory of the Viennese court pharmacy. The most glorious moment in the region's eighteenth-century scientific history is probably the gathering of mining and metallurgical experts in Skleno in 1786, interested in von Born's method. On von Born's initiative, this meeting resulted in the founding of the famous Society for the Art of Mining (Societät der Bergbaukunde), a truly international association that soon established chapters in fourteen countries, attracting over 150 members in Europe and America for research in mining and associated industries.[45]

---

44 See Peter Konečný, "Cestopisy európskych odborníkov ako forma komunikácie poznania o baníctve a hutníctve v Uhorsku, 1651–1759/Reiseberichte europäischer Fachleute als Kommunikationsform des Wissens über das Berg- und Hüttenwesen im Königreich Ungarn, 1651–1759," *Montánna história* 7 (2014): 200–39.

45 On von Born generally, see Helmut Reinalter, ed., *Die Aufklärung in Österreich: Ignaz von Born und seine Zeit* (Frankfurt am Main: Peter Lang, 1991). On von Born's work in amalgamation, see Lothar Suhling, "Von der Alten zur Neuen Welt und zurück: Der Vor- und Frühgeschichte der Europäischen Amalgamation nach Ignaz von Born im Überblick," in *Technik, Arbeit und Umwelt in der Geschichte. Günter Bayerl zum 60. Geburtstag*, ed. Günter Bayerl, Torsten Meyer, and Marcus Popplow (Münster: Waxmann Verlag, 2006), 77–94. On von Born and the Society, see Günter B. Fettweis and Günther Hamann, eds., *Über Ignaz von Born und die Societät der Bergbaukunde: Vorträge einer Gedenkveranstaltung zur 200; Wiederkehr des Gründungstages im September 1786 der ältesten internationalen*

Maximilian Hell was born and raised in a closely knit region marked by abundant natural resources and a potential for economic prosperity, ethnic, linguistic, religious, and cultural diversity, and strong civic traditions, including those of municipal self-government as well as urban sociability and sensitivity to the value of intellectual and educational goods. During the "long century" of his lifetime, the region saw periods of calamity and instability as well as recovery, in which local tradition and initiative intersected with the increasingly systematic endeavor of the Habsburg state apparatus to support technological innovation, with a view to the rationalization and maximization of resource exploitation. Maximilian's family legacy and environment comprised geographic and social mobility and adaptability, high levels of personal integrity and authority, as well as intellectual adroitness and ingenuity. Altogether, this was a heavy baggage of assets for the ambitious youngest son of the seventy-year old *Oberkunstmeister* of the Banská Štiavnica mines.

3 Apprenticeship

Maximilian Hell grew up in a respectable, mansion-like family home. It was still standing on the steep slope opposite the "maiden fortress" of Banská Štiavnica, a fortified tower erected in the sixteenth century to watch out for movements of Turkish raiders, at the time when his early twentieth-century biographer described the early circumstances of his life.[46] Little else is known about these circumstances, apart from the fact that after completing elementary school in Banská Štiavnica, his path diverted from what seems to have been regular in the family. Unlike Joseph Karl, who received some training in engineering, mechanics, hydraulics, and physics from his father and entered service in the machinery workshop of the mines before he was twenty (though later, in 1737, he did attend Mikoviny's courses),[47] the young Maximilian was sent to study in the Jesuit gymnasium in nearby Banská Bystrica.

While there is no direct evidence about the background and circumstances that led to this decision, the sources allow some informed conjectures. In a family such as his, Hell could hardly have avoided exposure to mathematics

wissenschaftlichen Gesellschaft (Vienna: Verlag der Österreichischen Akademie der Wissenschaften, 1989). See also Tibenský, "Pokusy o organizovanie vedeckého života," 22. The operational rules of the society (including a list of the directors of the national chapters) are reproduced from its short-lived journal *Bergbaukunde* in Tar and Zsámbék, *Selmectől Miskolcig*, 100–3.

46 Pinzger, *Hell Miksa*, 1:9.

47 Faller, *A magyar bányagépesítés úttörői*, 39.

and related fields, which in turn may have revealed his special talents to his elders. The same discovery could have been made by a teacher, or indeed the local Jesuits themselves, who not only maintained a convent in Banská Štiavnica but also performed ordinary parish duties due to a lack of secular priests, and were thus a permanent presence in the everyday life of the urban community. In this sense, the Society of Jesus was no different from the mining chamber, the chief employer in the town. The relationship between the two entities went beyond such parallels: several documents show the mining chamber to have shown concern with the proper care of the souls of their workers by the Jesuits to whom this was entrusted, and a willingness to support the efforts of the Society with financial donations.[48] The Hölls as both prominent figures in the mining sector and staunch Catholics may well have been brokers in this relationship. Interesting light is shed on this in a letter from the superior of the Banská Štiavnica residence, Father Anton Grueber (1701–46), to Queen Maria Theresa, probably in 1744, the year after Höll senior had died and when Grueber was appointed. Grueber began by reporting that the miners of the area "have humbly solicited us already for the second time to secure a place in Windschacht for the better worship of God and the special comfort of their souls, and to provide two fathers, the one proficient in the German and the other in the Slavic [i.e., Slovak] language" for this end. He went on to make the following recommendation:

> Now, as in consequence of the death of the former *Kunstmeister* Cornel Hell a shabby house, consisting of two very small and one somewhat bigger room, belonging to the Chamber here, has become vacant, it would suit us very well because of its vicinity (it is just a few footsteps from our filial church of St. Joseph).[49]

48 MOL, E 152 Acta Jesuitica, Irreg. Coll. Schemn. 13. t. 3–7.

49 ŠÚBA BŠ, HKG 2617, 35. On Grueber, who was himself also an ethnic German native of Banská Štiavnica, see the online compendium of Jesuits in Hungary based on the legacy of the eminent Hungarian Jesuit, László Szilas (1927–2012), *Jezsuita névtár*; http://jezsuita.hu/nevtar/grueber-antal/ (accessed April 12, 2019). Besides Szilas's work, we have also used other collections of a prosopographical nature about Jesuits, according to the different angles from which they look at Jesuits for different purposes. These include Carlos Sommervogel's (1834–1902) monumental *Bibliothèque de la Compagnie de Jésus* [...] *Bibliographie*, 12 vols.(Brussels: Oscar Schepens, 1890–1932); László Lukács, *Catalogi personarum et officiorum provinciae Austriae S.I.*, 9 vols. (Rome: Institutum Historicum S.I., 1994); and http://www.jesuitscience.net/ (accessed April 12, 2019), created as part of a PhD project at the University of Wuppertal by Dagmar Mrozik.

A lengthy justification followed, with reference to the growing number of the flock, and the consequent needs in terms of baptismal, funerary, and other services.

From the point of view of a family such as the Hölls, a member's association with (and possibly recruitment in) the Society of Jesus may have been a source of spiritual consolation and pride—besides being an opportunity to equip a bright son with the best education available, and the more mundane advantage of having one less mouth to feed. As Joseph Karl was by this time already establishing himself in the footsteps of his father, and the other brothers also seem to have filled positions around the mines, the career prospects there may have become restricted. While receiving a Jesuit education did not necessarily mean a life-long association with the Society, Hell did make the crucial step of applying for membership in the order and was admitted for his two-year novitiate in Trenčín on October 17, 1738.[50]

In terms of the organization of the Society of Jesus, the territory where Hell grew up, pursued his studies, and began his career in the order belonged to the Society's huge Austrian Province (Provincia Austriae or Austriaca). A map drawn by Johann Baptist Mayr (1681–1757), prelate of the Abbey of Rebsdorf in Bavaria and published by the prolific Augsburg map publisher Matthäus Seutter (1678–1757) around 1727–30 (reproduced in Appendix 1 of this book), shows the extent of the province, with all its main schools and houses, as Hell knew it from his youth until the suppression of the order in 1773. The province extended from Passau and Salzburg through the Austrian lands south of the Danube and the whole of the Kingdom of Hungary (including modern Slovakia and Croatia), to Transylvania, and even to the missions in the north Balkans. Originally, the Austrian province had been part of an even vaster province of South Germany (Provincia Germaniae Superioris), from which it was separated in 1583. While a Bohemian province had been carved out of the Austrian one in 1622, occasional initiatives to create an independent Hungarian province were thwarted.[51] Nevertheless, Hungarians and Slavs would be appointed as superiors of the Austrian province besides Germans. Furthermore, the rectors of the larger houses, themselves of very diverse origins, often played roles beyond their normal functions: as the mandatory annual visitation of all

50 Pinzger, *Hell Miksa*, 1:13. It may be of interest for Hell's itinerary and mobility in the region that while he graduated from Banská Bystrica, for unknown reasons the application took place—according to the records of the Jesuit residence in Trnava, which Pinzger claims to have used—in the town of Žilina (Zsolna, Solna, Sillein).

51 See László Lukács, *A független magyar jezsuita rendtartomány kérdése és az osztrák abszolutizmus (1649–1773)* (Szeged: Szegedi I. sz. Magyar Irodalomtörténeti Tanszék, 1989).

the houses of the province could not be carried out by the superior, the task was delegated to these rectors.

As for the Jesuit rank-and-file, its growth in number during the eighteenth century reflected the continuing vigor of the Society—and the support of the Catholic dynasty and government in Vienna—after the expulsion of the Ottomans from Hungary. The number of brethren in the whole of the Austrian province rose from around a thousand in 1651 and 1,300 in 1716 to a record high of 1,904 in 1767, out of which 1,038 were active in the fifty smaller or bigger convents in the territory of Hungary.[52] Their background was as diverse as the ethnic and linguistic composition of the Habsburg monarchy. On the basis of forms filled in at the entrance of each novice (usually still in their teens), it has been established that of the total number of "Austrian" Jesuits who were around in 1773, forty-four percent came from Austria, and forty-one percent from the Kingdom of Hungary.[53] The remaining fifteen percent derived largely from neighboring territories under Habsburg rule or the Holy Roman Empire, such as Bavaria, Bohemia, Moravia, Silesia, or Tyrol. The form also contains information about the novices' linguistic skills. Knowledge of Latin had been instilled in all these Jesuits from a young age, as it not only formed the core of the curriculum in the Jesuit schools but its use was also compulsory in conversation.[54] As for vernacular languages, nearly sixty-five percent of the "Austrian" Jesuits of Hell's generation were recorded to have known German well (*bene*), whereas only thirty percent were in command of Hungarian. Nearly as many mastered a Slavic language (seventeen percent Slovak, eleven percent the

52 These figures are taken from András Gyenis, *Régi jezsuita rendházak: Központi kormányzat* (Vác: n.p., 1941), 5–6. It is noteworthy that the average number of members in a province in the mid-seventeenth century was four hundred to eight hundred (and the Bohemian province was set up with fewer than three hundred). Practical considerations thus may well have warranted the division of the Austrian province and the creation of a Hungarian one. It has been suggested that the reasons why this did not happen included rivalry and mutual suspicion between Jesuits of Austrian and Hungarian background, and the courtly influence of the former, who also alleged their Hungarian colleagues to be both "barbarous" and much too sympathetic to the nationalist cause. See Lukács, *A független magyar jezsuita rendtartomány kérdése*, passim.

53 László Szilas, "Austria I. Antigua," in *Diccionario histórico de la Compañía de Jesús: Biográfico-temático*, ed. Charles Edward O'Neill and Joaquín María Domínguez (Rome: Institutum historicum S.I., 2001), 1:277–92, here 1:286–87. See also Félix Litva, entry entitled "Eslovaquia," in O'Neill and Domínguez, *Diccionario histórico de la Compañía de Jesús*, 2:1262–65.

54 See Joseph Bruckner, *La Compagnie de Jésus: Esquisse de son institut et son histoire* (Paris: Gabriel Beauchesne, 1919), 444–49; Peter Burke, *Languages and Communities in Early Modern Europe* (Cambridge: Cambridge University Press, 2004), 54.

language that in more recent times is known as Croatian),[55] followed by seven percent Italian, one percent Romanian, and one percent French speakers. Bi- and trilingualism, then, must have flourished among the novices of the Austrian province. The eighteen-year-old Maximilian Hell was no exception. According to the list of novices at Trenčín, he knew *Latinam, German*[*icam*], *Slav*[*icam*] *bene* (Latin, German, and Slavic [Slovak] well).[56] One notices the absence of Hungarian in this entry: the ethnic Hungarian component in the population of Upper Hungary was meager. But as we shall see, even those who, like Hell, had no Hungarian, could still refer to themselves as a Hungarus and characterize Hungary as their *patria*.

Hell spent most of his adolescence and early adulthood in the milieu of the Jesuit colleges of northern Hungary, in towns that were of great importance to the intellectual and cultural development of the kingdom as a whole. His formation there was interrupted by years of higher training at the University of Vienna. It is helpful to consider what can be garnered, mainly from sheer data and indirect evidence, about Hell's experiences in the former places, and then return to the Viennese years. Banská Bystrica, already mentioned several times as an important center in the mining district, within a long day's walk from Hell's hometown, was the site of a medium-sized Jesuit college with around thirty members[57] during the time of Hell's secondary studies there. Thus, in terms of weight and significance, it belonged to the second tier of Jesuit establishments in the region, surpassed only by Trnava with its residence, college, and university and around a hundred members (itself second only to Vienna and Graz in the whole of the Habsburg lands), and Trenčín, the seat of the only other novitiate besides Vienna in the entire Austrian province of the Society, with over seventy members (including the novices, overwhelmingly recruited from the Kingdom of Hungary). By contrast, the college of Levoča, where Hell was sent to take up his first teaching position upon his graduation as a *magister* from the University of Vienna in 1745, was a relatively small institution, with

55 Szilas, "Austria," 287. It is difficult to find a neutral designation for the Slavic languages of the eighteenth century. For a balanced and well-informed discussion in English, see Tomasz Kamusella, *The Politics of Language and Nationalism in Modern Central Europe* (Basingstoke: Palgrave Macmillan, 2009).

56 *Nomina noviciorum secundum Ordinem, quo ingressi sunt in hanc domum probationis Trenchinij Provinciae Austriae Societatis Jesu*, under the heading *Quas linguas calleat* (quoted after Pinzger, *Hell Miksa*, 1:13).

57 Members of Jesuit colleges included fully ordained priests (*sacerdotes*), magisters (graduates of lower university studies), secular assistants (*coadiutores temporales*), and in the case of training houses, novices (*novitii*).

fewer than twenty members.[58] Hell spent two years in Levoča, teaching grammar and syntax in his first year and rhetoric and poetry in the second, when he was also assigned with keeping the *historia domus* (history of the house) and acted as an assistant to the local clergy, *Patris regentis socius*. He was also the chair of the pupils' congregation of the Virgin Mary, a function in which he could exercise his own rhetorical skills.[59]

Levoča was a unique place from a different point of view than the other localities where Hell had spent time so far. In the far-away northeast of Upper Hungary, it belonged to the group of Spiš towns, which had enjoyed a set of privileges defined on a regional basis since the thirteenth century, and the political picture was further complicated by the fact that the right to tax these lands had been mortgaged to Poland by the king of Hungary in 1412, an arrangement that continued until the first partition of Poland in 1772. Better known in the period by its German name Zips, the area was much of a "language island" (*Sprachinsel*) where Protestantism had gained an early foothold. Its cultural and political association with Vienna was thus comparatively loose not only because of physical remoteness, and it is no coincidence that early in the eighteenth century the Rákóczi revolt drew a great deal of support in Spiš. The presence in Levoča of a Jesuit gymnasium and other Catholic institutions was part of Viennese efforts to stabilize this area as a loyal hinterland of the empire.[60] Still, even though in Levoča as well as in all the other towns where Hell spent his youthful years, a Lutheran majority was preserved among the inhabitants, confessional relations in the period seem to have been relatively calm.[61] Protocols of the town magistrates rarely refer to the Jesuits—and then in neutral contexts—and while the residence or the college was often party to litigation over property, debt, or other matters, these were not different in

58 The figures given are approximate because there was naturally some fluctuation over the years. They are based on Lukács, *Catalogi personarum*, 8 (1734–47): 140, 333, 757. This invaluable collection also provides full membership lists of all Jesuit colleges, residences, and missions in the Austrian province. On the Jesuit period of the Catholic gymnasium in Levoča, see László Halász, *A lőcsei királyi katholikus főgymnasium története* (Lőcse: Reiss József, 1896), 14–39.

59 Lukács, *Catalogi personarum*, 8:821.

60 On the cultural history of the area, see Wynfrid Kriegleder, Andrea Seidler, and Jozef Tancer, eds., *Deutsche Sprache und Kultur in der Zips*, Presse und Geschichte: Neue Beiträge 24 (Bremen: Edition lumière, 2007).

61 This was despite the fact that the latest settlement of religious affairs in the Kingdom of Hungary, the *Carolina resolutio* issued by Charles VI/III in 1731, still restricted rights of worship by non-Catholics, allowed them very limited self-government, kept mixed marriages under the control of the Catholic Church, and punished conversion to any version of Protestantism.

character from affairs of similar kinds between parties belonging to the same denomination.[62]

Vienna, where Hell interrupted his Upper Hungarian trajectory for three years of studies in philosophy (logics, physics, and metaphysics) and two in mathematics at the university during the early 1740s, and where he returned to complete the curriculum in theology at the end of the decade, had an altogether different ambience. Academic life in Vienna had by then been steeped in Jesuit erudition for nearly two centuries.[63] At first, Vienna seemed a fertile soil for the Reformation, and the early measures to counter its spread included some reforms at the University of Vienna in the 1530s, as well as the invitation of the Society of Jesus to the city by Ferdinand I, king of Hungary and Bohemia, who ruled the Habsburg hereditary provinces on behalf of Emperor Charles V (1500–58, r.1519–56) in 1550–51. A Jesuit college was opened in Vienna at the same time, under the leadership of Claude Le Jay (Claudius Jajus [1504–52]), Ignatius of Loyola's close associate, who immediately conceived a plan of bringing all faculties of the university except law and medicine under the college as a fully public institution, getting rid of "heretical" professors.

As soon found out by Le Jay and the renowned Dutch Jesuit theologian Peter Canisius (Petrus Canisius [1521–97]), who was also brought to Vienna in 1553 to lead the work of the Reformkommission of the university, this was not practicable because of a shortage of competent "non-heretic" professors. The *Nova reformatio* of 1554, a new constitution of the university that remained in effect until the Theresan and Josephian reforms beginning in the 1750s, reduced the corporative character of the university and increased the possibilities for interference by the territorial sovereign (*Landesherr*), who, however, also

62 This is revealed by a survey of the following stock of documents. Štátny archív v Banskej Bystrici, Banská Štiavnica. Protocollum Liberae Regiae Civitatis Montanae Schemnitziensis de Annis 1725–1735; Spišský archív v Levoči. XXI. 40–42. Protocollum Regiae ac Liberae Civitatis Leuchoviensis pro Anni 1740–1750; Štátny archív v Trenčíne, KN/I 58–65, Protocollum Liberae ac Regiae Civitatis Trenchiniensis, Actorum Politicorum 1738–1743; MGTN Contractus 1560–1755; MOL E 152 Acta Jesuitica II.a. Coll. Leucsov., passim.

63 The following survey is based on Rochus Perkmann, *Die Jesuiten und die Universität Wien* (Leipzig: Otto Wigand, 1866); J. Wrba, "Der Orden der Gesellschaft Jesu im Alten Universitätsviertel von Wien: Hundertfünfzig Jahre von den Jesuiten geprägte Universität," in *Das alte Universitätsviertel in Wien, 1385–1985*, ed. Günther Hamann, Kurt Mühlberger, and Franz Skacel (Vienna: Universitätsverlag für Wissenschaft und Forschung, 1985), 2:47–74; Kurt Mühlberger, "Universität und Jesuitenkolleg in Wien: Von der Berufung des Ordens bis zum Bau des Akademischen Kollegs," in *Die Jesuiten in Wien: Zur Kunst- und Kulturgeschichte der österreichischen Ordensprovinz der "Gesellschaft Jesu" im 17. und 18. Jahrhundert*, ed. Herbert Karner and Werner Telesko (Vienna: Österreichische Akademie der Wissenschaften, 2003), 21–37.

consolidated the finances. While mandatory courses had to be based on prescribed authors and readings, the religious tests for professors became less demanding, and during the next few decades Protestant professors, even rectors, were tolerated. However, as the Jesuit college reaped quick successes, obtaining the right to confer *magister* titles and thereby breaking the monopoly of the university, conflicts over competences remained on the agenda and were resolved in the "Klesl era" to the advantage of the Jesuits. Melchior Klesl (1552–1630) came from a Viennese Protestant burgher family but had a Jesuit education, was appointed as *Generalreformator* of the university and the region by the pope and the emperor in 1590, and as archbishop of Vienna in 1616. Though as university chancellor and then rector he took several steps that countered the Jesuits' interests, he introduced a Catholic test for all graduating students, and was the first to raise, in 1609, the idea of transferring the whole of the philosophical faculty to the Jesuits. This took place in 1622–23 with the incorporation of the college in the university, which secured all professorial chairs in philosophy (including—pertinently for the present case—branches of mathematics) and most in theology for the Society of Jesus. The Jesuits also obtained the building of the university and several boarding houses, with the obligation to erect in their place an academic college (Collegium Academicum Viennense Societatis Jesu) with a church, theater, library, laboratory, and (later) observatory. Beginning in 1746, they also ran the Seminarium Nobilium or Collegium Theresianum, or simply the Theresianum: an "imperial academy" launched in the framework of the reform program associated with Count Friedrich Wilhelm von Haugwitz (1702–65) as chancellor, for preparing young noblemen for entering the civil service in Vienna. But this institution remained a separate entity, much like the Oriental Academy (in its full name, Kaiserlich-königliche Akademie für Orientalische Sprachen [Imperial and royal academy of oriental languages]), a school that offered training in Turkish, Arabic, and Persian, as well as some other skills for future diplomats in the East. It was founded in 1754 in the context of Chancellor Wenzel Anton Count Kaunitz-Rietberg's (1711–94) general policy of administrative modernization, and also marked by a strong Jesuit presence.[64]

These latter developments took place in an era when, according to the standard narrative on the subject, sweeping reforms initiated by Maria Theresa's Dutch personal physician, Van Swieten, began to undermine the positions of the Jesuits at the university and, in the long run, more generally in the Habsburg

64 Given Vienna's geopolitical situation and cultural exposure to "the East," the Oriental Academy was a strategic institution. See David do Paço, *L'Orient à Vienne au dix-huitième siècle* (Oxford: Voltaire Foundation, 2015).

capital, preparing the ground for the order's suppression two and a half decades later.[65] Indeed, in 1749, Van Swieten, in his capacity as director of studies at the Faculty of Medicine, implemented reforms that, thanks to their greater emphasis on bedside work and other features, not only led to the rise of the international renown of the first great Viennese medical school but with its strict application of the principle that higher education was an affair of state in every aspect from appointments through remuneration to teaching materials and so forth also provided a model of centralization during the next few years for the other faculties, too. Another important development was set in motion by the Viennese archbishop Christoph Anton Migazzi (1714–1803), who in 1758 established a *Priesterseminar* that exclusively employed professors who supported Jansenism.[66]

We have recently been cautioned that the apparent breakthrough associated with Van Swieten was neither abrupt nor smooth, and that the ascription of a quasi-heroic status to him is an aspect of the twentieth-century master narrative on "Josephism," not fully supported by, and to some extent even contravening, the sources and the earlier literature.[67] As a result of these processes, the dominance of the Jesuits was to some extent reduced. However, interpreting them, with the hindsight gained from the dénouement of 1773, as the beginning of an irreversible path to suppression, or a period of transition toward such an end, is probably less instructive than regarding them as what they most probably were for those affected on all sides: a program of coordination and cooperation, with a reforming and calculating government determined to optimize the allocation of resources at its disposal for the sake of greater international competitiveness (the attainment of which required efforts apparently

65 Van Swieten is the key figure in Erna Lesky, *Österreichisches Gesundheitswesen im Zeitalter des aufgeklärten Absolutismus* (Vienna: Rohrer, 1959); Lesky, "Gerard van Swieten: Auftrag und Erfüllung," in *Gerhard van Swieten und seine Zeit*, ed. Erna Lesky and Adam Wandruszka (Vienna: Böhlau, 1973), 11–62; more generally, Notker Hammerstein, "Besonderheiten der österreichischen Universitäts- und Wissenschaftsreform zur Zeit Maria Theresias und Josephs II," in *Österreich im Europa der Aufklärung: Kontinuität und Zäsur in Europa zur Zeit Maria Theresias und Josephs II*, ed. Richard Georg Plaschka (Vienna: Verlag der Österreichischen Akademie der Wissenschaften, 1985), 787–812; Winfried Müller, "Der Jesuitenordnung und die Aufklärung im süddeutsch-österreichischen Raum," in Klueting, *Katholische Aufklärung*, 225–45, here 229–33.

66 For an account of the early proponents of Jansenism in Austria and the role of Migazzi in particular, see Peter Hersche, *Der Spätjansenismus in Österreich* (Vienna: Verlag der Österreichischen Akademie der Wissenschaften, 1978), 50–70.

67 Sonia Horn, "Auftrag und Erfüllung: Erna Lesky and medizinhistorische Narrative im 20. Jahrhundert," in *Josephinismus zwischen den Regimen. Eduard Winter, Fritz Valjavec und die zentraleuropäischen Historiographien im 20. Jahrhundert*, ed. Franz Leander Fillafer and Thomas Wallnig (Vienna: Böhlau, 2016), 181–212.

coinciding with those needed to secure the common good).[68] As with other (administrative, financial, military etc.) reforms initiated by von Haugwitz and Kaunitz during the 1740s and 1750s, largely in response to the Habsburg monarchy's mixed performance in the War of Austrian Succession (1740–48), the university reforms targeted privilege—more precisely, privilege that ran counter to the utilitarian calculus of efficiency—but not expertise. The meritocratic considerations that inspired these steps actually favored the Society of Jesus, which not only retained control over the faculties of theology and philosophy (under which mathematics, astronomy, and experimental physics were sorted) at the university but played a key role in providing such expertise in the two new Viennese institutions of higher learning, the Theresianum and the Oriental Academy.

It would indeed have been a waste of resources to abandon Jesuit knowledge. The Jesuit professors of Vienna and other universities in the Habsburg monarchy were sufficiently competent to write textbooks (which they were required to do regularly by a 1753 decree), including one in physics that presented the controversy of Cartesian and Newtonian positions in a cogent and accessible manner—similar, for instance, to the *Dissertatio physica de motu corporum* (Physical Dissertation on the Motion of Bodies, Trnava, 1753) by polymath Ferenc Kéri Borgia (1702–68). Kéri Borgia had previously been the first professor to systematically cultivate astronomy at the University of Trnava in the 1730s, to return there as rector in 1752, after serving a period of six years at the Jesuit college and thus the University of Vienna in various functions. These works obviously could not arise from rashly and newly gained knowledge, but from a confident use of discourses already available among Jesuits in the region, although difficult to bring into the public in a still ambivalent situation. While there was an urge to publish up-to-date works by the state that was arising as the supervisory authority of universities, the papal prohibition of teaching Copernicanism issued to Galileo in 1616 formally remained in force until 1757, when it was lifted thanks to Boscovich's efforts.[69] Among many other

68 For the state as a coordinating mechanism of this kind, applied to Habsburg history (in an earlier period), see Karin J. MacHardy, *War, Religion, and Court Language in Habsburg Austria* (Basingstoke: Palgrave Macmillan, 2002).

69 The manifestations of Jesuit reception of the new natural philosophy in Trnava are divided into two phases in Csaba Csapodi, "Newtonianizmus a nagyszombati jezsuita egyetemen," *Regnum* 6 (1944–46): 59–68. The textbooks written by several Trnava professors up to around 1758 testify to extensive familiarity with Newton, but with a strong preference for Descartes, while by the 1760s Newton clearly prevailed. At that time, the fully Newtonian two-volume textbook of the Viennese Jesuit professor Karl Scherffer's (1716–83) *Institutionum physicae* […] (1752–53) was in use in Trnava, too. Cf. Csaba Csapodi, "Két

multi-talented Jesuit fathers on the Viennese academic and intellectual scene was Joseph Franz (Frantz [1704–76])—mathematician, astronomer, and physicist, but also a master of oriental cultures who in the early 1740s collected precious coins and natural objects while traveling in Asia Minor and briefly served as director of the renowned school of languages in Pera, the Latin quarter of Istanbul.[70] His published output covers areas ranging from electricity through paleontology and botany to philosophy, but he also wrote *Godefridus Hierosolymitanus* (Gottfried of Jerusalem [1757]), a drama performed in Latin and French as well as Turkish at the Oriental Academy, of which—no doubt because of the Pera experience—he was also appointed as the first director. In addition, he served as dean of the university's faculty of philosophy from 1752 to 1759, and as tutor of the future emperor Joseph II (1741–90, r.1765–90), who had him buried at his personal expense.[71]

Kéri Borgia and Franz have been singled out from a crowd of similar figures on account of their relationship—probable in the first and ascertained in the second case—to the young Maximilian Hell during his early years in Vienna. After a consideration of the general milieu that surrounded Hell in the towns of Upper Hungary and then in the Habsburg capital, it is pertinent to attempt to construct a gallery of possible interlocutors—professors, fellow students—in these environments. As noted above, the Jesuit houses in Banská Štiavnica, Banská Bystrica, and Levoča were relatively small establishments, but a few of Hell's teachers and colleagues even there are known as authors of theological, historical, and literary works of minor significance.[72] It was during his novitiate in Trenčín that he may have first encountered figures whose stature surpassed the boundaries of the local.

The rector of the *domus probationis* there in these years was Ferenc Kazy (Kazi [1695–1759]), whose three-volume *Historia Regni Hungariae* (History of

világ határán: Fejezet a magyar felvilágosodás történetéből," *Századok* 79–80, no. 1 (1945–56): 85–137; Jolán M. Zemplén, *A felvidéki fizika története 1850-ig*, rev. and ed. István Gazda (Budapest: Magyar Tudománytörténeti és Egészségtudományi Egyesület, 2016 [1973]), 180–88. A previous, Slovak version of this study was published as *Dejiny fyziky na Slovensku do polovice 19. storočia* (Bratislava: Veda, 1974). On Scherffer, see below, 68–69.

70 Do Paço, *L'Orient à Vienne*, 27.

71 Johann Steinmayr, "Die Geschichte der Universitätssternwarte Wien," in *Die Geschichte der Universitätssternwarte Wien: Dargestellt anhand ihrer Instrumente und eines Typoskripte von Johann Steinmayr*, ed. Jürgen Hamel, Isolde Müller, and Thomas Posch, Acta Historica Astronomiae 38 (Frankfurt: Harri Deutsch Verlag, 2010), 169–201, here 177–78. Steinmayr (1890–1944) generally highlights the blooming of mathematical talent among the Jesuits of the Austrian province.

72 The source for this is the *Jezsuita névtár*; http://jezsuita.hu/nevtar/?l=J (accessed April 12, 2019), collated with data from Lukács, *Catalogi personarum*.

the Kingdom of Hungary, Trnava [1739–49]) was long considered, mainly in accounts by Piarist and Protestant authors, a piece of epigonism (or worse),[73] but today, together with his history of the University of Trnava (1737), it is appreciated as a respectable anticipation in methods and approach of the great Hungarian Jesuit historical school later in the century.[74] Some of Hell's fellow novices in Trenčín are even more interesting. They include Adam František (Franz) Kollár (1718–83), who was in the second year of his novitiate when Hell was admitted.[75] Kollár was to play an important part in the shaping, advocacy, and implementation of Theresan enlightened reform policies.[76] Like Kazy, he was also a native of northern Hungary and may have been Hell's schoolmate in the gymnasium of Banská Bystrica; his studies in philosophy at the University of Vienna in 1741–43 (and the year he spent there studying Hebrew in 1745) also partially overlapped with those of Hell.[77] He also began the curriculum in theology but left the Society of Jesus in 1748. In that year, his long-standing career at the Imperial and Royal Court Library began as a scribe, culminating in 1773 with his appointment as chief librarian (succeeding Van Swieten, and preceding the latter's son, Gottfried [1733–1803]). This appointment earned him the title of court councilor, in which capacity he sat on the important Studien-Hofkommission (court committee for science and education), responsible for the general overhaul of the education system in the Habsburg monarchy. It was also the body that adjudicated on Hell's plan for a Viennese academy of sciences in 1773–75.[78] Kollár, who had a prodigious talent for ancient and

73 Specifically, Kazy was charged with following too closely the work of Sámuel Timon (1675–1736), who in the 1720s was the rector of the Jesuit college in Cluj, another significant venue in the early career of Hell. See, e.g., Bálint Hóman, "Tudományos történetírásunk megalapítása a XVIII. században," in Hóman, *Történetírás és forráskritika* (Budapest: Magyar Történelmi Társulat, 1938), 353–80, here 367–68.

74 Elréd Borián, "A történetíró jezsuita testvérek: Kazy Ferenc és Kazy János újraértékelése," *Az Egyetemi Könyvtár Évkönyvei* 9 (1999): 45–64. The chief figures of Jesuit historical scholarship in eighteenth-century Hungary were István Kaprinai (1714–85), György Pray (1723–1801), and István Katona (1732–1811), all of whom were later interlocutors for Hell in his studies of early Hungarian history.

75 Lukács, *Catalogi personarum*, 8:332.

76 On Kollár, besides the slender volume of Jan Tibenský, *Slovenský Sokrates: Život a dielo Adama Františka Kollára* (Bratislava: Tatran, 1983), published in Hungarian as *A királynő könyvtárosa: Adam František Kollár élete és művei* (Budapest: Madách, 1985), the most up-to-date and valuable piece of academic literature is a Hungarian edition of his selected correspondence, with the editor's introduction, István Soós, ed., *Kollár Ádám Ferenc levelezése* (Budapest: Universitas Kiadó, 2000).

77 Lukács, *Catalogi personarum*, 8:528, 589, 716.

78 See below, 345–51.

modern (including exotic) languages and coined the word "ethnology,"[79] made a scholarly record in diverse fields, from inquiry into native American cultures (based on holdings of the court library) to legal and historical studies. His works in these latter fields, which were published in the 1760s, addressed a challenge to the privileges of the Hungarian nobility, based as they were on a distinctive historical ideology. These contributions made an impact on the atmosphere in which Hell's and his associate János Sajnovics's (1733–85) work on the linguistic kinship of Hungarian and "Lappish" (i.e., Sámi), and more broadly on early Hungarian history, was received in the 1770s.[80]

Another fellow novice worthy of note was János Zakarjás (Zachariás [1719–72]), Hell's junior by one year in the Trenčín house.[81] Originally from the town of Gyöngyös in central Hungary, he entered the Society of Jesus after attending the course in logic at the University of Trnava, where he returned after his probationary years to complete his studies and to teach in the gymnasium (which he then also did briefly in Esztergom). However, right upon his ordination in 1749, he applied—together with Xaver Franz Eder (Xavér Ferenc Éder [1727–72]), another native of Banská Štiavnica and a Trenčín and Trnava graduate—for missionary work. After completing the preparatory seminar and learning some Spanish in Córdoba, they were sent to Peru, arriving in Lima in the summer of 1751.[82] Zakarjás did not leave a coherent account of his experiences, nor

79 On this aspect of Kollár's contributions, see Han T. Vermeulen, *Before Boas: The Genesis of Ethnography and Ethnology in the German Enlightenment* (Lincoln, NE: University of Nebraska Press, 2015), 20, 218 (referring to prompts by Tibenský, cf. n. 184).

80 See below, 254–56, 379–87.

81 Lukács, *Catalogi personarum*, 8:394; http://jezsuita.hu/nevtar/zacharias-janos/ (accessed April 12, 2019).

82 Zakarjás and Eder (on the latter, see http://jezsuita.hu/nevtar/eder-x-ferenc/ [accessed April 12, 2019]) were among up to twenty eighteenth-century Jesuits from the Kingdom of Hungary active in the Indies. Another one was Ignác Szentmártonyi ([1718–93], http://jezsuita.hu/nevtar/szentmartoni-ignac/ [accessed June 5, 2019]) who taught mathemats ics in Vienna during the early phase of Hell's studies in the capital and later completed his curriculum in theology there at broadly the same time as Hell (see Lukács, *Catalogi personarum*, 9:43–44). Szentmártonyi joined the Brazilian mission in 1753 and carried out important cartographic work. Besides shorter and older accounts of these figures, focusing on adventurous and calamitous aspects and including Tivadar Ács, "Délamerikai magyar utazók a XVII. és XVIII. században," *A Földgömb*, 9 (1938): 67–74, 113–17, 150–53, and Ács, *Akik elvándoroltak* (Budapest: n.p., 1940), or ones in which the Jesuit presence in Latin America is embedded in a larger discussion of Hungarians in the continent, László Szabó, *Magyar múlt Dél-Amerikában* (*1519–1900*) (Budapest: Európa, 1982); see also László Bartusz-Dobosi, "Magyar missziósok az 'Indiákon,'" in *A magyar jezsuiták küldetése a kezdetektől napjainkig*, ed. Antal Molnár (Piliscsaba: Pázmány Péter Katolikus Egyetem, 2006), 200–16. There is now a comprehensive study of those working in Brazil; see Dóra

any academic treatise, but some of his letters—addressed to Kazy, Kéri Borgia, and another former fellow novice in Trenčín, József Bartakovics (1722–63), notable on account of his pursuits in poetry and drama[83]—have been preserved.[84] These provide an insight into his travels along the Andesian tributaries of the River Amazon and his work among the natives of Moxos (Mojo) province, and in a typical Jesuit fashion into the "natural and moral history" of the region.[85] While most of Zakarjás's fellow Hungarian missionaries suffered severely—including incarceration and death—from the consequences of the suppression of the Society of Jesus in the Iberian monarchies in the late 1750s, he managed to return to Hungary in unclear circumstances and worked as a schoolmaster and librarian in the town of Komárom (Komárno, Comaromium, Komorn) until his death in 1772.

There is no evidence of any direct contact between Hell and these figures at a later date—although, given his and Kollár's positions in the highest academic circles in Vienna over nearly thirty years between Hell's appointment and Kollár's death, in their case such contact may almost be taken for granted. Nevertheless, their profiles point to certain sensibilities in northern Hungarian Jesuit culture that are relevant to any attempt at understanding Hell's own trajectory, and vice versa: an interest in and commitment to the tradition of the ancient Hungarian monarchy and dedicating critical scholarship to its interpretation; a concomitant willingness to serve the Habsburg dynasty and the government, partly via such scholarship, in its efforts at improvement; and an openness to the wider world even at the expense of considerable physical exertion and personal hazard.

Nothing specific can be known or even conjectured about Hell's professional formation in the disciplines in which he later earned the greatest distinction, mathematics and astronomy, until his Viennese years. Upon his enrollment in

---

Babarczi, "Magyar jezsuiták Brazíliában a 18. század közepén" (PhD diss., University of Szeged, 2011).

83 http://jezsuita.hu/nevtar/bartakovics-jozsef/ (accessed April 12, 2019).

84 Published as "Zakarjás János és Fáy Dávid délamerikai jezsuita misszionáriusok uti levelei (1749–1756)," *Földrajzi Közlemények* 38 (1910): 115–28, 215–36. Eder, however, whose more robust health allowed him to travel even more widely, wrote a *Descriptio provinciae Moxitarum in Regno Peruano* (published posthumously in Buda in 1791, and in La Paz in 1888), still regarded as an important source for the ethnography of several isolated tribes in the region.

85 The term, of course, refers to José de Acosta's *Historia natural y moral de las Indias* (1590), which established the tradition of learned Jesuit travel account. On Zakarjás's contribution, see Lajos Boglár, "The Ethnographic Legacy of Eighteenth-Century Hungarian Travellers in South-America," *Acta ethnographica* 4, nos. 1–4 (1955): 313–59, here 323–33 (including the English translation of the letter to Kéri Borgia).

the university, these fields were supervised there by two eminent polymaths of the Jesuit college: Erasmus Frölich (Fröhlich [1700–58]), also known for his work in numismatics and antiquarian studies, and Joseph Franz, already mentioned as the first director of the Oriental Academy but at this time still at the helm of the Viennese Jesuit Observatory, which he and Frölich had constructed at one end of the compounds of the college back in 1733–34.[86] Franz soon recruited the young Hell to make observations there, apparently around 1743, though evidence for this is scanty. The only concrete reference to this year in this context seems to be in a letter by Hell to the Danish astronomer Thomas Bugge (1740–1815) as late as 1789: "How many strenuous works I have conducted in the service of astronomy for forty-six years of my life, ever since 1743, from which year my first observations are extant, will be talked about by future generations."[87] A manuscript biography, most probably written by Hell's successor Franz de Paula Triesnecker (1745–1817) (from 1809, von Triesnecker), gives the years "1744 and 1745," and 1745 is also mentioned in Schlichtegroll's *Nekrolog* of 1793.[88] Around the same time, the gifted student used his spare

86 This was the second astronomical observatory in Vienna, following upon the one created with support from Emperor Charles VI by court mathematician Johann Jakob (Giovanni Jacopo) Marinoni (1676–1755) on the top of his own house in 1730 (described by contemporaries as one of the most beautiful ones in Europe). The Jesuits' self-standing "tower" was forty-five meters high, rising above the neighboring buildings by around twenty-four meters, according to Pinsker, "Der Astronom," 102; for further details, see Per Pippin Aspaas, Thomas Posch, and Isolde Müller, "Astronomische Observatorien der Jesuiten in der 'Provincia Austriae' im 18. Jahrhundert," *Acta historica astronomiae* 52 (2014): 89–110. In the literature, the Jesuit observatory is often confused with the Imperial Observatory established in 1755. Cf. Karl Adolf-Franz Fischer, "Jesuiten-Mathematiker in der Deutschen Assistenz bis 1773," *Archivum historicum Societatis Iesu* 47 (1978): 159–224; Agustín Udías, *Searching the Heavens and the Earth: The History of Jesuit Observatories* (Dordrecht: Kluwer Academic, 2003), 29; Gudrun Wolfschmidt, "Cultural Heritage and Architecture of Baroque Observatories," Paper delivered at the European Society for Astronomy in Culture Seventeenth Annual Meeting, SEAC 2009, 4; http://www.math.uni-hamburg.de/spag/ign/stw/seac09-obs-barock.pdf (accessed April 12, 2019).

87 Hell in Vienna to Bugge in Copenhagen, Vienna July 24, 1789. Pinzger, *Hell Miksa*, 2:154. There is no primary evidence provided to support the claim that Hell was actually hired as an assistant of Franz at his observatory in 1745. Cf. Konradin Ferrari d'Occhieppo, "Maximilian Hell and Placidus Fixlmillner: Die Begründer der neueren Astronomie in Österreich," in *Österreichische Naturforscher, Ärzte und Techniker*, ed. Fritz Knoll (Vienna: Verlag der Gesellschaft für Natur und Technik, 1957), 27–31, here 27.

88 [Franz de Paula von Triesnecker], *Lebenslauf von Hell*, Österreichische Akademie der Wissenschaften, Wien, Nachlass Littrow, transcript by Hannelore and Horst Kastner-Masilko; http://kastner-masilko.at/LebenslaufHell.pdf (accessed April 12, 2019); "Maximilian Hell," in Schlichtegroll, *Nekrolog*, 284. The *Observationes astronomicae in speculo Viennensi 1734–50 factae* attributed to Franz might shed light on Hell's earlier career as an observer (see Heinrich Kellner, "Franz, Joseph," in *Allgemeine Deutsche Biographie* 7 [1878]: 318–19), but

time to construct sun and moon dials, as well as terrestrial and celestial globes. These were probably included in the Museum Mathematicum, or laboratory of the Jesuit college, which had been founded in 1714 and occupied a lower floor underneath the observatory itself.[89]

Karl Scherffer (1716–83) must also be mentioned among Hell's seniors at the University of Vienna who were to play a part in his later career. A mere four years older than Hell, Scherffer—a native of Gmunden in Upper Austria—already had a professorial career in Graz behind him when in 1750 he was called back to Vienna, where he had pursued his studies. The apparent reason for his recall was that as the prefect (*praefectus*) of the new observatory (established in 1745) as well as the laboratory in Graz he failed to obtain the money needed for modernizing the stock of instruments.[90] According to some accounts, no observations at all could be made in the Graz observatory,[91] which has also been described as "still-born."[92] This would have been certainly unworthy of the traditions of astronomy in Graz, where Kepler had stayed in the final years of the sixteenth century, and the Jesuit Paul Guldin (1577–1643) had presented his influential theory of gravity in the 1630s and 1640s. Be that as it may, Scherffer earned high esteem as a professor of mathematics and physics and was a prolific author of scientific writings in Latin and German. His *Institutionum Physicae Pars Prima, seu Physica Generalis* and *Pars Secunda, seu*

---

we have not been able to locate this work. Cf. Aspaas, Posch, and Müller, "Astronomische Observatorien der Jesuiten."

89 Steinmayr, "Geschichte der Universitätssternwarte," 263.

90 Helmut Platzgummer, "Scherffer, Karl," in O'Neill and Domínguez, *Diccionario histórico de la Compañía de Jesús* 4:3519–20.

91 Constant von Wurzbach, "Karl Scherffer," in *Biographisches Lexikon des Kaiserthums Oesterreich, enthaltend die Lebensskizzen der denkwürdigen Personen, welche seit 1750 in den österreichischen Kronländern geboren wurden oder darin gelebt und gewirkt haben*, vols. 1–60 (Vienna: Verlag der Univeritätsbuchdruckerei/K.k. Hof- und Stadtsdruckerei, 1856–91), 29:214–16.

92 Johann Steinmayr, "Die alte Jesuiten-Sternwarte in Graz," ed. Isolde Müller and Thomas Posch, in *Beiträge zur Astronomiegeschichte* 11, ed. Wolfgang R. Dick, Hilmar W. Duerbeck, and Jürgen Hamel, Acta historica astronomiae 43 (Frankfurt: Harri Deutsch, 2011), 232–60, here 245. This is, however, contradicted by an undated letter of Scherffer to Franz Weiss; see Magda Vargha, ed., *Correspondence de Ferenc Weiss astronome hongrois du XVIIIe siècle* (Budapest: Bibliothèque de l'Université Budapest, 1990), 8–9. On the evidence of manuscripts at the Universitätsbibliothek Graz, regular astronomical observations were made in Graz in 1758–60, 1762, and 1764–73, but some astronomical observations from the years 1746–47 are also extant, as well as meteorological observations from the years 1754–56 and 1760–73. See the editors' introduction and comments on Steinmayr's study. Thanks also to Michaela Scheibl at the Universitätsbibliothek Graz for the information provided via correspondence. On Weiss, see below, 75–6.

Physica Particularis (Introductions to physics: Part 1, general physics; Part 2, parts of physics [1752–53]) was the first to introduce Newtonianism in a physics textbook in the Habsburg lands, and was an important source (among many others) of the Graz professor Leopold Gottlieb Biwald's (1731–1805) *Physica generalis* and *Physica particularis* (General physics; Parts of physics [1767–68]), which, in turn, were influential across Europe.[93] Scherffer also remained very active in the Viennese astronomical community during Hell's tenure as imperial and royal astronomer, chiefly on the theoretical side, as demonstrated by his *Institutiones astronomiae theoreticae* (Introductions to theoretical astronomy [1777]).[94]

In 1745, Hell had his first (anonymous) work published. The *Elementa arithmeticae numericae et literalis, exposita a Joanne Crivellio* (Elements of numerical and literal arithmetics, explained by Joannes Crivelli) is the "third, corrected" edition of a textbook by the Venetian mathematician and priest Giovanni Francesco Crivelli (1690–1743), originally published in Italian in 1728 and then in Latin in 1740. In some of the literature on Hell, this volume is referred to by the title *Elementa algebrae Joannis Crivelli magis illustrata et novis demonstrationibus et problematibus aucta* (Elements of algebra by Joannes Crivelli, illustrated and expanded by new demonstrations and problems), and it is claimed that the "further explanations and expansions by new demonstrations and exercises" indicated in the title were considerable.[95] In the copy available to us (bearing the former title), this cannot be ascertained. Hell took the previous Latin edition of 1740 and—according to his short addition to the editorial preface—confined himself to "emending dubious Latin phrases by supplanting them with new ones that are both clearer and especially accommodated to

93 Cornelia Faustmann, "'In parte physicae theoretica Newtonum eiusque commentators secutus sum': Leopold Gottlieb Biwald's *Physica generalis* as a Compendium Propagating Newtonian Physics in Europe," in *The Circulation of Science and Technology: Proceedings of the 4th International Conference of the ESHS in Barcelona, 18–20 November 2010*, ed. Antoni Roca-Rosell (Barcelona: SCHCT-IEC, 2012), 349–54, and Faustmann, "Physik des 18. Jahrhunderts im Spiegel der Quellen" (PhD diss., University of Vienna, 2010).

94 It is noteworthy that while this work contains many references to great contemporary astronomers like Lalande, Lacaille, Halley, Boscovich, and so forth, none of Scherffer's peers in Vienna are acknowledged. Despite treating topics in which Hell ought to be considered an expert, he makes no reference to him: when mentioning, for instance, the so-called satellite of Venus, he presents in brief the same explanation as Hell had used in his treatment of the subject, but without any reference. Karl Scherffer, *Institutiones astronomiae theoreticae* (Vienna: Trattner, 1777), 8. Similarly, while a brief section is devoted to "De transitu Veneris, vel Mercurii infra discum Solis," he only quotes Lalande as an authority. Scherffer, *Institutiones astronomiae theoreticae*, 391.

95 Pinsker, "Der Astronom," 103–4. *Elementa algebrae* is also the title mentioned in Sommervogel, "Hell," 250.

the needs of beginners. Freed from its typographical errors, we hereby present this work to readers eagerly wishing to learn this highly useful science."[96] What is important to note is that in the summary of the progress of mathematics provided in the author's introduction to both editions, Crivelli firmly aligns himself with the moderns, mentioning Cartesian algebra and the invention of infinitesimal calculus (attributed by him to Leibniz) in a tone of high appreciation.[97] Hell apparently had no reason to dissent. To further locate Crivelli and his oeuvre, his *Elementi di fisica* (Elements of physics [1731; revised edition 1744]) should be mentioned, too: he closely follows Newton in all branches of physics from optics to astronomy, and in the enunciation of phenomena from colors through gravity to ebbs and tides, and speaks of Galileo as "the prince of scientists."[98]

The first edition of another anonymous work, titled *Adjumentum memoriae manuale chronologico-genealogico-historicum* was also published by Hell in 1750. This "manual of chronology, genealogy, and history for the assistance of memory" consisted of thematically arranged lists of important names and events of sacred and profane history (biblical figures, popes, religious orders; rulers of European states, major battles, and peace treaties) that went through ten editions; the final (posthumous) revision was published in 1802.[99] The *Adjumentum* was a pedagogical exercise, and he had other ample opportunities to test and improve his skills in this regard in several other ways during his Viennese years. Already as a student of philosophy, he was appointed *manducator*, a kind of supervisor of his peers; when he returned to the university for the course in theology in 1748, he was at first *bidellus concionum et tonorum*, that is, an assistant chairing test sermons and lectures, and then in his upper years the prefect of the students of theology in the Collegium Pazmanianum

96 [Giovanni Francesco Crivelli], *Elementa arithmeticae numericae et litteralis exposita a Joanne Crivellio, C.R.S. Academiae Bononiensis Academico Honorario, et Regiae Societatis Londinensis Socio: Editio tertia, prioribus correctior* (Vienna: Kaliwoda, 1745), 10. Cf. Crivelli, *Elementa arithmeticae numericae et litteralis exposita a Joanne Cribello* (Venice: Lazzaroni, 1740), vii.

97 [Crivelli], *Elementa arithmeticae* (1740), xii; [Crivelli], *Elementa arithmeticae* (1745), 7.

98 As the text of *Elementi di fisica, esposti dal p. d. Giovanni Crivelli: S'aggiungono dell' istesso autore due dissertazioni Sulle leggi del moto, e Dell'estimazione delle forze vive, ed I problemi aritmetici di Diofanto Alessandrino analiticamente dimostrati* (Venice: Baglioni, 1744) is available in searchable form at https://babel.hathitrust.org (accessed April 12, 2019), it is easy to identify a total of no fewer than forty references to Newton by name. The appreciation of Galileo (also earning twenty-nine mentions by name) is on p. 15.

99 Hell kept this work anonymous until he made a revision of it in 1773, published in Vienna in the following year.

(or shortly the Pazmaneum), a seminary established in 1623 to train Catholic priests and still in the management of the Society of Jesus.[100]

A different kind of pedagogical experience creates, remarkably, a bridge between Hell's descent from the mining region and a family of widely recognized mining experts and his formation in the Habsburg capital at the time of the first wave of "enlightened" reforms pursued by the government. According to some accounts, he came in contact with the aristocratic Königsegg family in the mid-1740s (either as an upper-grade philosophy student in Vienna, or while in Levoča), and he even offered instruction in mathematics and *Markscheidekunst* (mine metrology) to a young member of the family destined for a career (probably in the mining chamber) in Banská Štiavnica.[101] After his return to Vienna in late 1747, Hell is said to have received several assignments from "Count Königsegg." The Königsegg count in point can be no other than Karl Ferdinand (1696–1759), who after an initial career in the Catholic Church laid down his cassock and embarked on a quite spectacular period of diplomatic service, culminating in the position of vice-president of the Council of the Austrian Netherlands. In 1748, shortly after his return to Vienna, he was appointed president of the Münz- und Bergwesens-Directions-Hof-Collegiums, a newly created authority to supervise the affairs of mints and mines, separated from the Imperial Court Chamber (besides being placed at the helm of the court committee for the southeastern regions of the Banat and Illyria).[102] These appointments show that Königsegg, characterized by contemporaries

100 Lukács, *Catalogi personarum*, 8:526, 9:44.

101 [Von Triesnecker], *Lebenslauf*, 1; "Maximilian Hell," in Schlichtegroll, *Nekrolog*, 284–85; Carl Ludwig Littrow, *P. Hell's Reise nach Wardoe bei Lappland und seine Beobachtung des Venus-Durchganges im Jahre 1769: Aus den aufgefundenen Tagebüchern geschöpft und mit Erläuterungen begleitet* (Vienna: Gerold, 1835), 4; Pinzger, *Hell Miksa*, 1:14. The latter two are obviously based on the former ones.

102 Gerhard Seewann, "Königsegg-Erps, Karl Ferdinand Graf," in *Biographisches Lexikon zur Geschichte Südosteuropas*, ed. Mathias Bernath and Felix von Schroeder (Munich: Oldenbourg, 1976), 2:453–54. For the identification of Königsegg as Hell's contact, see Ansgar Rabenalt, "Astronomische Forschung im 18. Jahrhundert in Kremsmünster: Zu den ersten Berechnungen der Bahn des Uranus nach dem Briefwechsel zwischen Placidus Fixlmillner O.S.B. and Maximilian Hell S.J. (1771–1790)," *Mitteilungen des Oberösterreichischen Landesarchivs* 15 (1986): 93–216, here 109. On the context of the general overhaul of the administrative system during the first years of Maria Theresa, see Klaas van Gelder, "Networks, Agency, and Policy: A New Approach to Maria Theresa's Advisors during the War of the Austrian Succession," in *Maria Theresia? Neue Perspektiven Der Forschung*, ed. Thomas Wallnig, Elisabeth Lobenwein, and Franz-Stefan Seitschek, Das achtzehnte Jahrhundert: Jahrbuch der Österreichischen Gesellschaft zur Erforschung des 18. Jahrhunderts 32 (Bochum: Dr. Dieter Winkler Verlag, 2017), 151–70.

as an outstanding administrator, was intended to play an important part in the ongoing overhaul of the economic foundations of the Austrian state.

It is tempting to interpret the alleged delegation of relevant tasks to the young scion of experts with local knowledge in the mining district—who at the same time was a budding scientific genius—as a sign of selection with discerning eyes, and without any anti-Jesuit prejudice, on the part of the enlightened government. It may even be the case that Jesuit patronage played a part: the many functions held by Hell's teacher and mentor Franz at this time included *Bergrath* (i.e., senior official overseeing the mining industry). If all of this was indeed the case, Hell the "expert" had been discovered as an asset by the Viennese government well before his merits as a "scientist" were rewarded by the appointment of 1755, and the early discovery may even have played a part in the later appointment—while it must be added that a sharp distinction between expertise and science is meaningless in eighteenth-century contexts, as has been argued (significantly, given the contours of Hell's lineage) on the example of Leibniz's engagement of the problem of draining the Harz silver mines by relying on wind machines.[103]

Some caution regarding Hell's association with the Königsegg family is justified, though, as reports about it derive from accounts of Hell's life and career conceived shortly after his death (i.e., several decades after the event). One of these accounts was conceived by a colleague working with him closely for many years. Unfortunately, neither of them is corroborated by any testimony by Hell himself, nor any archival documents in the otherwise rich and well-kept holdings of the Department of Mints and Mines in Vienna.[104] In any case, according to these posterior reports, the tasks assigned to him included further courses in mathematics and *Markscheidekunst*, now to a group of ten young noblemen in preparation for work in the mining industry in Hungary, and even the translation of the laws of the mining industry from German into Latin.[105] What exact purpose such a translation was to serve is not clear—but given that

103 The futility of Leibniz's efforts to provide a "scientifically based" solution to the problem has been generally explained with reference to the resistance of "experts" in the Hanoverian mining administration, but this is more likely to have emerged out of struggles in the state. See Andre Wakefield, "Leibniz and the Wind Machines," *Osiris* 25 (2010): 171–88.

104 At the same time, these holdings contain ample references (even from the years of Maximilian's supposed collaboration with Königsegg) to Hell's father and brothers, the subjects ranging from the application of inventions through payment requests to inheritance issues. Österreichisches Staatsarchiv (ÖStA), Finanz- und Hofkammerarchiv, Neue Hofkammer, Akten Altes Münz- und Bergwesen, Chronologische Reihe, 1747–56.

105 See above, n. 101. The translation is only mentioned in the *Nekrolog*, where it is also claimed that the manuscript was delivered to Franz in 1749, but apparently was never published.

he came from a family of engineers and was fluent in Latin, which he had acquired in the Jesuit schools, Hell was certainly well suited for carrying it out.

Finally, in a roll-call of figures and possible encounters that link Hell's years of study in Vienna and his background around the mines of Banská Štiavnica, mention must be made of Nikolaus Poda (Boda, or Poda von Neuhaus [1723–98]), already referred to briefly.[106] Poda, the scion of a Tyrolean noble family but a native of Vienna who joined the Society of Jesus in 1740 and pursued his studies in philosophy in Klagenfurt, returned to the capital for the course in mathematics in 1748 (when Hell did the same in order to begin the theology curriculum), and became a first-year student of theology (*theologus primi anni*) when Hell was in his third year in 1750.[107] As we shall later see in more detail, whether or not they were in contact at the university, they cultivated relatively strong ties later on. Ordained in 1752, Poda then taught mathematics, mechanics, and hydraulics (but also developed a strong interest in entomology, mineralogy, and paleontology) in Klagenfurt, Linz, and Graz, and was the director of the observatory in Graz, before his appointment at the mining school in Banská Štiavnica in 1765. He was a professor of mine metrology, mechanics, and engineering there, also producing mechanical models and publishing works with descriptions and images of machines used in the local mines—namely those constructed by Hell's father and brother. In doing so, Poda apparently violated regulations requiring the express permission of the authorities for mines and mints for the publication of such images (after all, industrial secrets were at stake).[108] This may have been the cause for his untimely retirement in 1772 to the Abbey of Traunkirchen, where he devoted himself to the completion of his textbook on mechanics. In the turmoil caused by the Society's suppression in 1773, this work remained unpublished. Like others in the same position, Poda then maintained himself as a secular priest who also gave private lessons in the fields of his expertise, while he was also active in the scientific and freemasonic circles around von Born, whom he had known well from his Banská Štiavnica years.[109]

Several types are emerging from the present scrutiny as populating the social and intellectual universe of Hell as a rising star of an important chapter in the history of the Habsburg–Jesuit liaison. They include metropolitan

106 See nn. 35 and 42 above.

107 Lukács, *Catalogi personarum,* 9:44, 175.

108 Helmut W. Flügel, "Nikolaus Poda und die mineralogisch-paläontologische Sammlung der Jesuitenuniversität Graz von 1766," *Joannea Mineralogie* 3 (2006): 25–61, here 31–32.

109 Von Born played a part in the publication of Poda's *Kurzgefaßte Beschreibung* (cf. n. 35), and Poda participated in the international meeting for miners, metallurgists, and naturalists in Skleno in 1786, mentioned above.

professors (Kéri Borgia, Frölich, Franz, Kollár), some of them flamboyant, charismatic polymaths aligned with the projects of improvement launched by the Viennese government; aristocratic promoters of such projects themselves (Königsegg); scholars, teachers, and institutional leaders working in more modest localities, whose cultural (Kazy) and/or economic (Poda) significance nevertheless pointed way beyond the confines of those localities; and vagabonds defying the perils of traversing distant seas and lands for the sake of the greater glory of God, the saving of souls, and the progress of knowledge (Zakarjás). Most of the many individuals to be encountered as we follow the later phases of his career can be reduced to one of these types.

Hell's own trajectory led him to assume the character of most of these types in turns, occasionally even more than one of them at the same time. For the time being, having completed the curriculum in theology and been ordained a priest of the Society of Jesus in 1751, he continued his career in the Jesuit centers of the Hungarian provinces. First, he passed his obligatory third year of probation in Banská Bystrica, one of the two places in the Austrian province where this could be done (the other being Judenburg in Styria).[110] Once finished with the probation, in the summer and autumn of 1752 Hell was briefly involved as a consultant for the construction of an astronomical observatory at the University of Trnava, an indication of his growing reputation in the field.[111]

By this time, Trnava boasted some traditions in astronomical studies and observations, going back to the seventeenth century,[112] although, as mentioned, it was Kéri Borgia during his first stay there in 1735–36 who began to devote systematic attention to the subject, including the construction of instruments that were later also used elsewhere in Europe.[113] The idea of establishing an observatory originated with him, too. In many accounts, Hell is credited with planning and supervising the construction of the observatory, but all

110 Lukács, *Catalogi personarum*, 9:289–90. Some of the literature mentions Žilina, while Döbrentei gives Zvolen (Zólyom, Altsohl), but there was no *domus probationis* at either of these places.

111 For a comprehensive account of the establishment and history of the observatory, see Alžbeta Hološová and Henrieta Žažová, *History of the Observatory at the University of Trnava* (Trnava: Trnavská Univerzita, 2013).

112 Farkas Gábor Kiss, "Johann Misch Astrophilus Nagyszombaton," *Magyar Könyvszemle* 121, no. 2 (2005): 140–66; Lajos Bartha, "A nagyszombati egyetem csillagvizsgálójának kezdetei," *Padeu* 16 (2006): 8–38, here 11.

113 In the present context, it is interesting to note that Kéri Borgia's "scientific productions" are mentioned by Zakarjás in a letter of June 15, 1749 as part of the rich equipment seen at the University of Cádiz. "Zakariás János és Fáy Dávid," 125. While in Trnava, Kéri Borgia also published *a Dissertatio astronomica de cometa viso 1729 et 1730* (1736). Cf. Bartha, "A nagyszombati egyetem," 11–12.

he himself ever claimed was an advisory role.[114] The real initiator and founder was Kéri Borgia, according to the assessment of contemporaries: "Only Hungary had never seen anything like this until the year 1755, when Franciscus Kéri Borgia, worthy of memorialization by posterity, constructed for Urania a home in Trnava, and a perfect one in every aspect," wrote János Sajnovics, who served as an assistant astronomer in Trnava in 1766–68 and again in 1770–73 (preceded and interrupted by periods of performing the same function on the side of Hell, first in Vienna, and then on the Arctic expedition).[115]

While Kéri Borgia was also appointed as associate prefect (*socius praefectus*) of the new observatory, its direction, including its equipment, was entrusted to Xaver Franz Weiss (1717–85).[116] Born in Trnava, Weiss joined the Society of Jesus in 1733 and studied at the universities of his native town (philosophy) as well as Graz (theology). Between the two, from 1741 to 1745, he switched from one gymnasium in northern Hungary to the other each year teaching "humanities" (*humaniora*). It was during the years in Graz—at a Jesuit university with an observatory since exactly 1745—that he may have developed an interest and expertise in astronomy, to which his correspondence in 1750 (while on his third probation in Judenburg) with Scherffer (at that time, the director of the Graz observatory) testifies.[117] One of these letters also demonstrates that Weiss contemplated an expedition to Brazil during this time. From Scherffer's advice on how to proceed, it emerges that this was meant to be an expedition in the style of the geodetic surveys by Maupertuis in the Torne River Valley and La Condamine in the territory of Quito in the 1730s.[118] Nothing came of the plans for a

114 Cf. the letter to Bugge, already mentioned, in Pinzger, *Hell Miksa*, 2:154.

115 Joannes Sajnovics, *Idea astronomiae, honoribus regiae universitatis Budensis dicata* (Buda: Landerer, 1778), 6. Given the roles Sajnovics played in Hell's projects as imperial and royal astronomer, he will be introduced in more detail later.

116 For a biographical sketch, see http://jezsuita.hu/nevtar/weiss-ferenc/ (accessed April 12, 2019).

117 Scherffer to Weiss, Graz, August 29, 1750, in *Correspondence de Ferenc Weiss*, 1:13. "I wished to describe this to His Reverence [i.e., Weiss] before he leaves Judenburg: If something similar (which I doubt not, as long as the skies were clear) was seen there, please describe it." The preceding part of the letter describes an aurora borealis seen in Graz on August 26.

118 Scherffer to Weiss, Graz, August 2, 1750, *Correspondence de Ferenc Weiss*, 10–11. In 1750, King João V of Portugal (1689–1750, r.1706–50), in the aftermath of a treaty signed with Spain concerning their Latin American territories, had asked the general of the Jesuit order for ten Jesuits to be sent to map his dominions in Brazil. (Szentmártonyi, mentioned in n. 82 above, eventually became one of these.) Boscovich—soon to acquire fame for his survey of the papal lands, which included a measurement of the meridian between Rome and Rimini in collaboration with the English Jesuit Christophe Maire (1697–1767) also hoped initially to go to Brazil for the same purpose. See Elizabeth Hill, "Roger Boscovich: A Biographical Essay," in *Roger Joseph Boscovich S.J., F.R.S., 1711–1787: Studies of His Life and*

Brazilian expedition, however, and in the university year 1752–53, when Hell was present as a consultant for the planning of the observatory, Weiss was appointed professor of mathematics in Trnava. While there, he also wrote the first unequivocally Newtonian textbook in astronomy in Hungary, *Astronomiae physicae juxta Newtoni principia breviarium* (A short introduction to physical astronomy according to the *Principia* of Newton [1759]). An astronomical almanac, reporting on observations in Trnava (*Observationes astronomicae* […] *in observatorio Collegii Academici Societatis Jesu Tyrnaviae in Hungaria habitae* [Astronomical observations made in the observatory of the Jesuit collegium of the academy of the Society of Jesus in Trnava in Hungary (1759–72); covering the years 1756–71]), was also launched by Weiss, whose correspondence reveals him to have been widely connected and recognized among fellow astronomers and mathematicians all over Europe. He maintained a lifelong professional relationship with Hell—mostly also via correspondence, as by the time the foundation stone of the Trnava observatory was ceremoniously laid on January 2, 1753, Hell was already established in his next position as professor of mathematics, also commissioned with the creation of an observatory, at the Jesuit academy in Cluj.

4 Professor on the Frontier

With the transfer to Cluj, Hell moved to a Habsburg province that was altogether a far cry from those known to him from the times of his upbringing and studies. Like Upper Hungary, Transylvania was multi-ethnic and multi-confessional, but the parallels ceased there. Already in the Middle Ages, the region was under separate governance with its own governor (*vajda* or *voivode*) and provincial assembly. From the rise of the Principality of Transylvania after the Battle of Mohács in 1526, this became an independent diet, in which the three privileged groups: Hungarian nobles, Szekel freemen, and "Saxon" burghers were represented. The Szekels (*székelyek*, *siculi*), concentrated in the easternmost areas of Transylvania, were Hungarian-speakers who preserved a separate identity on account of the tasks they performed in warfare, especially as border guards, and the consequent peculiarities of social organization and hierarchy; while Saxons were predominantly town-dwellers, migrating to the Kingdom of Hungary as *hospites* from various parts of Germany in several waves since the twelfth century. The most (and increasingly) numerous among the several other ethnic groups living in Transylvania were the Romanians,

Work on the 250th Anniversary of His Birth, ed. Lancelot Law Whyte (London: Allen & Unwin, 1961), 16–101, here 25–27.

who, apart from a few notable exceptions who managed to gain Hungarian noble status and a small literate elite of Orthodox Christian priests, were peasants or shepherds, and thus remained outside the estates structure. There was a marked presence of Roma ("gypsies") from the sixteenth and Armenians from the seventeenth century; Jews began to appear in the early seventeenth century, and by the eighteenth century there were also Muslims of varied ethnic background as "remnants" of the Ottoman era.

Thanks mainly to the predominantly Orthodox Romanians, Transylvania had been accustomed to denominational diversity well before the Protestant Reformation, which was embraced there eagerly. Lutheranism was the favored brand in the Saxon towns, while many among the Hungarian elite as well as commoners had converted to Calvinism by the 1560s. The teachings of anti-Trinitarians (called Unitarians in the region) and even more radical sects fell on fertile ground, too. Adherence to Protestantism also accentuated the distinctiveness of Transylvania as a political unit from the 1540s onward, when the part of the Hungarian nobility that refused to acknowledge the claim of the Habsburgs to the throne of Hungary managed to establish it as an independent principality under rulers elected from its own ranks. Among these, over a century and a half it was only the Báthoris at the turn of the sixteenth and seventeenth centuries that were Catholic; and although the practice of religious freedom, famously enshrined (at least for the four main western Christian denominations) in law in 1568, had its ups and downs, the sometimes venomous disputes went with less physical violence and administrative infringement than in most other countries of Europe.

To further nuance the picture, all of this took place in a region at the southeastern fringe of the Western world that was, despite its richness in mineral resources and the fact that it profited from the land route of Levantine trade between the Black Sea and the Baltic, socially and economically somewhat backward. The appeal that Protestantism had there for a thin literate elite largely consisted in the encouragement and boost it gave to the cultivation of vernacular culture(s), perceived as wedged between two conquering empires. In the negotiations dictated by this geopolitical and geo-cultural position, Transylvania sometimes drifted close to being a mere Ottoman satellite; and while the turbulence and frequency of its seventeenth-century diets had more in common with an archaic kind of anarchy than modern parliamentarianism, the exertions of princely authority also resembled "oriental despotism" as much as they had features of administrative centralization familiar from histories of state-building in early modern Europe.[119]

119 For overviews and assessments of the history of Transylvania in the early modern period, especially the age of the independent principality, see Ştefan Pascu, *A History of*

The demise of the independent Principality of Transylvania in the turmoil of the wars that led to the expulsion of the Ottomans from Hungary has already been mentioned briefly above. From the Habsburg vantage point, this *reconquista* implied the task of integrating the vast newly gained territories with their already extensive composite monarchy politically, economically, and culturally. Although the *Diploma Leopoldinum* of 1690[120] stipulated the maintenance of the religious status quo in Transylvania, Catholic mission, naturally with a prominent role assigned to the Society of Jesus, was central to this vast enterprise: despite differences in emphasis, the Habsburg endeavor of consolidating the dynasty's hold over a somewhat exotic fringe area was compatible with the Jesuits' striving for the conversion of souls in obscure and contested locations (whether in Europe or overseas).[121] After their 1607 expulsion, Jesuit presence in the region can still be documented quite extensively: the staunchly Calvinist but deeply pragmatic prince Gábor Bethlen (1580–1629, r.1613–29) allowed a handful of Jesuits to return for a new Transylvanian mission, and the Society could also operate some schools, either openly, or formally

Transylvania (Detroit, MI: Wayne University State Press, 1982), 96–129; Béla Köpeczi, László Makkai, András Mócsy and Zoltán Szász, with Gábor Barta, eds., *History of Transylvania* (Budapest: Akadémiai Kiadó, 1994), part 3, 247–311. Cf. also László Kürti, *The Remote Borderland: Transylvania in the Hungarian Imagination* (Albany, NY: SUNY Press, 2001), 1–24, on Transylvania as a bridge between supposedly "advanced" Austria–Hungary and the "backward" East. For assessments of the political status and system of Transylvania, see Teréz Oborni, "Between Vienna and Constantinople: Notes on the Legal Status of the Principality of Transylvania," in *The European Tributary States of the Ottoman Empire in the Sixteenth and Seventeenth Centuries*, ed. Gábor Kármán and Lovro Kunčević (Leiden: Brill, 2013), 67–89; Gábor Kármán, "The Hardship of Being an Ottoman Tributary: Transylvania at the Peace Congress of Westphalia," in *Frieden und Konfliktmanagement in interkulturellen Räumen: Das Osmanische Reich und die Habsburgermonarchie in der Frühen Neuzeit*, ed. Arno Strohmeyer and Norbert Spannenberger (Stuttgart: Franz Steiner Verlag, 2013), 163–83.

120 This constitutional document settled the status of Transylvania as a province directly dependent on Vienna, thus separated from the rest of the Kingdom of Hungary, autonomous in its internal affairs as a principality under a Habsburg governor. In 1765, Transylvania was raised to the status of Grand Principality.

121 Cf. Jean Nouzille, "Les jésuites en Transylvanie au XVII[e] et XVIII siècles," *XVII[e] siècle: Revue trimestrielle* 50, no. 3 (1998): 315–28; Shore, *Jesuits and the Politics of Religious Pluralism*, 8. On the central role of "baroque" in Habsburg state-building, especially as regards the integration of the territories obtained after 1526, more generally see R.J.W. [Robert John Weston] Evans, *The Making of the Habsburg Monarchy, 1550–1700: An Interpretation* (Oxford: Oxford University Press, 1979); Evans, *Austria, Hungary and the Habsburgs*, especially 3–16, 36–74.

under the auspices of local parishes.[122] Nevertheless, a full-scale reinstatement did not occur until 1693, when—thanks to funds from Emperor Leopold I, soon followed by many local Catholic dignitaries[123]—the Society was able to embark on a systematic program of proselytization via schooling, charitable activities, aesthetic and spiritual appeal, and the redefinition of the urban landscape. Cluj—a town of a mere eight-thousand inhabitants, but still the most important urban and administrative center in the region—was to play a central part in the program's execution.

As far as the strictly religious goals are concerned, the Jesuit record in eighteenth-century Cluj was mixed. Conversion rates remained modest, and even the Uniate (or Greek Catholic) Church—which was established in 1692 and existed "in union" with the pope but retained an eastern liturgy—attracted far fewer Orthodox Romanians than originally hoped.[124] Besides interdenominational tensions, the Jesuits evoked the resentment of the secular wing of the local Catholic clergy, too. A stormy controversy occurred in 1754 (i.e., exactly during the time Hell spent in Cluj), when complaints were raised about the "arrogance" and "insolence" of the Jesuits, and about various kinds of "usurpations" by them, whether of jurisdictional rights over monasteries around the town, or of the administering of parish duties, specifically to military personnel. In his defense, Rector András Gál (dates unknown) expressed his respect for Transylvanian bishop Zsigmond Antal Sztojka (dates unknown), but referred to privileges granted by Pope Gregory XIII (1502–85, r.1572–85) to the rector of the Jesuit college in its ancient founding document. He also alleged that the monasteries in question had never been subject to the diocese, but only directly to the archbishop of Esztergom, and stated that the administration of religious services in the army had been bestowed on the Society of Jesus by the *capellanus major castrensis* (chief military chaplain of the imperial troops, effectively with episcopal powers). In fact, the holder of that office, the influential Viennese Jesuit Ignaz Kampmiller (1693–1777)—also Maria Theresa's confessor—had already written to Sztojka in consternation. Kampmiller, allegedly with support from her majesty, which he had sought in an audience, urged the bishop to retreat on his moves against the rector, referring to the utmost importance of restoring peace and harmony, "especially in those territories, where the number of heretics is so substantial." Nevertheless, Sztojka persevered, rejecting the rector's arguments and even issuing threats of

122 Júlia Varga, "Katolikus közép- és felsőoktatás Erdélyben a 17. századtól a 19. század közepéig" (PhD diss., Budapest, Eötvös Loránd University, 2007), 62–92.

123 Varga, "Katolikus közép- és felsőoktatás Erdélyben," 112–15.

124 Shore, *Jesuits and the Politics of Religious Pluralism*, 27–88.

excommunication to Gál, and eventually it was the latter who felt forced to retreat.[125]

Though this affair and its outcome, which must have seemed unusual for a man with Hell's stock of experience, might be taken as a confirmation of the familiar narrative of the decline of Jesuit influence in the mid-eighteenth century, the Society's visibility and impact in Cluj was striking. As the town was small and had been architecturally rather static since the late Middle Ages, the building complex erected in its center under Jesuit auspices, dedicated to educational, religious, and secular purposes, exerted a transformative effect beyond its relatively modest scale. Its consistent use of the conventions of baroque emphasized the Jesuit commitment to a universalist vision whose geographically closest local idiom found expression in Vienna: a function of the "Jesuit district" in Cluj was to make it "look more Austrian, less individual, less 'ethnic,' and more rationally organized," and thus to tip the precarious balance between east and west that existed in the town toward the latter.[126] This Jesuit vision also penetrated the daily lives of town-dwellers from the elite to the marginalized, thanks to the Society's participation in the mechanisms of social ordering through ritual, example, and injunction. Practices of penance, drama performances, the inculcation of values of "propriety" in a range of institutions like the orphanage or the religious sodalities set up by the Society offered a rich storehouse of devices, making it possible to correct and control irregular, socially harmful practices from dueling through sexual license and polygamy to outrageous conduct and "superstition."[127]

As a matter of fact, the characteristic terrain where such Jesuit antidotes to social ills—easily aligned with the "enlightened" quest of subjecting the passions to the governance of reason in the interest of harmony and happiness—worked, was urban, and the very thinness of the urban fabric in Transylvania set limits to their effectiveness. The domain where the eighteenth-century Jesuits of Cluj were probably most unequivocally successful is itself typically

125 The complaints are developed in letters by Sztojka addressed to the Cluj college (Cluj, January 16, 1754; Sibiu, February 22, 1754) and a report by Cluj chaplains Péter Ferendi and Ferenc Nagy (March 6, 1754). The intervention of the *capellanus major* is contained in Kampmiller to Sztojka, Vienna, February 5, 1754, while Gál's defense was made in a *responsio* dated March 20, 1754.The conclusion of the affair is documented in Sztojka's letters of August 14, 1754 "to the beloved clergy and to the beloved, pious population of both sexes, in the free and royal city of Cluj," as well as specifically to parish priest János Bíró, and the record of a meeting between Sztojka and Gál on August 24, 1754. Cluj, Archives of the Parish of St. Michael, 36, 99–107.

126 Shore, *Jesuits and the Politics of Religious Pluralism*, 111–17.

127 Shore, *Jesuits and the Politics of Religious Pluralism*, 147–62.

urban: education, where they covered the full spectrum with two boys' schools, a seminary and a convent for nobles (*convictus nobiliorum*), a gymnasium, and especially the academy, which was re-established in 1698.[128] Originally confined to a single faculty of philosophy, the academy obtained a faculty of theology as well in 1712. The number of students in the college grew steadily (from fifty in 1703 and 186 in 1711, to 387 in 1747, 427 in 1753, and 493 in 1771),[129] as did academic prestige: in 1753, shortly after Hell's arrival, the official designation of the institution changed from Collegium Academicum to Alma Universitas, that is, a university proper. Besides being a training ground for future Jesuits, the college offered cultural goods of a broad appeal way beyond the boundaries of the Catholic community. The curriculum underwent several waves of ambitious innovations, so that advanced students could pursue topics in the natural sciences, post-Ptolemaic astronomy was cultivated, historical studies—with a healthy equilibrium of extolling patriotic virtues and the prestige of the Habsburgs—became established, and Hebrew took its place alongside Latin and Greek in the study of classical languages.[130] To support these developments, the college maintained a library with holdings that grew from about one thousand to six thousand between the beginning of the eighteenth century and the suppression of the Society, containing an impressive number of titles in modern natural philosophy and other secular fields.[131] From 1726 on, it also made room for a printing press, which until 1773 issued 353 works in Latin as well as the local vernaculars, mainly textbooks for the regional schools and religious literature, but also works relevant to enlightened improvement in the economy and the polity.[132] All of this made the Cluj academy a highly distinctive institution and enabled it to compete successfully with the prestigious Calvinist higher schools of the region in attracting even non-Catholic students.

Thus, in late 1752, Maximilian Hell arrived in a peripheral but vibrant sociocultural and academic setting, where the stakes of cultivating the values of Jesuit science at a high-level of professionalism were significant, even though different from other far-away missionary outposts like China, where the influence earned by impressing the emperor and a small circle of court mandarins

128 On the academy generally, see Vencel Bíró, *A kolozsvári jezsuita egyetem szervezete és építkezései a XVIII. században* (Kolozsvár: Erdélyi Múzeum Egyesület, 1945); Varga, "Katolikus közép- és felsőoktatás Erdélyben," 111–63.

129 Bíró, *A kolozsvári jezsuita egyetem*, 7 (based on the college registers).

130 Shore, *Jesuits and the Politics of Religious Pluralism*, 92, 94, 106.

131 Lajos György, *A kolozsvári római katolikus Lyceum-könyvtár története 1579–1948* (Budapest: Argumentum Kiadó, 1994), 55–78.

132 Varga, "Katolikus közép- és felsőoktatás," 119.

with tokens of European technological advancement and mathematical-astronomical prowess also secured penetration in the rank-and-file of a centrally dominated social hierarchy.[133] Indeed, Hell, who spent less than three full years in Cluj, was the only one among the Jesuits active there who ever made a mark in scholarship, if we disregard János Frivaldszky (1730–84). Frivaldszky was an eclectic professor of philosophy and mathematics, as well as librarian and historian of the house and co-founder of the Transylvanian Society for Agriculture. His published work ranged from pioneering dissertations on iron ore and the minerals of Transylvania (strongly criticized by von Born) through pieces of antiquarianism to studies dedicated to fighting famine by crop-rotation and turning familiar crops to new uses.[134] Yet, the delegation of Hell as a dynamic and promising, young but already widely experienced man of science to peripheral Cluj was meant to give a boost to existing local initiatives in his fields of expertise. The first professor there to devote attention to astronomy was Miklós Jánossi (1701–41), active in Cluj in the mid-1730s, possibly also engaging in observations from his own domicile in the convent, although astronomy appears as a matter of applied mathematics, not empirical measurement, in his 1737 textbook on trigonometry.[135] A significant element of Hell's commission was apparently to redress this situation and supervise the construction of a new building of the college with an observatory,[136] which was to be the fourth one run by Jesuits in the Austrian province after Vienna, Graz, and Trnava (also still a project in progress).

In fact, throughout the time Hell spent in Cluj, whatever observations he carried out there seem to have been done, similarly to Jánossi, from his home,[137] and it is not clear exactly what preparations for a real observatory were really

133 On Jesuit mathematics and astronomy in China, see Catherine Jami, *The Emperor's New Mathematics: Western Learning and Imperial Authority during the Kangxi Reign (1662–1722)* (Oxford: Oxford University Press, 2011); for the development of the parallel with Transylvania, see Shore, *Jesuits and the Politics of Religious Pluralism*, 157–58.

134 http://jezsuita.hu/nevtar/frivaldszky-janos/ (accessed April 12, 2019).

135 László Heinrich, *Az első kolozsvári csillagda* (Bucharest: Kriterion, 1978), 24–27; http://jezsuita.hu/nevtar/janossi-miklos/ (accessed April 12, 2019). A collaborator of Jánossi in Cluj in 1737 was Mihály Lipsicz (1703–65) (http://jezsuita.hu/nevtar/lipsicz-mihaly-ii/ [accessed April 12, 2019]), who later, in the early 1740s, may have taught Weiss in Trnava and published *Hungaria coelestis astronomiae et chronologam in synopsi complentes* (Košice, 1741), a "baroque fusion of science and triumphalist history." Cf. Shore, *Jesuits and the Politics of Religious Pluralism*, 164.

136 No actual instruction to Hell in this sense is extant, but (considerably later) references in Hell's own work and correspondence, as well as the posterior accounts of his life in Schlichtegroll, von Triesnecker, and Döbrentei are unanimous about the chief purpose of his appointment in Cluj.

137 Gábor Döbrentei, "Gróf Batthyány Ignác," *Erdélyi Muzéum* 2 (1815): 3–18, here 5.

executed before he left for Vienna in 1755. According to some of the literature, the new building, including the observatory, was completed around 1759, and on an engraving from that year the building with a small tower is indeed visible.[138] In various further sources, two of Hell's successors as professors of mathematics in Cluj, Matthias Geiger (1720–1800) and Miklós Benkő (1723–1801), are described as *prof*[*essor*] *mathes*[*eos*]*, praef*[*ectus*] *Mus*[*aei*] *Mathem*[*athici*] *et Spec*[*ulae*] *astron*[*omicae*] (professor of mathematics, director of the mathematical museum [i.e., laboratory] and the astronomical observatory) in the periods 1755–57 and 1758–62 respectively.[139] However, in the last year of his Cluj appointment, Hell's titles already also included that of *praefectus* [...] *spec. mathematicae*, although at that time there was as yet certainly no *specula* at all. The Cluj observatory is not mentioned in the numerous works of Lalande or Johann III Bernoulli (1744–1807) that provide Europe-wide surveys of contemporary astronomy,[140] let alone in Hell's *Ephemerides*. Over two decades after leaving Cluj, Hell provided this account in a letter to Bernoulli:

> A fourth observatory, the construction of which was begun by me in Claudiopolis [Cluj] in Transylvania in the year 1753—I had laid down its very stable foundations by the year 1755, when I was called to Vienna—has remained unfinished until now. As of the year 1773, work on this building was about to be continued and brought to an end, if it were not for that fatal dissolution of my order, which brought this task in disarray.[141] I had in fact an astronomer there, a father of our Society by the name Hartmann, professor of physics, whom I had furnished with a mobile,

138 Heinrich, *Az első kolozsvári csillagda*, 47.

139 Fischer, "Jesuiten-Mathematiker in der Deutschen Assistenz," 170; http://jezsuita.hu/nevtar/geiger-matyas/; http://jezsuita.hu/nevtar/benko-miklos/ (accessed April 12, 2019).

140 See, e.g., Lalande, *Astronomie*, 2nd ed., vols. 1–2 (Paris: Veuve Desaint, 1771); Lalande, *Astronomie*, 3rd ed., vols. 1–3 (Paris: Veuve Desaint, 1792); Johann III Bernoulli, *Receuil pour les astronomes*, vols. 1–3 (Berlin: l'Auteur, 1771–76); Bernoulli, *Lettres astronomiques où l'on donne une idée de l'état actuel de l'astronomie pratique dans plusieurs villes de l'Europe* (Berlin: l'Auteur, 1771); Bernoulli, *Lettres sur différens sujets, écrites pendant le cours d'un voyage par l'Allemagne, la Suisse, la France méridionale et l'Italie*, 3 vols. (Berlin: G.J. Decker, 1777–79).

141 As a matter of fact, the dissolution of the Society of Jesus heavily affected the Cluj academy. It was to be a secular university, with faculties of law and medicine added to philosophy and theology faculties, under the new name of Collegium Regium Theresianum Claudiopolitanum, where ex-Jesuits were retained, but leading roles were assigned to the Piarists (who had hitherto played little role in education in Transylvania). In 1784, Joseph II applied the "one country, one university" principle (already implicit in the *Ratio educationis* of 1777) by regarding—for this purpose—Hungary and Transylvania as a single country, and relegated the Cluj institution to the status of Lyceum Regium Academicum.

> three-foot quadrant, a pendulum clock, and a five-foot Newtonian telescope. [By the time of the suppression of the Society], I had already received from him several observations aimed at establishing the longitude and latitude of this observatory.[142]

The Cluj interlocutor mentioned by Hell must have been Ferdinand Hartmann (dates unknown), native of Sibiu (Nagyszeben, Cibinium/Hermannopolis, Hermannstadt), a Saxon town in far southeastern Transylvania. Hartmann entered the Society of Jesus in 1753 and served as a professor of geometry and "practical geography" (that is, geodesy) in Trnava in 1768–69, and as a professor of mathematics (1770–71) and experimental physics (1772–73) in Cluj.[143] If, according to the letter to Bernoulli, Hartmann carried out observations from a still "unfinished" building, another twelve years later Hell reported that the foundations (*fundamenta*) he had been able to lay "still to this day lie hidden underground."[144] Whatever stage of completion the building ever reached, it fell victim to the fire of 1798 that ravaged extensive parts of Cluj, though some of the astronomical equipment could be saved for the new observatory, which was erected by 1805.[145]

The focus of Hell's recorded activities while in Cluj was not astronomy. He undertook experiments in electricity[146]—in a characteristically eighteenth-century fashion, combining a fascination with the field and an avid interest in magnetism[147]—in the Museum Mathematicum, lectured as a professor of mathematics, preached in German and "Slavic," and extended pastoral care for military personnel. Unfortunately, his sermons, which may have allowed a glimpse of his religious views, are not extant. The electrical experiments,

142 Hell to Bernoulli III, Vienna, February 15, 1777. Universitätsbibliothek Basel (hereafter: UBB), LIa964. Some letters at the end of each line are missing due to the binding. These are supplied in brackets.

143 Fischer, "Jesuiten-Mathematiker in der Deutschen Assistenz," 170. According to Heinrich, *Az első kolozsvári csillagda*, 49 (where it is also inaccurately claimed that Hartmann was Hell's immediate successor and held the position until 1769), it was József Mártonffy (1746–1800; http://jezsuita.hu/nevtar/martonffy-jozsef/ [accessed April 12, 2019]), future bishop of Alba Iulia (Gyulafehérvár) and a student of mathematics in Vienna in 1771–72 (presumably associated with Hell), who assisted Hartmann in obtaining instruments.

144 Hell to Bugge, Vienna, July 24, 1789. Pinzger, *Hell Miksa*, 2:154–55.

145 Heinrich, *Az első kolozsvári csillagda*, 51–52.

146 He may have been inspired also in this by Franz, who used to perform electrical experiments in the Museum Mathematicum and published a *Dissertatio de natura electrica* [Treatise on the nature of electricity (1751)].

147 John L. Heilbron, *Electricity in the 17th and 18th Centuries: A Study in Early Modern Physics* (New York: Dover, 1979).

however, bear some relation to a slender German-language book by Hell on the useful applications of artificial steel magnets, *Anleitung zum nützlichen Gebrauch der künstlichen Stahl-Magneten* (Introduction to the useful application of artificial steel magnets), first published in Vienna in 1762, and then again in Graz in 1770. The bulk of this richly illustrated, fifty-page booklet is devoted to explaining how pieces of steel in various forms and sizes may be applied with the strongest magnetic force possible.

Hell's interest in magnetism will be dealt with in more detail in Chapter 8, in the context of his important engagement and controversy with Franz Anton Mesmer (1734–1815) following the latter's presentation of his *Dissertatio physico-medica de planetarum influxu* (Physico-medical dissertation on the influence of the planets) to the Viennese medical faculty in 1766. A few aspects are worth stressing here. First, after a short historical account of the variegated uses of the magnetic needle—to which, in Hell's presentation, Europe owes all the riches of the Americas, easy access to fields of precious metals, as well as many other practical and scientific benefits—and a summary of eighteenth-century inquiry into the subject, Hell records that the new type of artificial magnet had been quite unknown in "our lands" until recently: the first ones he had ever seen were

> two finely polished little rods of English steel [...] brought to Transylvania from England by a certain professor of mathematics of the Reformed University [*sic*] in Cluj in the year 1754, exactly when I held the teaching position in mathematics at our university, and thanks to my acquaintance with the professor mentioned I had the honor of holding these two rods in my hands.[148]

Hell's Calvinist colleague was probably György Verestói (1698–1765). Verestói, who studied at the University of Franeker in the 1720s, was appointed as professor of philosophy and mathematics of the College of the Reformed Church in Cluj in 1728. He does not seem to have changed chairs till 1758, when he took over theology. In 1760, he was elected superintendent (bishop) of the Calvinist church in Transylvania.[149] Verestói is mainly appreciated as an outstanding orator who, however, cultivated a strong interest in the natural sciences and

148 Maximilian Hell, *Anleitung zum nützlichen Gebrauch der künstlichen Stahl-Magneten* (Vienna: Ghelen, 1762), 12.

149 See István Török, "A kolozsvári collegium XVIII. századi tanárainak életrajza. (Verestói György 1728–1764 tanár s később püspök.)," *Protestáns Közlöny* 3, nos. 13–14 (1886): 122–23; 128–30; Török, *A kolozsvári ev. ref. kollégium története* (Cluj: Ev. Ref. Collegium, 1905), 3:12–21.

their popularization, even by weaving topics from physics and astronomy in his applauded funeral orations.[150] In any case, the complex interaction of Jesuits with their environment in Cluj thus included inter-denominational knowledge exchange. As Hell then goes on to explain, at that time

> I already had a desire to do some research about this secret, but as for the time being I wanted to continue my pursuits in electricity, so that I could examine in these electric phenomena the Newtonian theory, and after various experiments I had come so far as to conclude that magnetic phenomena are nothing else than a certain degree of motion of electric matter; I postponed the exploration of the secrets of the artificial steel magnet, until I have fully developed my theory of electricity

—but then, though he had advanced considerably in this pursuit, his call to leave Cluj in the autumn of 1755 "interrupted all of my inquiries, as I had to dedicate myself fully to astronomy."[151] It is noteworthy, however, that Hell's apparent enthusiasm about electricity also led him to assign to it a role in causing, besides magnetism, another phenomenon that was a long-term subject of his interests: northern lights. As he wrote a few years later, already as director of the Viennese university observatory, to his Trnava colleague Franz Weiss:

> Honorable Father Colleague in Christ! Many thanks for the observation and elegant drawing of the aurora borealis that was observed in Tyrnavia [Trnava]. Your observation is in harmony with ours in most aspects, for here in Vienna, too, those tiny stripes as well as the ray that stretched out toward the north from the first pyramid were observed. However, since I personally observed the phenomenon somewhat later, I failed to see both the ray and those numerous stripes. Nor did I catch sight of those electric bundles to the left of the two northern rays because there was too much moisture in the atmosphere. I did observe, however, the three major beams. As for the cloud above the rays, I for my part could not distinguish it from here, but because this phenomenon is an electric phenomenon, I told my guests during the observation itself that there was bound to be

150 Katalin Németh S., "Magyar orátor a XVIII. században: Verestói György," *Irodalomtörténet* 73, no. 4 (1984): 877–80; Farkas Wellmann Éva, *Irodalom és közönsége a XVIII. században: Verestói György munkássága* (Budapest: Gondolat Kiadó, 2013); Réka Lengyel, "'A világosság a tudomány': A felvilágosodás mint módszer Verestói György halotti beszédben," in *A felvilágosodás előzményei Erdélyben és Magyarországon (1650–1750)*, ed. Mihály Balázs and István Bartók (Szeged: SZTE Magyar Irodalmi Tanszék, 2016), 315–27, here 321–25.

151 Hell, *Anleitung*, 13.

> a sort of cloud above the major rays, or at least some [accumulation of] thicker air that held a higher or lesser degree of electricity than the mountaintops of our Earth, from where it was capable of eliciting these rays. It filled me with joy that this cloud, which I had seen only in my imagination, was in fact spotted in Tyrnavia [Trnava], [for] this cloud demonstrates wonderfully that this opinion of mine is true, that *the aurora borealis is an electric phenomenon*.[152]

Hell was later to discard this opinion and develop another theory on the aurora, based on his experiences in Norway.

Besides the interaction with his local Calvinist counterpart, Hell's preoccupation with "useful applications" deserves attention. As we shall see, it is also paramount in other works originating in the Cluj years. In the preface to the *Anleitung*, he writes:

> The reasons that led me to conceive this treatise were the great benefits from the use of these magnets [...]; the same motivation has also obliged me to write it not in erudite Latin, but in the common vernacular of our lands; as I am writing here not for the learned, but only for the skillful mechanics of our lands, who construct the machines with which good, strong, and proper magnetic needles ought to be produced; so I hope that this work of my spare hours will be embraced by these craftsmen in the same spirit in which it was conceived, namely to serve the common good, which I finally want to urge my readers to turn to the greater glory of God.[153]

While strictly utilitarian ends are here smoothly integrated with the Jesuit striving of working—as the Society's motto says—*ad maiorem Dei gloriam*, Hell also makes a point of stressing that as far as the cognitive–methodological foundations of the claims advanced in the book are concerned, these are strictly empirical: "I have learned not from books, nor by oral instruction or otherwise from someone else, but from my own experiments alone."[154] We have no first-hand report about any of the experiments he carried out while in Cluj. Secondary evidence, deriving from the section on the electricity of bodies in

152 Hell to Weiss in Trnava, dated Vienna, April 1, 1761 (Vargha priv. In Pinzger, *Hell Miksa*, 2:187, this letter is wrongly dated April 1, 1766).

153 Hell, *Anleitung*, 5. For another forceful statement on the need, indeed the social responsibility, of seeking "useful applications" for scientific discoveries beyond the pleasure they cause to the discoverer, see Hell, *Anleitung*, 33.

154 Hell, *Anleitung*, 4.

the textbook *Institutiones physicae* (Introductions to physics [1756]) by the Trnava professor and later Trenčín rector András Jaszlinszky (1715–83), however, reports that the purview of Hell's work during the Cluj years not only included the possible uses of electricity and magnetism in healing and resulted in three (now lost) treatises on the subject but also the successful treatment of three elderly men against pain in the leg, dyspepsia, and some kind of tumor by electric sparks.[155] As such, then, the later engagement with Mesmer has specific antecedents in Hell's Cluj activities.

The Cluj period also saw the publication of two textbooks by Hell, *Varia compendia praxesque operationum arithmeticarum* (Various introductions and exercises in arithmetic),[156] and the first and only volume, dedicated to arithmetic and algebra, of a planned series entitled *Elementa mathematica naturali philosophiae ancillantia* (Basic mathematics for the aid of natural philosophy).[157] In addition, he also composed a collection of exercises, published separately in Cluj as *Exercitationes arithmeticae* (Exercises in arithmetic) in 1755, and subsequently as an appendix to the *Elementa*. Hell thus became firmly involved in the response to the recently introduced requirement by the Viennese authorities, already mentioned, of supporting the reform of higher education by publishing standard textbooks to supplement and supersede students' lecture notes. Even though he soon left Transylvania and quit teaching mathematics for good, the *Elementa* was reissued several times, in both Poznań (Posen) and Vienna, but apparently never revised. Thus, in the third edition (Vienna, 1761), we read in the exercises:

> A merchant in Cluj, selling a Cluj short *ulna* [or "ell," a measure of length] for the same price as a long *ulna* was bought in Vienna, wishes to know the profit percent. Since five Cluj *ulnae* equal four Viennese, this means that for every four Viennese *ulnae* there is a gain of one Cluj *ulna*. Accordingly, the sum should be stated thus [...].[158]

155 Andreas Jaszlinszky, *Institutiones physicae* (Trnava: Academia Societatis Jesu, 1756), 2:189. Cf. Heinrich, *A kolozsvári csillagda*, 37. Jaszlinszky was one of the scholars involved in the intense engagement with Cartesianism and Newtonianism in Trnava in the 1750s. Cf. above, 62n.69.

156 Virtually all accounts of Hell's life and career mention this work. However, we have been unable to locate it in any library.

157 Maximilian Hell, *Elementa arithmeticae numericae, et literalis seu algebrae ad prefixam in scholis nostris normam concinnata* (Vienna: Trattner, 1761 [1755]).

158 Hell, *Elementa arithmeticae numericae*, appendix, 35.

This is applied mathematics, adapted for a local audience. Practical applications permeate the book as a whole: the exercises in the appendix are specifically designed not merely for the use of the studious youth (*ad usum privatum studiosae iuventutis*) but contain questions of an economic nature for the use of citizens and merchants (*Questionibus oeconomicis, & ad usum Civilem ac Mercatorum applicatis declaratae*).[159] The same ends are also apparent from a section describing and comparing various measurements and currencies from around Europe.[160] Elsewhere, in a collection of thirty-nine questions for the public examination of two of Hell's students, the task of the candidates is to calculate Cluj's distance from Rome on the basis of data according to which a *peregrinus*, who made half the journey on horseback and a quarter of it on foot, covered altogether 126 miles (the solution given both by simple equation and by proportion).[161] The utilitarian inspiration and aims of the *Elementa* is emphasized in the author's preface in a way that combines religious commitments specific to the Society of Jesus with secular ones. Hell confesses there to be aspiring to serve "the glory of God and the progress of the benefit of the fatherland," and the former aspect is repeated once again in his introduction to the supplement of exercises for further study at home, bidding his students farewell in the wish that they "add to the Greater glory of God through [them] selves and [their] efforts."[162] *Ad maiorem Dei gloriam*, the motto of the Society of Jesus, with its missionary implications, thus found its way to Hell's 1755 mathematics textbook in unison with the expression of his patriotic loyalties.

It is against the whole of the background and trajectory outlined in this chapter that Hell's notion of *patria*—one in harmony with his allegiance to the Jesuit order—needs to be appreciated. Hell as a patriot belonged to the community of free and educated, Hungarus denizens of the Kingdom of Hungary, the *natio hungarica*: a socially highly variegated group dominated by the nobility, but sharing more widely in a political heritage focused on the veneration of royal dynasties and a stock of ancient customs and statutes (re-conceptualized

159 Hell, *Elementa arithmeticae numericae*, unpaginated.

160 Hell, *Elementa arithmeticae numericae*, 87–93.

161 Maximilian Hell [Maximilianus Höll], *Materia tentaminis mathematici: Aula Academica S.J. Claudiopolitana, die 14 Mensis Julii 1755*. Cited in Heinrich, *A kolozsvári csillagda*, 32–33.

162 Hell, *Elementa arithmeticae numericae*, praefatio, unpaginated, and appendix, unpaginated; see also the *Scholion* 362: "The following courses of mathematics are recommended: [...] If beginners are to seek their basic knowledge of mathematics in those textbooks, I hope they will keep in mind the words of Paul the Evangelist, [*whatever you do*], *do all to the glory of God* (1 Corinthians 4:31)." Hell, *Elementa arithmeticae numericae*, 230. Curiously, the reference to 1 Cor. 4:31 is a misprint for 1 Cor. 10:31. The *gloriam DEI* part, however, resonates clear enough.

later in the century as a "constitution"), and a cultural heritage that was multiethnic, multi-confessional, and expressed chiefly in the Latin language (also the language of public affairs and political communication until 1844). "Lingua Slavus, natione Hungarus, eruditione Germanus"—I am Slav (Slovak) by (mother) tongue, Hungarus by nation, German by erudition: this is how the prototype of this kind of "patriot," the Lutheran polymath Matej/Mátyás/Matthias Bel/Bél (1684–1749), explained his identity. The supranational Hungarus consciousness, soon to be challenged by the rise of linguistic nationalism, was compatible both with the cosmopolitanism of the Enlightenment—in a way, given its strong anchorage in the home-grown traditions of secondary and higher education, the Hungarus elite also understood itself as a local Republic of Letters marked by emulation as well as tolerance—and the global horizons of the Society of Jesus.[163] As it was also conducive to the cultivation of dialogue and the maintenance of equilibrium among diverse stakeholders and leading voices in the kingdom, nor was Hungarus patriotism antithetical to the views of the architects of Theresan reform in the imperial capital.

Hell's pursuit of the progress of his "fatherland" and the glory of God in the periphery of the Austrian province barely lasted three years. Before the 1755–56 academic year had started, he was called back to its center, but this time principally as a servant of the state rather than God: he was appointed as imperial and royal astronomer at the helm of the newly established Viennese university observatory.

163 Some scholars have attributed the rise of the concept of Hungarus to the philosophy of history worked out by Hungarian Jesuits and, more generally, to the "national baroque"; others to the patriotism of the Slovak and German Lutheran professionals; still others stress that, from the mid-eighteenth century, the Enlightenment notion of humanity (*Humanität*/*Menschenliebe*) was crucial to it. See Gyula Szekfü, *Magyar történet* (Budapest: Királyi Magyar Egyetemi Nyomda, 1935), 4:378–79; Andor Tarnai, *Extra Hungariam non est vita* [...] (*Egy szállóige történetéhez*) (Budapest: Akadémiai Kiadó, 1969); http://mek.niif.hu/05400/05453/05453.htm (accessed April 12, 2019), esp. 99–100; Moritz Csáky, "Die Hungarus-Konzeption," in *Ungarn und Österreich unter Maria Theresia und Joseph II*, ed. Anna Maria Drabek, Richard G. Plaschka, and Adam Wandruszka (Vienna: Verlag der Österreichischen Akademie der Wissenschaften, 1982), 71–89; István Fried, "A hungarustudat kérdőjelei," in *A közép-európai szöveguniverzum* (Budapest: Lucidus, 2002), 47–68; Ambrus Miskolczy, "A 'hungarus alternatíva': Példák és ellenpéldák," *Regio* 20, no. 2 (2009): 3–46; Miskolczy, "'Hungarus Consciousness' in the Age of Early Nationalism," in *Latin at the Crossroads of Identity: The Evolution of Linguistic Identity in the Kingdom of Hungary*, ed. Gábor Almási and Lav Šubarić (Leiden: Brill, 2015), 64–94.

CHAPTER 2

Metropolitan Lures: Enlightened and Jesuit Networks, and a New Node of Science

1 An Agenda for Astronomic Advance

In January 1755, the Viennese court mathematician Johann Jakob (Giovanni Jacopo) Marinoni (1676–1755) passed away. Originally from Udine, Marinoni, whose contribution to the beginnings of astronomical observation activities in the Habsburg capital has already been mentioned briefly,[1] was appointed in 1703, and from 1720 he also served as the second director of the Viennese Imperial and Royal Academy for Engineering (Wiener kaiserliche und königliche Ingenieurakademie), established in 1717 under the auspices of the Aulic War Council primarily to ensure the adequate training of military engineers.[2] During his more than five-decade career in Vienna, Marinoni also played leading roles in large-scale government-run projects, from modernizing and expanding the system of fortifications around the capital to the land survey of Lombardy (the so-called "Theresan cadaster"—in fact begun long before Maria Theresa's accession).[3] As a surveyor, he introduced new methods and instruments in the Habsburg lands; as an astronomer, he carried out observations (also popularized in broadsheets) and even assembled students to instruct in the small observatory in his home in central Vienna, equipped with instruments purchased from far and wide, and donated in his last will to the court. In 1745, Marinoni published a volume describing the observatory, its activities, and equipment in great detail. The book was dedicated to the empress, and recommended by its reviewers, Frölich and Franz, as a textbook.[4] This was a formidable legacy in more sense than one.

1 Cf. above, Chapter 1, n. 86.

2 Madalina Veres, "Constructing Imperial Spaces: Habsburg Cartography in the Age of Enlightenment" (PhD diss., University of Pittsburgh, 2015), 58–61.

3 Carlo Capra, "The State of Milan's 'New Census,'" *Catastro* (December 2002): 129–33.

4 Johann Jakob Marinoni, *De astronomica specula domestica et organico apparatu astronomico libri duo* (Vienna: Kaliwoda, 1745), approbatio. The foreword also reveals that Marinoni exchanged observation results with the Jesuit observatory tower, in whose construction he acted as an advisor. For Marinoni's key biographical details and his activities as an astronomer, see Friedrich Slezák, "Johann Jakob Marinoni (1676–1755)," *Donauraum* 21 (1976): 195–207; Pärr, *Maximilian Hell*, 84–89 and the literature cited there.

© PER PIPPIN ASPAAS AND LÁSZLÓ KONTLER, 2020 | DOI:10.1163/9789004416833_004
This is an open access chapter distributed under the terms of the CC-BY-NC-ND 4.0 License.

Precisely at this time, in keeping with the university reforms initiated by Van Swieten, a new main building of the university was being erected upon the resolution of Maria Theresa. The plans were drafted by the court architect brought to Vienna by Francis of Lorraine, Jean-Nicolas Jadot de Ville-Issey (1710–61), while the construction work was supervised by Johann Joseph Count Trautson (1707–57), archbishop of Vienna, as "protector of the university" from 1752 onward. It was also decided to launch a chair for mechanics and astronomy, and to construct a new "public," or "Imperial and Royal Observatory," on top of the new assembly hall in the new building. This decision gave the observatory a prominent position in the city center. When finished, it would rise some 37.9 meters above street level. Ideally, it should have been even higher in order to prevent the spires of the nearby Jesuit church and even the Stephansdom from blocking the view of parts of the sky, but the fundaments of the building were not strong enough to support that.[5] To begin with, Father Franz was appointed as the scientific and technical supervisor of the construction of the tower, which appears to have been mostly completed and ready to be installed with the instruments bequeathed by Marinoni by the time Hell was invited from Cluj to take charge.

Hell's appointment as court astronomer resulted from the confluence of talent, contacts, and timing. His talent in the mathematical sciences, and astronomy in particular, perhaps together with his bent for practical applications, had been demonstrated and noted in Vienna, Trnava, and Cluj. That he had already published three mathematical textbooks as well as a work of history of a kind that was frequently resorted to in almanacs must also have spoken in his favor.[6] Thanks to his apparent association with Königsegg as a powerful figure in an important government office, his qualities may have already been known in courtly circles, not to speak about the leverage gained from support by the

5 Steinmayr, "Geschichte der Universitätssternwarte," 265–66. The location was far from ideal in other respects, too: the traffic of chariots on the block-paved streets caused shocks even to the more modest structure, during the summer the temperature was badly affected by the radiation of the heat that the roofs received from the Sun, while in the winter the smoke from ovens often obliterated the sight. Karl von Littrow, *Die neue Sternwarte der k.k. Universität Wien* (Vienna: n.p., 1874), 41. Cf. Pärr, *Maximilian Hell*, 101.

6 In the first non-anonymous edition of the *Adjumentum memoriae* (Vienna: Ghelen, 1774), preface, unpaginated, Hell claims that "since chronology and geography cannot subsist without astronomy, and history without chronology and geography is a blind matron hallucinating virtually every minute, we must confess that history is in debt to astronomy in the same measure as it is in debt to chronology and geography. Accordingly, it is the prerogative of the astronomer to treat chronological–historical subjects solidly." While this quote is missing in the earlier editions, the linking of astronomy with chronology and history appears to be commonplace.

ubiquitous Franz. As for timing, the loss of Marinoni, who despite his advanced age may have been the obvious choice for the newly created position, opened the floor for another candidate. Hell happened to be exactly the right age and had the requisite qualifications: sufficiently young and robust, and at the same time sufficiently experienced to be entrusted with this prestigious task.

Yet, at this point, it is again noteworthy that the candidate chosen was a Jesuit: had there been a strong desire or a concerted master plan to consistently dismantle the Society's influence in Vienna, this would have been an opportunity to look elsewhere. During the late 1740s and early 1750s, the supposedly more reform-minded Benedictines of the Habsburg monarchy,[7] though certainly not on a par with the Jesuits in this regard, also became highly active in the cultivation of astronomy. In 1746–48, plans were conceived for erecting a "mathematical tower" at Kremsmünster, one of their wealthiest monasteries, at that time led by the influential abbot Alexander Fixlmillner (1686–1759). Though the construction took much longer than in the case of the new Viennese observatory, by the time it was completed in 1758[8] the result was a truly impressive, forty-seven-meter high structure of seven stories serving the purposes of "all kinds of natural science, astronomy as well as geo-science, seismology and meteorology."[9] Several learned Benedictines well versed in mathematics and astronomy participated in the planning and the execution of the project,[10] including Anselm Desing (1699–1772) and Eugen Dobler (1714–96), the latter also serving as the first director of the mathematical tower.

Kremsmünster also boasted the man who, besides Hell, has been hailed as one of the two "founders of modern astronomy in Austria."[11] Placidus Fixlmillner (1721–91), after studies at the Benedictine University of Salzburg, settled for

7 On the "Benedictine Enlightenment," see Cornelia Faustmann, Gottfried Glassner, and Thomas Wallnig, eds., *Melk in der barocken Gelehrtenrepublik: Die Brüder Pez, ihre Netzwerke und Forschungen* (Melk: Stift Melk, 2014); Thomas Wallnig, "Franz Stephan Rautenstrauch (1734–1785)," in Lehner and Burson, *Enlightenment and Catholicism*, 209–25.

8 However, it may not have been ready for observations until 1760. See Rabenalt, "Astronomische Forschung," 97. For a contemporaneous account, see Placidus Fixlmillner's "Kurze Geschichte und Beschreibung der Sternwarte zu Kremsmünster (nebst drey Kupferplatten)," in Jean (Johann) III Bernoulli, *Sammlung kurzer Reisebeschreibungen und anderer zur Erweiterung der Länder- und Menschenkenntniß dienender Nachrichten*, Vierter Band (Berlin: Bey dem Herausgeber, 1784), 373–81.

9 Wolfschmidt, "Cultural Heritage and Architecture," 7.

10 This uniquely well-documented process is described in fascinating detail in Johann-Christian Klamt, *Sternwarte und Museum im Zeitalter der Aufklärung: Der Mathematische Turm zu Kremsmünster (1749–1758)* (Mainz: Zabern, 1999).

11 Konradin Ferrari d'Occhieppo, "Maximilian Hell und Placidus Fixlmillner: Die Begründer der neueren Astronomie in Österreich," in *Österreichische Naturforscher, Ärzte und Techniker*, ed. Fritz Knoll (Vienna: Verlag der Gesellschaft für Natur und Technik, 1957), 27–31.

the rest of his life at the monastery led by his uncle Alexander in 1745. He succeeded Dobler as director of the observatory in 1762, and although he produced a number of works in theology, law, and music, it was as an astronomer that Fixlmillner acquired his reputation—all the more impressive as he appears to have been largely self-taught in practical astronomy. Hell visited the Kremsmünster Abbey in September 1770, and by 1771 at the latest, Hell and Fixlmillner had initiated a scientific correspondence that was to last throughout their careers, and their collaboration also entailed Fixlmillner's publication of his astronomical observations in Hell's *Ephemerides*.[12] However, in 1755 clearly none of these figures were a match to Hell in terms of experience and expertise in the fields indispensable for filling the new position at the University of Vienna.[13] Besides good contacts close to the fire, the principles of enlightened meritocracy also favored the emerging Jesuit.

The new court astronomer was called back to his home university in September 1755[14] and began his new role on November 1. A description of the position—"instruction," in German, with Latin phrases interspersed—is attached to the letter of appointment, issued by the chamber of Lower Austria on October 30, 1755.[15] This is a very valuable document: it prescribes in great detail diverse activities, and thus expresses with exactitude the expectations harbored by his administrative and academic superiors who designed the position in the whirlwind of university reform.

12 Information on Fixlmillner's career has been gleaned from Wurzbach, *Biographisches Lexikon* (1858) 4:261–62 and Rabenalt, "Astronomische Forschung." See also the useful overview of Fixlmillner's life and writings in *Scriptores ordinis S. Benedicti qui 1750–1800 fuerunt in Imperio Austriaco-Hungarico* (Vienna: Leon, 1881), 95–98.

13 It is worth mentioning that in other important instances the Viennese decision-makers did not shy away from filling a newly created, key university chair with a scholar who, to all intents and purposes, trained himself in the given field "on the job." A case in point is Joseph von Sonnenfels (1732–1817)—very much a generalist *philosophe* on the Viennese literary scene, best known for his advocacy of the cultivation of the German vernacular, before his appointment as professor of *Polizeywissenschaft* at the university in 1763.

14 "In September of the year 1755, I was called, totally unexpected and urgently, from Cluj to the chair that I now keep here in Vienna," Hell recalled a few years later. Hell, *Anleitung zum nützlichen Gebrauch der künstlichen Stahl-Magneten*, 13. In his first letter to Delisle in Paris, dated Vienna, February 2, 1758 (Archives nationales, Paris, MAR/2JJ/66), Hell gives the exact date as September 14, 1755.

15 Ernennung Maximilian Hells zum k.k. Astronomen. Beilage: Instruction. Für dem Kaiser. Königl. Astronomen Maximilianum Hell S.J. Universitätsarchiv Wien (hereafter: UAW), Universitätskonsistorium, CA 1.2.102. See the English translation of the full text below in appendix 1. Cf. Pinzger, *Hell emlékezete*, 16–17 (in Hungarian translation). In the letter to Delisle mentioned above (n. 14), Hell gave a succinct summary (confined to five items out of the original seven).

To begin with, the imperial and royal astronomer was "to set in place a perfect arrangement [*vollkommene Einrichtung*] for all the instruments pertaining to this study [*Studium*] and make sure they are calibrated when necessary and well taken care of."[16] Though the word *Einrichtung* has a wide meaning, it is a question of whether the "perfect arrangement" of the fresh heritage of Marinoni's instruments also implied their "regular perfection and modernization," as suggested in some of the literature.[17] Hell himself wrote in a letter to the French astronomer Joseph-Nicolas Delisle (1688–1768) merely that he was to take good care of the instruments that were already to hand.[18] While he did acquire some instruments for his observatory over the years, this act of "modernization" was neither required of him in his work instruction, nor anything pursued as vigorously and systematically as at some other places even in Central Europe. The stock of instruments that was available to Hell[19] was far from the most up-to-date available in this period. On this point, Hell was soon surpassed by, for instance, the Jesuit Christian Mayer's (1719–83) observatories in Schwetzingen (established 1761) and Mannheim (established 1772), where considerable resources were set in motion to acquire instruments from the best makers in England.[20] In contrast, Hell had to make do with the heritage of Marinoni and some occasional acquisitions.

Further,

> it will be [the imperial and royal astronomer's] responsibility to make daily observations of the trajectories of the planets, thereby taking heed of the astronomical journals [*Ephemerides astronomicae*] that were begun by, and continued through many years by the Gentleman de Marinoni, and to enter his observations meticulously in suitable notebooks.[21]

Apart from the fact that the fate of Marinoni's journals is unknown, and even Hell's manuscripts of observations—with the notable exception of some of his diaries from the expedition in Denmark–Norway—have not been found, while of course he did publish all kinds of astronomical observations for years to

16 Instruction. Für dem Kaiser. Königl. Astronomen Maximilianum Hell, S.J.

17 See Pinsker, "Der Astronom Pater Max Hell S.J.," 105.

18 The same letter as in n. 14 and n. 15.

19 Hamel, Müller, and Posch, *Die Geschichte der Universitätssternwarte*; Aspaas, Posch, and Müller, "Astronomische Observatorien," 94–97.

20 Alexander Moutchnik, *Forschung und Lehre in der zweiten Hälfte des 18. Jahrhunderts: Der Naturwissenschaftler und Universitätsprofessor Christian Mayer S.J. (1719–1783)* (Augsburg: Dr. Erwin Rauner Verlag, 2006), 74–85, 257–69.

21 Instruction. Für dem Kaiser. Königl. Astronomen Maximilianum Hell S.J.

come in his public *Ephemerides*, there is nothing especially noteworthy in this point of the instructions. More interesting is the next one, according to which "the public is to be urged and invited by way of published announcements or posters placed on gates to make observations of eclipses, occultations of stars, comets, and other unusual astronomical phenomena."[22] This part of the instructions recognizes and proposes to give a further boost to the avid interest taken by European publics in celestial phenomena, especially on the rise since the invention of the telescope, and perhaps—in combination with the fifth point—also to streamline this interest. The age of the famous "Urania-Sternwarten" (Urania observatories), established with the specific aim of disseminating scientific knowledge and developing a much wider outreach than the Imperial Observatory of Vienna was ever expected to have,[23] was of course still a matter of the future. Nevertheless, the seventeenth- and eighteenth-century press was swarming with reports about exactly the kinds of celestial events mentioned by the instruction, and in turn such events, together with the instruments and the practices of their observation, also appear to have become sufficiently embedded in European cultural sensibilities to provide a new semantics of objectivity, accuracy, and speed as features of journalistic work.[24] Both the *Wienerisches Diarium* (Viennese diary) and its French counterpart, the *Gazette de Vienne* (Gazette of Vienna) reported about the observations of Halley's Comet in 1759, made at Hell's observatory as well as that of the Jesuit collegium. At the latter site, the future emperor Joseph II was present on at least one occasion. No other visitor is mentioned by name, nor is there any hint of an invitation for others to follow his example.[25] However, throughout his career Hell regularly received less high-profile guests at the observatory, foreign diplomats and visiting students alike. His observatory was an integral part of the public space of the Austrian capital.

---

22 Instruction. Für dem Kaiser. Königl. Astronomen Maximilianum Hell S.J.

23 See, e.g., Gudrun Wolfschmidt, "Die Entwicklung und Verbreitung der Urania zur Popularisierung der Astronomie," in *Konferenzbeiträge/Proceedings: Festkolloquium und Fachtagung 250 Jahre Universitätssternwarte Wien*, ed. Maria G. Firneis and Franz Kerschbaum, Communications in Asteroseismology 149 (Vienna: Austrian Academy of Sciences Press, 2008), 92–103; Ole Molvig, "The Berlin Urania, Humboldtian Cosmology, and the Public," in *The Heavens on Earth: Observatories and Astronomy in Nineteenth-Century Science and Culture*, ed. David Aubin, Charlotte Bigg, and Otto Sibum (Durham, NC: Duke University Press, 2010), 325–43.

24 Eileen Reeves, *Evening News: Optics, Astronomy, and Journalism in Early Modern Europe* (Philadelphia: University of Pennsylvania Press, 2014).

25 *Wienerisches Diarium* (hereafter: *WD*), May 5, May 16, and June 9, 1759; *Gazette de Vienne*, May 5, May 9, and May 19, 1759.

The fourth and fifth points of the instructions are crucial to the intended functions of the university observatory and its head, and are best considered together. According to the former:

> In order to promote the honor of this capital and its university, and to steer it toward the common good, the imperial and royal astronomer shall maintain a perpetual scientific correspondence [*commercium litterarium*] with all the famous observatories abroad, and in so doing make sure that all observations that are necessary for the advancement of geography be communicated to this observatory by the foreign ones, and that no observations of the kind that other astronomers are eager to receive, shall be neglected by him.

Next,

> all supervision of the calendars [i.e., almanacs][26] is bestowed and laid upon him. This responsibility will not only consist in making sure that everything that may originate from the superstition of the ancients and the multitude, or from the unfounded astrology, on weather, medications, bloodletting, growth of plants or human accidents, shall be completely avoided: he is also to edit an astronomical calendar every year and to publish it in time.[27]

These requirements further elaborate on the previously formulated expectation of developing a public profile for the observatory. To begin with the aspect

26 "Calender" (or "Kalender") in early modern German is a broad designation corresponding to the English word "almanac." The German word "Almanach" is a late eighteenth-century import from French, which initially was reserved for almanacs with poems (frequently referred to as "Musen-Almanach"); cf. Hartmut Sührig, "Die Entwicklung der niedersächsischen Kalender im 17. Jahrhundert," *Archiv für die Geschichte des ganzen Buchwesens* 20 (1979): 329–794, esp. 335–72.

27 Instruction. Für dem Kaiser. Königl. Astronomen Maximilianum Hell S.J. Calendars had many truly useful functions like registering the dates of fairs and the schedule of postal services, or providing advice on the preservation of health in each season on the basis of centuries-old experience, and many others. But to illustrate the relevance of the polemic against divination based on astrology included in calendars with one example among many: a calendar issued in Bratislava in exactly the same year as the instruction to Hell, determined on the basis of zodiac signs the best days of the year for not only bloodletting and purging or hunting and fishing, but even cutting hair and nails. I. Gábor Kovács, *Kis magyar kalendáriumtörténet 1880–ig.: A magyar kalendáriumok történeti és művelődésszociológiai vizsgálata* (Budapest: Akadémiai Kiadó, 1989), 27.

elaborated in the fifth point, working for and especially *on* the public implied an educational mission that pointed beyond the discipline of astronomy and was to engage and undermine the meanings traditionally associated with celestial phenomena. The explicit injunction to level sound astronomical and other scientific knowledge against superstitious beliefs via the supervision of calendars—the practical guide of the common man for locating himself in time by an overview of the seasons, holidays, rendering or prescribing specific activities to them, marking ordinary or curious occurrences and proposing modes of relating to them—could well be understood as an attempt to enlist, perhaps even against his own inclination, the Jesuit scholar for the cause of Enlightenment. Given Van Swieten's pervasive influence and his frontal offensive against every manner of superstition, this would not be implausible, except that there was nothing particularly unpalatable in it for a loyal member of the Society of Jesus. In fact, on Hell's own testimony, the instruction for him was conceived by no other than Father Franz.[28] Inasmuch as it was an Enlightenment document, the Enlightenment in question is a Jesuit one.

In any case, the first half of the 1750s was exactly the time when the issue of superstition was put into the limelight in the Habsburg monarchy by cases of alleged "vampirism" or *magia posthuma*—revenants harming the living—in Serbia, the Banat, and Moravia.[29] While military surgeons active in the southern frontier regions inquired into the cases in the former two provinces, court physicians were sent to investigate those in Moravia, and their reports (together with Van Swieten's advice pursuant to them) served as the basis for Maria Theresa's decision to take legal measures to stamp out "superstition." In March 1755, during the period immediately preceding the issuance of the instruction to Hell, a royal rescript forbade traditional measures against *magia posthuma*, which was followed by a circular letter to the parishes and courts of Hungary condemning a broader range of superstitious beliefs, including soothsaying, treasure-digging, divination, and the persecution of witches. In September, another decree prohibited the clergy from intervening in vampire cases without the approval of the secular authorities, and required consultation with medical specialists. It also ordered the translation from the original French into

28 Hell to Delisle, Vienna, February 2, 1758 (Archives nationales, Paris, MAR/2JJ/66).

29 On these cases and their impact, including Van Swieten's involvement, see Gábor Klaniczay, "Decline of Witches and Rise of Vampires in 18th-Century Habsburg Monarchy," *Ethnologia Europaea* 17 (1987): 165–80; Ádám Mézes, "Insecure Boundaries: Medical Experts and the Returning Dead on the Southern Habsburg Borderland" (MA thesis, Central European University, 2013); www.etd.ceu.hu/2013/mezes_adam.pdf (accessed April 15, 2019). It is perhaps worth noting that this aspect of the instructions was missing from the summary in Hell's 1758 letter to Delisle mentioned above, n. 14.

Latin and German of a tract by Van Swieten[30] that offered a fully natural explanation of the phenomena serving as a basis for vampire beliefs (such as the processes of fermentation and lack of oxygen as reasons for the slower decomposition of the body). Remarkably, before delving into the specific subject matter of vampirism, in his introduction Van Swieten presented a view of the relationship between science and religion not at all incompatible with that outlined above with reference to the Catholic Reform.[31] He acknowledges the existence of miracles especially as proofs for the omnipotence of God resorted to as a means of conversion, whether in the early days of Christianity, or in modern missions. He is even willing to recognize Satan's power as real. The question is not, Van Swieten stresses, whether "extraordinary effects" have taken place, but whether they can be demonstrated to have arisen from supernatural causes. He goes on to suggest that

> since the sciences and the arts have taken momentum, the natural causes of many effects that formerly left the ignorant in marvel have been clearly discovered. Take, for example, the eclipses, which threw entire peoples, for whom these appeared as miracles, into the most frightful terror and anxiety in old times. However, the improvement of astronomy has dispelled all this terror. […] We calmly contemplate the omnipotence of the Creator, who moves these huge bodies in such an infinitely vast space with such a precision, throughout so many centuries, that even the weak human understanding has been enabled to calculate with exactitude their return at a certain time in future centuries.[32]

It is only the ignorant who can be deceived by charlatans and impostors into wonderment at the sight of the works of gunpowder, electricity, or optical devices, but the progress of knowledge reduces the number of genuine miracles.

Van Swieten, the apparently uncompromising promoter of rational reform, speaks here a language familiar from the program of Catholic Reform, gaining further impetus from the Enlightenment preoccupation with progress. In developing this combination, he has been shown to have relied on recent developments in Italian enlightened Catholicism, especially the works of Lodovico

30 *Remarques sur le vampyrisme de Sylésie de l'an* 1755, *faites à S.M.I. et R.*; republished as an appendix in [Andreas Ulrich Mayer], *Abhandlung des Daseyns der Gespenster, nebst einem Anhange von Vampyrismus* (Augsburg: n.p., 1768). In October 1756, an Italian edition appeared in Rovereto, and according to the preface of the 1768 version, it was also translated into German in February 1756.

31 Cf. above, "Introduction," 11–17.

32 Van Swieten, "Vampyrismus," in [Meyer], *Abhandlung*, appendix, 7–8.

Antonio Muratori (1672–1750) and his followers like the Roveretan Girolamo Tartarotti (1706–61).[33] In turn, the latter's local friend Giuseppe Valeriano Vanneti (1719–64) was the translator of the 1756 Italian edition of Van Swieten's treatise on vampirism.[34] In the conceptual framing of this work, the chief strategist of Viennese academic reform employed an example to underline the reconcilability of religious belief with the enlightened pursuit of knowledge and social betterment that was derived from the discipline of the newly appointed court astronomer and resonated well with the exhortation in the instruction issued to the latter around the same time to turn the achievements of that discipline to the defeat of "superstition." Hell's appointment and the job description accommodated smoothly in the program of enlightened reform as pursued in Vienna in the mid-1750s, and that program was congenial to his profile as a Jesuit man of science.

Virtually the only trace we have of Hell's activities in his capacity as supervisor of calendars is a work of 1760. While the *Ephemerides* was published in the large *quarto* format and in stately Latin, which was also the language of most of his learned correspondence and publications, this booklet came out in German—obviously reflecting on the fact that lesser format calendars flourished and sold by the tens of thousands each year in the vernaculars.[35] As the title page reveals, Hell—speaking from the position of both a "priest of the Austrian province of the Society of Jesus" and "astronomer of the Imperial and Royal Majesties"—offers in the book "A Brief Introduction to the Paschal Celebration for the Common Lay Person, Including a Thorough Refutation of a Work that Christoph Sigismund Schumacher, Calendar Author in Dresden has Published in the Year 1760."[36] Not much is known about Schumacher (1704–68),

33 Klaniczay, "Decline of Witches and Rise of Vampires," 171.

34 Franco Venturi, *Settecento riformatore: Da Muratori a Beccaria* (Turin: Einaudi, 1969), 379–82.

35 See István György Tóth, "Les analphabets et les almanachs en Hongrie au XVIII[e] siècle," in *Les lectures du peuple en Europe et dans les Amériques du XVII[e] au XX[e] siècle*, ed. Hans-Jürgen Lüsebrink et al. (Brussels: Editions Complexe, 2003), 127–32. A survey of the various vernacular almanacs published in the Habsburg lands during the eighteenth century would be very welcome (the lack of a separate section on almanacs in György Kókay, *Geschichte des Buchhandels in Ungarn* [Wiesbaden: Harrassowitz, 1990] is regrettable). On French-language almanacs issued in Habsburg lands during the eighteenth century, see Hans-Jürgen Lüsebrink and York-Gothart Mix, eds., *Französische Almanachkultur im deutschen Sprachraum (1700–1815)* (Göttingen: Vandenhoeck & Ruprecht, 2013).

36 *Maximiliani Hell S.J. der Oesterreichischen Provinz Priestern Ihro beyder Kaiserl. Königl. Majest. Astronomi bey der uralten hohen Wienerischen Universität Kurzer Unterricht der Oster-Feyer für den gemeinen Mann samt der gründlichen Wiederlegung einer Schrift, welche Herr Christoph Sigismund Schumacher, Calender-Schreiber in Dreßden unter der*

except that he was an astronomer noted on account of his reliable calculations by Bernoulli in his *Recueil pour les astronomes* (Anthology for the astronomers [1771–73]). Two letters from him to Hell, both dated Bratislava in the spring of 1759, are preserved. Schumacher there presents himself as an almanac editor and astronomer who has previously stayed in Transylvania and the eastern parts of Hungary. He has had little success so far, but is determined to linger on in Hungary until God decides otherwise.[37] Soon afterward, he appears to have returned to Germany, where he had been born, and died in Leipzig in dire circumstances. As a Protestant, he is said to have "mocked" Catholics for having missed celebrating Easter on the proper date.[38] While this was not "superstition," it naturally called for an academically sound defense of "Easter as it is practiced in the Roman Catholic Church," which Hell undertook in the booklet. He underscored that he wrote this text on the paschal celebration "in the truly vulgar civic mother tongue" (*in der gänz gemeinen bürgerlichen Muttersprach*) because he wanted to reach the "common man" (*gemeine Mann*).[39] Latin functioned well in learned communication, but Hell was willing to switch language in order to reach the public of the calendars.

To return to the fourth point of the instruction and the final remark of the fifth one, the public aspects of the appointment appear in them in a different guise. They articulate an endeavor to strike a name for Vienna on an international plane by integrating the institution with state-of-the-art work in the field and making the imperial capital competitive in this regard—the same as the reforms of finances, the administration, the military, and so on taking place in the same period were to achieve in these respective areas. From early on, Hell indeed started to make international contacts. This can be perceived not only from the appendices of his *Ephemerides*, which give an idea of a rapidly expanding network, but also from entries in prestigious journals like the *Nova acta eruditorum* (New transactions of the learned) of Leipzig or the *Journal des Sçavans* (Journal of scholars) of Paris.[40] What survives of Hell's letters

Innschrift Untersuchung der Oster-Feyer von Anno 1700. bis 2500. verfasset und Anno 1760. in Druk gegeben hat (Vienna: Trattner, 1760).

37 Schumacher to Hell in Vienna, dated Bratislava, March and May 1, 1759 (WUS, secretary's copy).

38 Pinzger, *Hell Miksa*, 1:62.

39 Hell, *Kurzer Unterricht*, preface, unpaginated.

40 See, e.g., *Nova acta eruditorum* for February 1762, 49–58; *Journal des Sçavans* (hereafter: *JS*) (October 1761): 672–75. As for the latter case, there is a copy of a letter from Hell to the editors of the journal in Paris, dated Vienna, March 18, 1761 (Universitätssternwarte Wien; hereafter: WUS), explicitly asking for a review of the *Ephemerides*.

demonstrates that scientific correspondence with all major international observatories was soon by and large established. As the case of Paris illustrates, the *Ephemerides* seems in most cases to have functioned as a door-opener. In the autumn of 1757, two Jesuit astronomers, the above-mentioned Christian Mayer of Heidelberg and Franz Huberti (1715–89) of Würzburg, traveled to Paris to visit its main scientific institutions. Huberti brought with him a copy of the *Ephemerides* to show to the astronomers of Paris, and in a letter to Hell dated October 3, 1757 he described their reaction as follows:

> Upon order from my Mæcenas, His most Honorable and Eminent *Princeps* [i.e., the prince-bishop, *Fürstbischof*] of Würzburg, I have found myself under obligation to go to Paris, despite my wish to pay Vienna another visit. I showed your *Ephemerides*, which I had brought with me, to the astronomers of Paris. It was pleasant so see how they at first sight raised their eyebrows, but soon praised the great industry of the calculations and immediately asked me to provide a copy for them from Germany. Only Delisle, a man who is advancing his old age, very favorable to our Society and thoroughly outspoken, added that he had great respect for your calculations, but would have preferred that you spent more of your time on observations than on calculations. I answered that you would not take a rest from the task of making observations either.[41]

Arguably, the main achievement of Hell was indeed the *Ephemerides ad meridianum Vindobonensem*, the first volume of which covered the year 1757 and which continued until 1806 (published 1805). In 1760, without revision of contents or layout, it was renamed the *Ephemerides astronomicae ad meridianum Vindobonensem*, a name it retained until the very end. This periodical not only contained tables of the rising and setting of the Sun and other standard contents of astronomical almanacs; it also included observation data collected from an ever-widening range of locations, as well as articles and treatises on various scientific subjects as appendices.[42] The significance and the trajectory of the annual will be discussed in detail below. What deserves mentioning here is that it was probably in recognition of its standards that Hell was elected corresponding member (*membre correspondant*) of the Académie Royale des

41 Huberti to Hell in Vienna, dated Paris, October 3, 1757 (WUS, secretary's copy). For more on the visit of Huberti and Mayer to Paris, see Moutchnik, *Forschung und Lehre*, 67–69; 152–54; 447.

42 For a complete list of items published in the *Ephemerides*, see Carlos Sommervogel, "Hell, Maximilien," in *Bibliothèque de la Compagnie de Jésus* [...] *Bibliographie* (Brussels: Oscar Schepens, 1893), 4:238–58.

Sciences of Paris shortly after the episode related above. This was the first time that a representative of the Austrian province of the Society of Jesus had received this honor,[43] also marking the start of a close and long-standing—though sometimes rather strained—scientific cooperation between the imperial astronomer of Vienna and his colleagues in France. Hell's surviving letters bear witness of a rather frequent correspondence with the major French contemporary astronomers—Nicolas-Louis de Lacaille (Abbé Lacaille [1713–62]), Joseph-Nicolas Delisle (1688–1768), Charles Messier (1730–1817), César-François Cassini de Thury (Cassini III [1714–84]), the abbé Jean Baptiste Chappe d'Auteroche (1722–69), Alexandre-Guy Pingré (1711–96), and Joseph-Jérôme Lefrançois de Lalande (1732–1807)—from the late 1750s onward. The court astronomer of Vienna never visited France personally, and he never learned French well enough to speak or write it properly. This did not hamper communication, however, as the French astronomers would tend to write their letters in their own language while Hell composed his in Latin. The same kind of bilingual communication probably took place whenever he received French-speaking visitors.[44] Outside the German- and French-speaking world, in the early 1760s Hell forged contacts with colleagues at observatories in Madrid, St. Petersburg, Milan, Bologna, Florence, Padua, and Stockholm, using Latin in all cases.[45] Correspondence with England (and election to membership in several other academies) came later.

---

43 In September 1758, astronomer Lacaille suggested Hell as a corresponding member. With support from Lacaille's colleagues Giovanni Domenico (Jean Dominique) Maraldi (1709–88) and Guillaume le Gentil de la Galaisière (1725–92), Hell was formally appointed a corresponding member of the Académie Royale des Sciences on December 23 of that year (Archives de l'Académie des sciences, Paris. Protocol de séances and Lettre de nomination, signé par De Fouchy; also, Weiss to Hell in Vienna, dated Trnava, December 23, 1758 [WUS, secretary's copy]). According to the *Connoissance des temps* for 1760 (published 1759) and later editions, Hell's formal correspondent at the academy initially was Lacaille. After the latter's demise, his contacts were Delisle (1763–68) and Lalande (1769–92).

44 The first verifiable visits took place in 1761, when Chappe d'Auteroche passed by on his way to Tobolsk in Siberia, and Cassini de Thury arrived to observe the transit of Venus from the Jesuit observatory and to initiate a joint project of cartography. Cf. Jean Chappe d'Auteroche, *Voyage en Sibérie fait par ordre du Roi en 1761*, ed. Madeleine Pinault Sørensen and Michel Mervaud (Oxford: Voltaire Foundation, 2004), entries from December 31, 1760 to January 8, 1761, 2:250–51; César-François Cassini de Thury, "Observation du passage de Vénus sur le Soleil, faite à Vienne en Autriche," in *Histoire de l'Académie Royale des Sciences* (hereafter: *HARS*) 1761 (published 1763), *Mémoires*, 409–12.

45 For a complete list of Hell's extant correspondence, see "Metadata Serving as Basis for Illustrations of Maximilian Hell's Network in the Book *Maximilian Hell (1720–1792) and the Ends of Jesuit Science in Enlightenment Europe* by Per Pippin Aspaas and László Kontler

According to the sixth point of the instructions:

> The above-mentioned [i.e., Hell] is given responsibility, besides mechanical, practical, and calculatorial astronomy, also for the courses in mechanics, which he shall deliver in the German vernacular at a suitable time every Sunday in the philosophical lecture hall, and illustrate by means of mechanical experiments, and he is to announce these courses by way of posters of invitation in advance.[46]

Hell's activity as a lecturer is in need of further study, though the reconstruction beyond what we already know from various reports may be blocked by the lack of lecture notes or a textbook by him. The assignment to teach mechanics as well as astronomy, especially the requirement of practical illustrations, once again—like in the period of his probable association with Königsegg and the imperial mining authorities, with Franz's involvement—points to a deliberate effort on the part of the Viennese reformers to exploit his Banská Štiavnica background and experience. Nevertheless, he appears to have abandoned his lectures in "popular mechanics" after only one year because his other duties proved too time-consuming.[47] He did, however, host individual aspiring astronomers in his apartment in order to give them instruction in practical astronomy. Some of these visitors stayed for a few weeks or months, others up to several years.

The last point of the instructions required the imperial and royal astronomer to

> report every week to the director of philosophy about all his observations and scientific correspondence, and he shall inform the director, to whom he is responsible in all matters relating to his office, about his further activities, on what subject matters are to be included in his calendars and mechanics courses, and what works he is going to publish.[48]

(Brill Academic Publishers, 2020)," UiT Open Repository 2019, https://doi.org/10.18710/CVW8YU.

46 Instruction. Für dem Kaiser. Königl. Astronomen Maximilianum Hell S.J.

47 Von Littrow, *P. Hell's Reise nach Wardoe*, 5: cf. "Maximilian Hell," in Schlichtegroll, *Nekrolog*, 288–89. See, however, also the claim that there was a "large attendance of Hell's lectures." Konradin Ferrari d'Occhieppo, "Hell, Maximilian," in *Dictionary of Scientific Biography*, ed. Charles Coulston Gillispie (New York: Charles Scribner's Sons, 1970–81), 6 (1972): 234.

48 Instruction. Für dem Kaiser. Königl. Astronomen Maximilianum Hell S.J.

One of Hell's biographers regarded this part of the instruction as "ridiculously patronizing," and attributed it to the influence of Van Swieten and Joseph von Sonnenfels (1732–1817)—by implication, to the pervasive regulatory gaze of the emerging enlightened state and its ambition of exercising unnecessary supervisory functions over an independent man of science (who in this case was a Jesuit).[49] The circumstances put this in a rather different light. The director, namely the dean of the Faculty of Philosophy, to whom the periodic reports were due and Hell was answerable in general, was at this time no other than Franz, Hell's former teacher and supporter as well as—according to Hell—the author of the instruction itself. The relationship between the two men appears to have been one of a senior and a junior member of the Society of Jesus, master and disciple, probably marked not only by mutual respect but also cordiality, consolidated by this time through more than a decade-long acquaintance and collaboration on various projects. Patronage may have been involved, but the instruction is certainly not patronizing. This is not to claim that the relationship was fully smooth. Though not much is on record, it is evident from an elaborate letter addressed to the senior astronomer Delisle in Paris that Hell felt that the tasks assigned to him by Franz were slightly too demanding: "You will surely be amazed that Father Franz, who ought to know the chores of an astronomer, was able to place the burden of obeying to these instructions on the shoulders of one man alone," Hell fumed. Without any helping hands, "no assistant, no secretary, and—worst of all—without any funds," the imperial astronomer had to take care of all his tasks on his own. A final complaint put forward in the same letter was that Franz kept Marinoni's journal of observations hidden: Hell states that he had not even been given permission to inspect them.[50]

As to the required reporting, unfortunately it must have been taking place orally (another sign that the dean's supervisory functions over the imperial and royal astronomer were exercised in practice rather informally—true to the nature of their personal relationship), as there are no written traces of this in the Viennese University Archives. The relatively small number of documents by Hell and ones relating to him preserved there mainly concern extraordinary issues, such as the renovation of the university building including the observatory premises; the fate of books (including those on astronomy) belonging to

49 Ferenc Pinzger, "Hell Miksa (1720–1792)," in *Stella Csillagászati Egyesület Almanachja 1927–re* (Budapest: Királyi Magyar Egyetemi Nyomda, 1926), 177–200, here 178. In regard of especially von Sonnenfels, this is a strange assumption, as he did not come to play any significant role in Viennese academic life until the 1760s. Cf. above, 94n13.

50 Hell's letter to Delisle in Paris, dated Vienna, February 2, 1758 (Archives nationales, Paris, MAR/2JJ/66).

the library of the Jesuit college after the suppression of the order; the fate of the room Hell abandoned in the college during the same period; and, finally, the assignment of the room in the observatory that both he and von Triesnecker used to two students of astronomy after von Triesnecker's death.[51] A detailed investigation of the interactions between Hell and the administrative and scientific staff of the university is made difficult by the scarcity of material.

The appointment also entailed an annual stipend of three hundred florins, payable from the university's coffers, an income that secured comfortable circumstances. For the time being, the site of this comfort was to be the upper floors of the new university building, directly underneath the observatory, which the court astronomer shared with his assistant (referred to as the *socius*, *bidellus*, or *adjunctus*), a servant (*famulus*), and a secretary (*scriba*). Furthermore, his apartment had sufficient space to host a student of astronomy for shorter or longer periods. It was a common arrangement for astronomers in those days to live in the observatory building itself: given the nightly chores that went with the profession, it was simply convenient to do so. While this also meant immediate proximity to the hub of university life—and, given the building's location, to the heartbeat of Vienna as a two hundred thousand-strong urban center—an atmosphere of seclusion seems to have reigned in these upper quarters. In a letter from 1762, Hell refers to his apartment as "an almost sacred space," inhabited only by priests.[52] His living quarters, at least, were not public.

2 Science in the City and in the World: Hell and the *respublica astronomica*

Perhaps the most conspicuous aspect of the instruction to Hell is the intention of enlisting the imperial and royal astronomer and the observatory under his direction to the service of putting Vienna once and for all on the map of European science. The Habsburg capital had been a luminous center of glory and representation for a long time on many accounts, but despite institutions like the university or the imperial library, the systematic pursuit of scientific

51 UAW, Universitätskonsistorium CA 1.0.195 ; CA 1.3.117; CA 1.3.140; CA 1.3.405; CA 1.4.158. These documents have also been cataloged, with a summary, at http://scopeq.cc.univie.ac.at/Query/volltextsuche.aspx (search on "Maximilian Hell") (accessed April 15, 2019).

52 Hell to Károly Eszterházy, bishop of Eger, dated Vienna, August 6, 1762. Eger, Főegyházmegyei Levéltár, Archivum vetus (hereafter: FLE, AV), 2629.

knowledge had not come to be recognized as integral to the sinews of power until the eighteenth century.[53] As such, the creation of the new observatory and the appointment of a qualified, dynamic professional at its helm was part of a more comprehensive endeavor, not confined to the university reform. Vienna in the 1750s was swarming with scholarly initiatives, some of them launched and steered directly by the government, others more or less free from its tutelage but encouraged or condoned by it, all of them aiming at helping the Habsburg capital to keep abreast with international developments.

The creation of the Oriental Academy and the Theresianum has already been mentioned. In 1754, a Botanical Garden, initially rather a *hortus medicus* to support the practical training of students of medicine, was also established by Maria Theresa on the advice of Van Swieten, who proudly reported on this move—together with the acquisition of a mineral collection as well as the imperial sponsorship of von Jacquin's expedition to the Caribbean—as a proof for the emerging "taste for the sciences" in Vienna to Linnaeus.[54] In 1757, the Botanical Garden was attached to the university, and—thanks to reorganization on more broadly scientific grounds and massive growth in stock—it started to flourish from 1768 under the leadership of the founder of the Viennese botanical school: von Jacquin, now transferred from the mining academy in Banská Štiavnica to the Viennese chair of botany and chemistry. Besides, plans for an academy of sciences in Vienna,[55] on the agenda with fluctuating vigor ever since Leibniz (supported enthusiastically by the general and statesman Eugene of Savoy [1663–1736]) first conceived the idea of an imperial academy of sciences there in the 1710s, were renewed in this period, and a project was submitted to von Haugwitz in 1750 by Josef von Petrasch (1714–72). In 1746, von

53 Even then, these remained primarily associated with the growth of military capacity. Cf. William D. Godsey, *The Sinews of Habsburg Power: Lower Austria in a Fiscal–Military State 1650–1820* (Oxford: Oxford University Press, 2018).

54 Klemun and Hühnel, *Nikolaus Joseph Jacquin*, 51–52.

55 The following summary is mainly based on the very detailed presentation of these plans in Joseph Feil, *Versuche zur Gründung einer Akademie der Wissenschaften unter Maria Theresia* (Vienna: Gerold, 1860), 7–44. On Leibniz's academy project, see Günther Hamann, "G.W. Leibnizens Plan einer Wiener Akademie der Wissenschaften," in *Akten des 11. Internationalen Leibniz-Kongresses*, ed. Kurt Müller, Heinrich Schepers, and Wilhelm Totok (Wiesbaden: Franz Steiner Verlag, 1973), 205–27; Regina Stuber, "Die hannoversche Sukzession von 1714: Leibniz im Wiener Abseits?," in *Leibniz, Caroline und die Folgen der englischen Sukzession*, ed. Wenchao Li (Stuttgart: Franz Steiner Verlag, 2016), 31–50. It must be added that during the same period the idea of an academy as a monastic environment for shared scholarship was widely discussed among the Benedictines of Central Europe. See Thomas Wallnig, *Critical Monks: The German Benedictines, 1680–1740* (Leiden: Brill, 2019), 91–101.

Petrasch had already founded and for several years successfully managed the Societas Eruditorum Incognitorum in Terris Austriacis (Society of unknown scholars in Austrian lands), the first German scientific society of the Habsburg lands, in Olomouc (Olmütz) in Moravia. Von Petrasch's very detailed plan included elaborate statutes, set out principles about the exact composition of the future membership, stressed the need for them to enjoy freedom from censorship, and—naturally—proposed a handsome budget to be covered from the income of the academy's publishing house. While the plan was deeply inspired by the famous writer and language reformer Johann Christoph Gottsched (1700–66), the purview of the academy was not to be confined to language and literature. On the contrary: von Petrasch criticized all the famous foreign predecessors and counterparts for being too restrictive, and set a comprehensive agenda "for the improvement of the arts and the sciences, to promote the benefit and the rise of the Austrian hereditary lands." Significantly, there was a great emphasis on international integration via correspondence and the election of external members. Eventually, von Petrasch's plan shared the fate of that of Leibniz: it was shelved. While the chief of the Imperial Chamber, Count Johann Joseph Khevenhüller-Metsch (1706–76), had some concerns about its comprehensiveness (stressing the need for distinguishing "useful" sciences from "idle" ones) and the tendency for "freethinking" that von Petrasch's views on censorship implied to him, the main reason was lack of funds.

For the time being, arguably, the main instrument of the internationalization of Viennese science was the new observatory and the fulfillment by Hell of the parts of the instruction that required him to pursue a *commercium litterarium* (learned correspondence) and the publication of an astronomical almanac. It is worth considering the *Ephemerides*, and the development of Hell's correspondence and personal relationships, in conjunction with his own astronomical contributions over the first one and a half decade of his career as imperial and royal astronomer.[56]

The first volume of the *Ephemerides ad meridianum Vindobonensem* came out in 1757.[57] It continued to Hell's death and beyond, under his successor von

56 An earlier version of the development of the *Ephemerides* was presented in László Kontler, "The Uses of Knowledge and the Symbolic Map of the Enlightened Monarchy of the Habsburgs: Maximilian Hell as Imperial and Royal Astronomer (1755–1792)," in *Negotiating Knowledge in Early Modern Empires: A Decentered View*, ed. László Kontler et al. (Basingstoke: Palgrave Macmillan, 2014), 79–105.

57 The issue for the year 1757 has no appendix, but appendices were added for every issue from the volume for 1758 onward. As to the year of printing, Hell's *Ephemerides*, like any other almanac, was routinely issued before the year it covered. However, the year of

Triesnecker, until 1806. It was not only the second of modern, regularly published astronomical annuals after the Parisian *Connoissance des temps* (Knowledge of time) of the Bureau des Longitudes (1679),[58] and preceding the London *Nautical Almanac* of the Commissioners of Longitudes (1767) as well as the Berlin *Astronomisches Jahrbuch* (Astronomical yearbook [1774]). It is also noteworthy in terms of its difference in contents and conception from each of these prestigious counterparts. Like Hell, the *Jahrbuch*'s editor Johann Elert Bode (1747–1826), besides publishing the astronomical tables for the given year and news and treatises in the field, also aimed at reporting on astronomical observations made at various locations in and outside Germany.[59] However, the

printing is missing from the title page of every issue until the volume for 1766, published "Viennæ MDCCLXV." Thus, on the title page of the first issue, we find *Anni 1757*, and this year is taken for granted as the year of printing in some modern studies (e.g., Ferrari d'Occhieppo, "Hell and Fixlmillner," 28; Harris, "Boscovich, the 'Boscovich Circle,'" 537n19; Karin Lackner et al., *Der historische Buchbestand der Universitätssternwarte Wien: Ein illustrierter Katalog*, vol. 2, *18. Jahrhundert* [Frankfurt: Peter Lang, 2006], 17, 23). One exception to the above rule was the volume for 1761, which was delayed due to the move of the printing house. Several items in Hell's correspondence from January and February 1761 contain apologies for this delay, revealing the exceptionality of the situation (Hell to Lacaille, to Delisle and to Messier in Paris, all dated January 31, 1761; Hell to Rieger in Madrid, dated February 6, 1761; Hell to Braun in St. Petersburg and to Chappe d'Auteroche in Tobolsk, both dated February 8, 1761; all in WUS, Manuscripte Hell). Two manuscript bibliographies of Hell's published works, both written in Hell's own hand and preserved at the monastery of Pannonhalma in Hungary, explicitly state that the first volume of the *Ephemerides* was in fact published in 1756 (Hell's MSS "opera à P. Hell. S.J. edita" [dated June 9, 1773] and "Elenchus operum editorum à P. Maximiliano Hell" [1791]). In Hell's correspondence, no letter from the year 1756 is known to have survived. However, a letter from Stepling in Prague to Hell in Vienna, dated January 30, 1757, contains praise for the *Ephemerides*: "The *Ephemerides* published by the Reverend Father for the year 1757, which are of really high quality, I have had the great pleasure of seeing and leafing through. I congratulate you, Reverend Father, with this start, so useful for astronomy and truly honourable for Our Society [of Jesus]." All this evidence combined seems to indicate that the *Anni 1757* volume was also published ahead of the year it covered.

58 In 1762, the publication was renamed *Connoissance des mouvemens célestes*, a name it kept for only five years. In 1768, it reverted back to its original name, which it retained until 1797, when the spelling *Connoissance des temps* was modernized into *Connaissance des temps*. See further Guy Boistel, "Un 'bréviaire' pour les astronomes et les marins: La *Connaisance* [sic] *des temps* et les calculateurs de Bureau des longitudes, de Lalande à Loewy (1772–1907)," *Archives internationales d'histoire des sciences* 64 (2014): 462–80.

59 On Bode in general, see Friedhelm Schwernin, *Der Berliner Astronom: Leben und Werk von Johann Elert Bode 1747–1826* (Frankfurt: Harri Deutsch Verlag, 2006); on Bode's annuals, see Jürgen Hamel, "Ephemeriden und Informationen: Inhaltliche Untersuchung Berliner Kalender bis zu Bodes Astronomischen Jahrbuch," in *300 Jahre Astronomie in Berlin und Potsdam* (Frankfurt: Harri Deutsch Verlag, 2000), 49–68; Cornelia Maria Schörg, "Die Präsenz der Wiener Universitätssternwarte und ihrer Forschungen in den deutschsprachigen

otherwise commendable and forward-looking decision to issue the annual in German proved somewhat counterproductive from the point of view of the chances of dissemination, if we are to judge on the basis of a comment that the first volume received in the *Journal des Sçavans*. The author of the review rejoiced that the international "taste" for calculating the astronomical tables had resulted in a new publication, but at the end of a rather detailed account added that "we regret to see it printed in a language so little known in France, in Italy, in England, where astronomy is yet keenly cultivated."[60] To a certain extent, the reviewer's words may well have been just one of the many eighteenth-century instances of French condescension toward other languages and cultures. Still, Bode's decision to promote scientific culture in the vernacular seems to have defeated the purpose of circulation, and the work of foremost German astronomers may have continued to be noted in France and Britain despite the *Astronomisches Jahrbuch*. At the same time, the apparently obsolete Latin of the Viennese *Ephemerides* was still eligible as a *lingua franca* in the enlightened *respublica astronomica*. Besides expediency, Hell had other compelling reasons for choosing Latin. His being a member of a Catholic religious order was only one of them. As discussed in Chapter 1, Hell was also a Hungarus: a member of a caste of learned men in the multi-ethnic eastern half of the Habsburg monarchy, who, regardless of their personal ethnic background, harbored a strong sense of allegiance to the cultural traditions of the old Kingdom of Hungary, and—especially in the absence of improved vernacular languages—habitually resorted to Latin as their preferred medium of communication.[61]

The difference between the *Ephemerides* on the one hand and the *Connoissance des temps* and the *Nautical Almanac* on the other was of a different nature. The latter two confined themselves, besides the astronomical tables and the necessary commentary and explanations, to publishing (in the case of the former, relatively extensive, while in the case of the latter rather scarce) miscellaneous additional material of astronomical interest, and their maintaining

---

astronomischen Jahrbüchern und Fachzeitschriften 1755–1830" (Mag. Phil. diss., University of Vienna, 2009), 31–37.

60 *JS* (March 1775): 173.

61 Not merely a specialty of the educated elite, Latin was even spoken by soldiers, merchants, and other ordinary people in eighteenth-century Hungary. István Tóth, *Literacy and Written Culture in Early Modern Central Europe* (Budapest: Central European University Press, 2000), esp. 130–45. For a comprehensive bibliography, see Gábor Almási, "Latin and the Language Question in Hungary (1700–1844): A Survey of Hungarian Secondary Literature (Parts 1 and 2)," *Das achtzehnte Jahrhundert und Österreich* 28 (2014): 211–319 and 30 (2016): 237–90.

institutions published local observation results separately. By contrast, soon after its first appearance Hell's *Ephemerides* grew into a real switchboard for communicating information on astronomical observations carried out at an expanding—and changing—range of locations in and around Vienna, in the Habsburg monarchy, in Europe, and in the wider world. In this way, Hell uniquely shaped his almanac as a contribution to building a "total archive encompassing all celestial phenomena" not merely in chronological but also spatial terms, capturing not only the succession of stellar constellations in a given temporal unit (a calendar year) but also as many as possible of the major celestial events as observed at locations spread across the globe.[62] Observation reports were already included in the second (1758) volume of the *Ephemerides*, published in 1757, for the time being still confined to giving an account of Hell's own activity at the university observatory in Vienna.

This remained the standard—but in an expanding number of entries and at ever-greater length—until 1761. By that year, when Hell also published in the *Ephemerides* a detailed forecast of and instructions for the "singular phenomenon" of the transit of Venus before the Sun expected for June 5, the size of the appendix containing the observation reports grew threefold (thirty entries and ninety-two pages—compared to ten entries and twenty-eight pages in 1758). It also included accounts of work by others in Vienna: the "Abbé Lysogorski," and the amateur astronomer "Mr. Caspar Sambach, a painter of this famous city" who carried out observations ("instructed in my method, explained slightly earlier to him") on the top of his own house in the suburb of Spittelberg.[63] The real watershed was the 1762 volume, including a comprehensive overview of observations of the transit of Venus that took place on June 5, 1761. Transit observation data were included from France (the Paris observatories), England (Greenwich), Spain (Madrid), Italy (Bologna, Rome, Padua, Florence), Germany (Ingolstadt, Munich, Würzburg, Schwetzingen, Dillingen, Göttingen, Dresden), the Habsburg monarchy (Ljubljana [Labacum, Laibach], Trnava), Poland (Poznań [Posnania, Posen]), Sweden (Stockholm), and "Muscovy" (St. Petersburg). The data are followed by a summary table providing the names of the

62 For the notion of astronomical observations and almanacs as an "archive," see Florence Hsia, "Astronomy after the Deluge," in *Science in the Archive: Pasts, Presents, Futures*, ed. Lorraine Daston (Chicago: University of Chicago Press, 2017), 17–37.

63 *Ephemerides anni 1761 ad meridianum Vindobonensem jussu Augustorum calculis definitae a Maximilian Hell, è S.J. caesaro-regio astronomo, et mechanices experiment: Prof. public. et ordin.* (Vienna: Trattner, 1760), 178. The annals will be referred to hereafter as Hell, *Ephemerides* Year Covered (Year Published). Unless explicitly stated, page numbers refer to the separate pagination of the *appendices*, not the almanac part of each volume. On Lysogorski and Sambach, see below, 122 and 148–49.

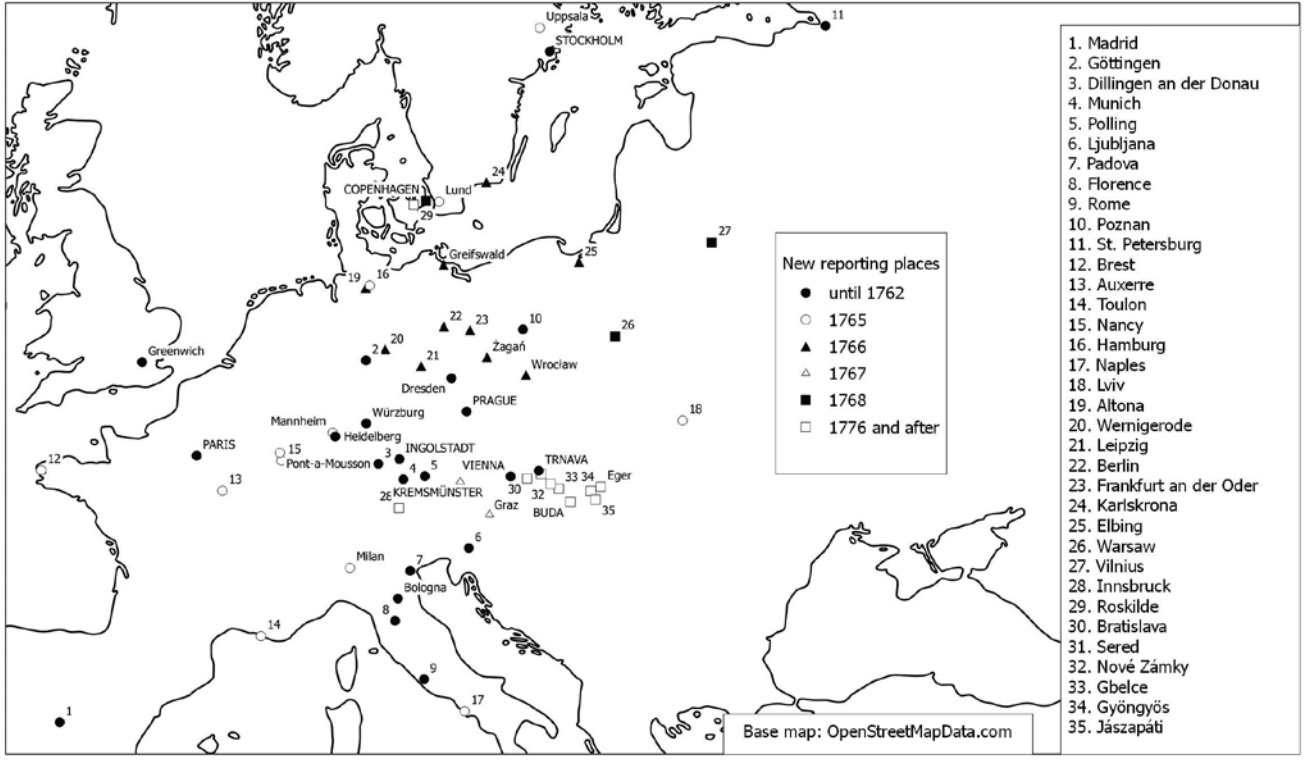

FIGURE 2 Map of source locations of observation reports published in the *Ephemerides*
Capital letters indicate places with at least five reports; numbers indicate places with a maximum of three reports. For reasons of space, the following source locations could not be included. Until 1762: Puducherry (Pondicherry), Tobolsk; 1764: Cape of Good Hope, Island of Rodrigues, Tranquebar; 1766: Godthaab/Nuuk, Åbo/Turku; 1772: Beijing; 1776 after: "Tartaria occidentalis," Lambhuus (Bessastaðir, Iceland), Trondheim. Map constructed by Katalin Pataki in collaboration with the authors

observers and the instruments used by them, and finally a collation of the data. Other astronomical observations are then reported at some length, besides places already familiar from above, also from Prague and Polling (Bavaria).

The 1763 volume neglected observations, but in 1764 the picture about the Transit enterprise was rounded off by reports on the expeditions to the Isle of Rodrigues, Tranquebar (Tharangambadi), the Cape of Good Hope, and Tobolsk—Hell not failing to note, "benevolently communicated to me by that author [i.e., the Abbé Chappe d'Auteroche]."[64] Hell also published, with his own explanations, the Swedish astronomer Anders Planman's (Andreas Planmann [1724–1803]) tables of the calculations of the solar parallax by various scholars on the basis of the 1761 observations. In subsequent years, additional information source locations appeared in the appendix of the *Ephemerides* on astronomical observations: Uppsala, Lund, Pont-à-Mousson, Naples, Milan, Nancy, Toulon, Auxerre, Brest, Hamburg, Lviv (Lvov, Lwów, Leopolis, Lemberg) (1765); Greifswald, Finnmarchia, Blekinge, Berlin, Leipzig, Sagan, Altona, Wernigerode, Wrocław (Vratislavia, Breslau), Elblag (Elbing), Frankfurt am Oder (1766); Kremsmünster, Graz (1767); Copenhagen, Warsaw, Vilnius (1768). In 1768, Hell also published a separate set of observations from China, based on a manuscript of observations compiled by the Jesuit astronomer Augustin von Hallerstein (1703–74). In ten years from the launching of the *Ephemerides*, its coverage of astronomical observation activity reached continental dimensions, with a remarkable density especially in regard of the German-speaking territories. Finally, besides issuing tables of the Sun, the moon, and the planets of the solar system and widely collected observation results, supplements to the *Ephemerides* for the years 1763 and 1764 also contained new editions of the solar tables of Lacaille, the lunar tables of Tobias Mayer (1723–62), and the planetary tables of Cassini de Thury. These were precious items for any skilled astronomer.

The way in which the information was collected is an interesting and important question, but it is difficult to provide a conclusive answer. As a broad generalization, one may safely point to the operation of the "Jesuit network": out of the fifty-three locations from which data were collected and published in the *Ephemerides* between 1758 and 1768, twenty were homes to Jesuit colleges with observatories,[65] and the sources of the information from more exotic

64 Hell, *Ephemerides* 1764 (1763), 221.

65 Paris, Pont-à-Mousson, Rome, Bologna, Florence, Lyon, Milan, Naples, Madrid, Ingolstadt, Schwetzingen, Würzburg, Trnava, Graz, Vienna, Prague, Wrocław, Poznan, Lviv, Vilnius. To this number one may add places with Jesuit colleges that had no observatories but supplied Hell with data (such as Dillingen and Ljubljana), and two observatories maintained by other prestigious Catholic orders (Benedictines at Kremsmünster and Augustinians at

places were also fellow brethren. Even the suppression and persecution of the Society does not seem to have initially caused a major disruption of the flow of information from such locations: observations from Pont-à-Mousson, for instance, were still reported in the *Ephemerides* in 1771.[66] It must also be mentioned that on the testimony of the annual, Hell was unconnected with quite a few Jesuit observatories of the time—some of them important, others less so.[67] Yet again, the absence of a location does not necessarily mean lack of connection: it suffices to mention the Mannheim of Christian Mayer. In addition, Hell's correspondence shows that he did make efforts to initiate contact with French Jesuit colleagues like Esprit Pézenas (1692–1776) in Marseille and Laurent Béraud (1702–77) in Lyon, who were not responsive.

At the same time, some of the material that fed the appendices of the *Ephemerides* can be traced in Hell's extant personal correspondence with the most highly recognized fellow astronomers of Europe at the time. As already seen, he was especially well connected in Paris, and Christian Mayer in Heidelberg/Schwetzingen and Weiss in Trnava have also been mentioned. But Hell's partners also included Leonardo Ximenes (1716–86) in Florence, Eustachio Zanotti (1709–82) in Bologna, Abraham Gotthelf Kästner (1719–1800) in Göttingen, Joseph Stepling (1716–78) in Prague, Anders Johan Lexell (1740–84) in St. Petersburg, Pehr Wilhelm Wargentin (1717–83) in Stockholm, and several others.[68] Many of his correspondents were fellow Jesuit scholars: the strong sense of community, and the regular exchange of letters inherent in the way of life and *modus operandi* of the society were elements that fitted perfectly well with the

---

Sagan). The identification of Jesuit observatories in this note and in n. 344 is based on Udías, *Searching the Heavens and the Earth*, 21–22.

66 It must be added, however, that none of the recent literature known to us about the suppression of the Jesuits in the Western Catholic monarchies—such as *Mélanges de 'l École française de Rome*, special issue, "De la suppression à la restauration de la Compagnie de Jésus: Nouvelles recherches," ed. Pierre-Antoine Fabre, 126, no. 1 (2014), or Fabre and Patrick Goujon, *Suppression et rétablissement de la Compagnie de Jésus (1773–1814)* (Paris: Lessius, 2014)—discusses the question of the fate of the observatories maintained by the order. D. Gillian Thompson, "The French Jesuits 1756–1814," in Burson and Wright, *Jesuit Suppression*, 181–98, discusses the fate of Jesuits, but is also silent about the impact on the Jesuit infrastructure of learning.

67 These include Lisbon, Coimbra, Avignon, Marseille, Parma, Brescia, Siena, Palermo, Mannheim, Augsburg, Olomouc (Olmütz).

68 WUS, Manuscripte Hell, vol. 3. For further analysis of the extant parts of Hell's correspondence, and the extent to which it represented a network with denominational bias, see Per Pippin Aspaas and Katalin Pataki, "Did Astronomy Constitute a Denominationally Neutral Space within the Republic of Letters? An Outline for the Use of Visualization Tools in the Study of Astronomical Correspondence," *Das Achtzehnte Jahrhundert und Österreich* 34 (July 2019): 65–89.

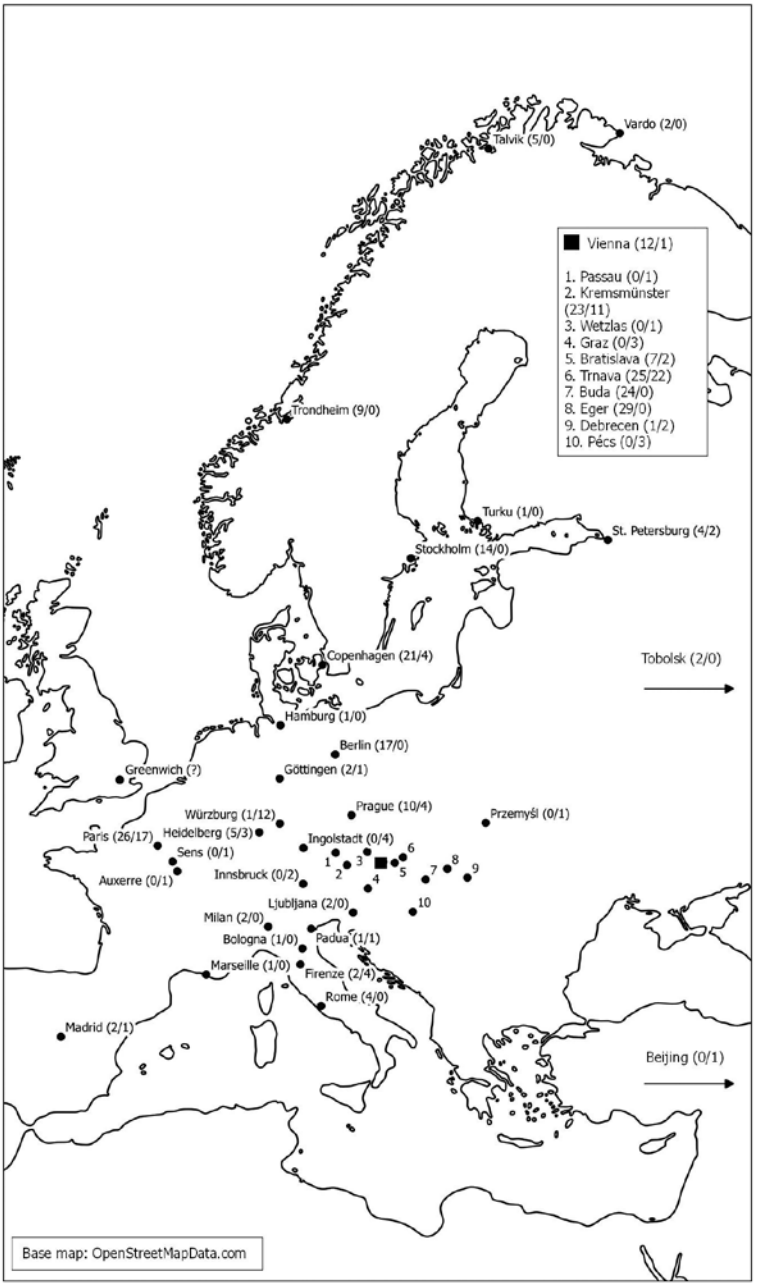

FIGURE 3 Map of Hell's correspondence (number of letters sent/received)
Only letters actually consulted by the authors have been included in the map, with the exception of Greenwich, where Hell had at least one correspondent (relevant British archives have, however, not been visited for verification). Map constructed by Katalin Pataki in collaboration with the authors

demands of practical astronomy.[69] Vis-à-vis some of these feeders of information, Hell—thanks to the means at his disposal as imperial and royal astronomer—played a role not merely as a recipient but also as a generator of information by ordering instruments from Viennese instrument-makers and distributing them to colleagues at less affluent institutions (or even amateurs) in preparation for the 1761 transit of Venus observations.[70] In addition, given the time lag (in each volume, containing the astronomical tables prepared at the end of any specific year for the following year, observation reports covered the previous year—i.e., the 1767 volume published reports of observations carried out in 1765), Hell was also able to rely on published material he managed to obtain (though at least partly also thanks to the correspondence network he built). In other words, the publication activity and the maintenance of a *commercium litterarium* was not only combined in the instructions Hell received upon his appointment in 1755 but also in the execution of his tasks as imperial and royal astronomer. Thanks to the *Ephemerides*, within a decade or so from its launching, Vienna had established itself as a node of astronomical knowledge in Europe, with Hell as a nodal astronomer. Besides his expertise and (ever-more widely acknowledged) credentials as an outstanding professional, this was due to the coincidence of his being a prominent Jesuit, his prestigious position in the imperial capital, the complex character of the information contained in the publication medium, and the universal accessibility of the language chosen for its dissemination.

However, the strategy of using the *Ephemerides* as a tool of promotion may have served not only, and perhaps not even principally, Hell's personal advance, or the renown of Vienna and the dynasty for scientific patronage. There are reasons to believe that the Jesuit court astronomer wanted to highlight the knowledge published in the journal as "Catholic knowledge," a proof of the commitment of universal Catholicism to the cause of scientific progress, and thus to promoting the cause of enlightened reform while attenuating any anti-Jesuitic sentiment within it. This will be analyzed further in the next chapter, chiefly devoted to Hell's engagement with the 1761 transit of Venus. A pertinent example to be mentioned here is the enthusiastic account in the 1767 volume of the *Ephemerides* on the amateur scientist Peter Anich (1723–66), a simple

69 On the emphasis on correspondence in the internal structure of the Society of Jesus, see, e.g., László Szilas, "Quellen der ungarischen Kirchengeschichte aus ehemaligen Jesuitenarchiven," *Ungarn-Jahrbuch: Zeitschrift für die Kunde Ungarns und verwandte Gebiete* 4 (1972): 172–89.

70 See in particular the following letters: Hell to Christian Mayer, February 9, March 12, and April 10, 1761; Hell to Ximenes, February 18, 1761; cf. below, 121–2.

farmer and turning-lathe operator from the village of Oberperfuss in Tyrol. In 1751, Anich called on the mathematics professor of the Jesuit college at Innsbruck, Ignaz Weinhart (1705–87), who, according to Hell's account, realized his visitor's talent, and decided to give him lessons on Sundays and holidays. "Thanks to his abilities and diligence,"[71] Anich soon became a well-trained, and in his narrow *patria* also well-recognized, surveyor and mapmaker. Hell corresponded with Weinhart, and their letters and their jointly written introduction to the *eulogium* on Anich (which also appeared separately) leave no doubt about the propagandistic goals of publishing the account.[72] The authors recall the similar, also recent story of Johann Ludewig (1715–60) of Cossebaude in Saxony, whose case had been advanced as a proof that "thanks to Martin Luther, in Saxony even simple farmers cultivate philosophy, and publish works on mathematics and other sciences."[73] As presented by the two Jesuit scholars, Anich is a counter-example—almost a refutation: a Catholic peasant (naturally, with proper guidance from qualified Jesuits) is at least as capable of achievement and service in the sciences as a Protestant one.

After a sketch of the build-up of the *Ephemerides* as a tool of obtaining international visibility, the story of Anich leads us to a consideration of the specific mechanisms and "vectors" of the operation of the Viennese university observatory as a node linking the local, metropolitan, and transnational planes or scales of pursuing astronomical and other kinds of knowledge. Hell brought to the awareness of his international peers relevant work done at a great many lesser "nodes," and representing these efforts in the *Ephemerides* alongside the achievements of the famous centers was very much in the spirit of the Enlightenment notions about the public and "democratic" character of scientific knowledge. This has several aspects, including cross-confessional ones. The praise lavished on Anich was undoubtedly meant to underline the excellence of the Catholic contribution to science, and Hell was—as we shall later see explicitly expressed—no great friend of Protestantism as a religious creed and

71 Hell, *Ephemerides* 1767 (1766), 8. Cf. the separate edition, Maximilian Hell and Ignaz Weinhart, *Elogium Rustici Tyrolensis Celeberrimi Petri Anich Oberperfussensis Coloni, Tornatoris, Chalcographi, Mechanicarum Artium Magistri, Geodetæ, Geographi, et Astrophili ad Prodigium Excellentis* [...] (Innsbruck: Trattner, 1768), 7.

72 It might be added that a German summary of the story also appeared in the appendix of the *WD*, no. 13 (February 14, 1767) and no. 15 (February 21, 1767), unpaginated. In addition, a French resumé was published in the Parisian *Journal encyclopédique*; see Sommervogel, "Hell, Maximilien," 254.

73 Hell, *Ephemerides* 1767 (1766), 4; Hell and Weinhart, *Elogium Petri Anich*, 3. Cf. Johann Ludewig, *Der gelehrte Bauer: Mit Christian Gotthold Hoffmanns Vorbericht nebst Kupffern* (Dresden, 1756), critical edition by Holger Böning and Reinhart Siegert (Stuttgart-Bad Cannstatt: Frommann-Holzboog, 1992).

practice. Nor was he generally of a high opinion about Protestant education and learning. Nevertheless, he was by no means averse to professional collaboration across denominational boundaries in reasonable cases, and then he cultivated a spirit of mutual collegiality. The refutation of Schumacher had confessional implications, but this was because of a perceived provocation. But Hell's apparent cooperation with the Calvinist philosophy professor in Cluj in the 1750s had continuity in the correspondence he maintained a few years later, for instance, with the medical doctor and polymath István Hatvani (1718–86).[74]

Hatvani, a somewhat under-appreciated but remarkable figure, was a teacher of the Calvinist college of Debrecen in eastern Hungary, one of the country's most important Protestant educational institutions, established in 1538. With support from the municipal council of Debrecen and other sponsors, in the 1740s Hatvani peregrinated to Basel, where he took degrees in theology and medicine, but as he received an invitation to return to Debrecen to teach mathematics, philosophy, and experimental physics, he also decided to study mathematics with the Bernoullis. He then spent a brief period at Leiden, taking the opportunity to work with Pieter van Musschenbroek (1692–1761), whose *Elementa physicae* (Elements of physics [1726]) he had already used during his studies in Debrecen. In 1748, Hatvani returned to Debrecen, despite being offered teaching positions in Heidelberg, Marburg, and Leiden. He held his inaugural lecture in January 1749 on the significance of mathematics for theology and its indispensability for physics.[75] Hatvani also became a pioneer of experiments in electricity in Hungary, using an *electrica machina* (electrical machine)

74 On Hatvani, see Wurzbach, *Biographisches Lexikon* (1862), 8:49–50; József Szinnyei, *Magyar írók élete és munkái* (Budapest: Hornyánszky, 1896), 4; Jolán M. Zemplén, *A magyarországi fizika története a XVIII. században* (Budapest: Akadémiai Kiadó, 1964), 395–424; Béla Tóth, *Hatvani István* (Budapest: Közgazdasági és Jogi Könyvkiadó, 1977); Katalin Fehér, *Hatvani István és tanítványai* (Budapest: Országos Pedagógiai Könyvtár és Múzeum, 2002); Miroslav Tibor Morovics and Andrej Šperka, "The Beginnings of Scientific Interest in Electrical Phenomena in Hungarian Kingdom," in *The Global and the Local: The History of Science and the Cultural Integration of Europe; Proceedings of the 2nd ICESHS*, ed. Michal Kokowski (Cracow, Poland, September 6–9, 2006), 926–33; http://www.2iceshs.cyfronet.pl/2ICESHS_Proceedings/Chapter_29/R-Varia_II_Morovics_Sperka.pdf (accessed April 15, 2019).

75 The lecture was published in the journal *Museum Helveticum* in Zürich in 1751. According to Hatvani's interesting concept of "moral evidence," fully developed in the work mentioned below in critical engagement with Descartes, Locke, and Leibniz and strong reliance on Newton, while the fundamental task of philosophy is the quest for logical, metaphysical, and moral truth, the path to attaining the latter is not dissimilar from procedures of supplying mathematical proof, or the formation of other kinds of evidence via sense perception.

purchased in Vienna on his way back from Leiden, others obtained later on via a Buda merchant, and ones constructed by himself. In 1757, as a supplement to his noteworthy "introduction to the principles of a more solid philosophy,"[76] he published his (very accurate) calculation of the geographic latitude of Debrecen. This is all the more noteworthy as—though in Leiden, Hatvani obtained some experience in astronomy and took part in the observation of the lunar eclipse of July 25, 1748—Debrecen itself, like any other Protestant school in the country, was not equipped with an observatory.

Two years after his work on the latitude of his town, the professor at the reformed college contacted the Jesuit imperial astronomer. Hatvani had read in the Latin-language newspaper *Diarium Viennense* (Viennese diary) that Hell and his counterpart at the Jesuit observatory, Joseph Liesganig (1719–99), had recently observed Halley's Comet in the company of Emperor Francis I. Hatvani now wrote to inform the court astronomer that

> on the very same day as you observed it [i.e., the comet] in the presence of His Highness the Emperor, on the 3rd of May, I too caught sight of it with my naked eye. At 9 o'clock of the same evening I showed it to our students, and at about the same time on the following evening I demonstrated it to the highly illustrious Judge of this city.[77]

Hatvani then proceeds to give the details of his observations, for which he used an eleven-foot telescope that Johann Friedrich Weidler (1691–1755)—a professor of mathematics and law at the Protestant University in Wittenberg, also famous for his *Historia astronomiae* (History of astronomy [1741])—had once provided for him. He adds:

> I am writing this to you, elevated Gentleman, for no other reason than that you shall become aware that we who live in the flatlands are not idle observers of Urania either. I beg you to forgive me, a person whom you do not know even by name, for my daring to intrude in your arduous affairs. However, it is that common bond that unites all disciplines in a sort of blood relationship, which has brought me, a man occupying the lowlands

76 István Hatvani, *Introductio ad principia philosophiae solidioris cui accedit observatio elevationis poli Debrecinensis* (Debrecen: Kállai, 1757), published in Hungarian as *Bevezetés a szilárdabb filozófia alapelveibe* (Debrecen: Debreceni Akadémiai Bizottság, 1990).

77 Hatvani to Hell in Vienna, dated Debrecen, May 29, 1759, WUS, secretary's copy.

> of a teacher, to dare in this letter to address you, who thanks to your great merits sits in such an illustrious chair.[78]

No doubt Hatvani resorted to such flowers of courtesy, not to say flattery, in order to create an opportunity to incidentally attach to his letter a copy of his printed determination of the geographical latitude of Debrecen. The imperial and royal astronomer's answer was no less swift and enthusiastic than elaborate and respectful. He congratulated Hatvani on being the first to have attempted to determine the geographical coordinates of Debrecen. What is more, Hell found Hatvani's observations sound and the calculations accurate. He even returned his interlocutor's compliments by acknowledging that Hatvani's "name, industry, and experience in the mathematical sciences have been known to me for quite a while, ever since I lived in Transylvania."[79] Thus, while we cannot ascertain the extent to which Hatvani, beginning his electrical experiments in Debrecen in the 1750s, may have been aware of a similar interest on the part of Hell around the same time, the one-time Cluj professor appears to have been well informed—or found it important to pretend familiarity with Hatvani's work, which would be even more noteworthy. Moreover, in his reply Father Hell furnished Hatvani with a calculation of coming occultations of the moons of Jupiter, and encouraged him to make diligent observations of these phenomena, so that even the longitude of Debrecen could be accurately determined. In all, he promised close collaboration and ended his letter by urging Hatvani to "continue to bestow the same benevolence upon me in the future, and give more honor to the learned world as well as our homeland [*Patria nostra*] through the publication of your illustrious works."[80]

Hatvani responded a few weeks later by assuring Hell of his determination to carry out the observations expected of him, but added that his lack of instrumentation posed serious problems. Although he was in possession of a couple of telescopes and a decent pendulum clock, he had no proper place to mount them and was even missing a quadrant. By issuing his work of astronomy, Hatvani asserted, "I wanted to set an example, so that others might discover that the Hungarians [*Ungari*] would not be wanting in intellectual capacity, if only they had the patrons to provide for them."[81]

The exchange of letters between Hell and Hatvani appears to have stopped here, and neither the latter's comet observation nor any other future

78 Hatvani to Hell in Vienna, dated Debrecen, May 29, 1759, WUS, secretary's copy.
79 Hell to Hatvani in Debrecen, dated Vienna, June 14, 1759. WUS, Hell's draft.
80 Hell to Hatvani in Debrecen, dated Vienna, June 14, 1759. WUS, Hell's draft.
81 Hatvani to Hell in Vienna, dated Debrecen, July 7, 1759. WUS, secretary's copy.

astronomical activity eventually gained a mention in the *Ephemerides*. The episode is nonetheless interesting and important due to its conformity with the procedural and ethical norms of scientific sociability. It illustrates the attention Hell as a responsible metropolitan man of science paid to information on high-standard work done among less fortunate circumstances at more obscure locations, and the importance he attached to promptly acknowledging the value of such endeavors. Second, while Protestants remained in a precarious situation across the Habsburg possessions, the appeal to the ideals of the supra-imperial Republic of Letters ("that common bond that unites all disciplines in a sort of blood relationship") as well as to sub-imperial patriotism (Ungaria, *Patria nostra*) enabled the Jesuit court astronomer and the Calvinist professor from the Hungarian countryside to communicate in a mutually respectful, even cordial tone.

While there was certainly nothing marginal about Hatvani as a scholar, confessionally and geographically it is meaningful to perceive of his predicament in terms of marginality. Hell's attitude was also quite open-minded toward another sort of marginality: the contributions of enthusiastic and proficient practitioners on the margins of the profession, usually called "amateurs."[82] Despite the obvious financial and practical challenge that the procurement of proper astronomical equipment and the development of a suitable observation site implied, there were a few in Hell's network who cultivated astronomy as a matter of leisure and pleasure. At the Castle Wetzlas near Pölla in Lower Austria, for instance, the nobleman Johann Felix von Ehrmans zum Schlug (dates unknown) built an observatory in 1729, which he and his son used to observe the Venus transit of 1761. A single letter from von Ehrmans to Hell is preserved, in which the former characterizes himself as a *Liebhaber der Astronomie* (amateur of astronomy), and asks for advice on where to obtain solar filters for his two telescopes, a one-foot and nine-inches long Gregorian, and a four-foot long Newtonian he had ordered at the instrument-maker Schulz in Vienna.[83] In the subsequently published report of the Venus transit of 1761, Hell accords several pages to the observations of this nobleman, explaining that he had once been a pupil of the court mathematician Marinoni, from whom he had

82 The category of the scientific *amateurs*, with well-attested equivalents in various languages as *amantes*, *Liebhabern*, or *dilettanti*, has been the object of several sociological studies of the history of science; see, e.g., the special issue of *Gesnerus: Swiss Journal for the History of Medicine and Sciences* 73, no. 2 (2016), especially the editors' introduction: Hervé Guilleman and Nathalie Richard, "Towards a Contemporary Historiography of Amateurs in Science (18th–20th Century)," 201–37; cf. Aspaas, *Maximilianus Hell*, 37–8.

83 Felix Freyherr von Ehrmans zum Schlug to Hell in Vienna, dated Wetzlas, May 8, 1761 (WUS, secretary's copy).

bought a quadrant. Hell, for his part, helped von Ehrmans with the acquisition of the Newtonian telescope.[84]

There were also amateurs of more modest means, such as painter Caspar Franz Sambach (1715–95), who from 1762 onward had a career as a professor and later director of the Academy of Fine Arts in Vienna. Sambach also had a reputation as an able observer. He used instruments that he himself had constructed to make observations at various locations in Vienna, and received at least verbal support from Hell.[85] Hell's 1761 Venus transit report includes an account of Sambach and his observation, which regrettably failed because of clouds. Hell also mentions the observations of a *Perillustris D*[*ominus*] *Müller* (Highly illustrious Mr. Müller) in the St. Leopold district, as well as those of a *Mercator quidam* (anonymous merchant) in a suburb of Vienna.[86] It may also be mentioned that Sambach in 1769 provided Hell with data from a solar eclipse, which helped him determine the longitude of his observatory in Vardø.[87]

The Venus transit report of 1761, along with the preserved correspondence of Maximilian Hell from the years 1758–61, lends some credibility to Hell's attempt to portray Vienna as a city where several able *amantes astronomiae* (amateurs of astronomy) were active. He spared no effort to assist these enthusiasts in pursuing their leisure interests. But the Vienna of the time was in the first place an emerging hub of professional astronomical research with two solid institutional bases, located within a few hundred footsteps from one another. If Hell's position as a nodal astronomer is visualized as being in the pivot of a set of concentric circles, the Viennese Jesuit observatory and its staff were certainly in the innermost of those circles.

---

84 Maximilian Hell, "Observatio transitus Veneris ante discum Solis die 5ta Junii 1761," in *Ephemerides* 1762 (1761), 62–67. Von Ehrmans's modest observatory tower still stands on top of the old castle currently used as "Ferienschloss Wetzlas"; http://www.ferienschloss.at/ (accessed April 15, 2019). In the generation after Hell, a prominent noble astronomer was Elisabeth von Matt (1762–1814). She built a private observatory in the center of Vienna and engaged in many geodetic operations in Austria and Bohemia in the early 1800s in collaboration with Johann Tobias Bürg, adjunct at the Vienna University Observatory. See Peter Brosche and Klaralinda Ma-Kircher, "Elisabeth von Matt (1762–1814), an Enlightened Practitioner of Astronomy in Vienna," *Journal of Astronomical History and Heritage* 13 (2010): 187–93.

85 Steinmayr, "Geschichte der Universitätssternwarte," 282.

86 Hell, *Ephemerides* 1762 (1761), 20–21.

87 Maximilian Hell, *Observatio transitus Veneris ante discum Solis die 3. Junii anno 1769* (Copenhagen: Giese, 1770), 33, 41.

With a view to the proliferation of the commissions of Father Franz, in 1755–56[88] there was a change at the helm of the Jesuit observatory. The successor, Joseph Liesganig[89] (also spelled Liesganigg), a native of Graz, was Hell's senior by one year and entered the Society of Jesus at the tender age of fifteen. Like Hell, he pursued his university studies in Vienna, although the two men did so in almost exactly alternate years. Between 1742 and 1745, at the time when Hell took his course in philosophy and started as an assistant of Franz's, Liesganig was already back in Graz as a *repetens* (gymnasium teacher) of mathematics, and thereafter of rhetoric briefly in Linz. He then returned to Vienna and completed his studies in theology by 1749 (which means that in this period the two future directors had a chance to know each other: Liesganig was in his last year while Hell was in his first[90]). Liesganig later served as a preacher and the inspector at a German school in Komárno (Komárom, Komorn) along the Danube in western Hungary, and then passed his third year of probation in Banská Bystrica (probably in 1749–50, that is, two years earlier than Hell). In 1750–51, we already find him serving as a professor of mathematics in Košice, but he was back in the capital again in the following university year (when Hell had just left for his own final probation), now as a professor of mathematics at the university and assistant at the Jesuit observatory. He was thus close at hand when the court astronomer was to be appointed, but Hell—whom his connection with Franz and his overall record[91] may have made a stronger candidate, despite his then current position in remote Transylvania—was preferred for that role. Liesganig had to be content with his appointment as prefect of the Jesuit observatory, a position he retained until the Society's suppression in 1773. As observatory director, Liesganig was above all given prestigious tasks in

88 Surprisingly, it cannot be fully ascertained when exactly the change took place. According to Fischer, "Jesuiten-Mathematiker in der Deutschen Assistenz," 207, Liesganig was *praef*[*ectus*] *Spec*[*ulae*] *astron*[*omicae*] in Vienna in the entire period from 1752/53 to 1772/73. According to the same source, Franz was *praefectus* of the observatory from 1738/39 to 1754/55, however. Fischer, "Jesuiten-Mathematiker," 197.

89 Already mentioned briefly above, Liesganig still awaits an academic study focusing on his life and work. The account in this section is based on Steinmayr, "Geschichte der Universitätssternwarte," 178–81; Walther Fischer, "Liesganig, Joseph," in *Neue Deutsche Biographie* 14 (Berlin: Duncker & Humblot, 1985), 540–42; Fischer, "Jesuiten-Mathematiker in der Deutschen Assistenz," 207; Peter Brosche, *Der Astronom der Herzogin: Leben und Werk von Franz Xaver von Zach (1754–1832)* (Frankfurt: Harri Deutsch Verlag, 2009), 20–25.

90 Lukács, *Catalogi personarum*, 9:43.

91 Liesganig's only publication to date was the study tool *Tabulae memoriales praecipua arithmeticae tum numericae tum literalis, geometriae, etiam curvarum, et trigonometriae, atque utriusque architecturae elementa complexae, in usum auditorum* (Vienna: Trattner, 1754).

geodesy in the entire stretch between Brno (Bruna, Brünn) in the north via Vienna and Graz to Varaždin (Varasd, Varasdinum, Warasdin) in the south, and later in life in Galicia (on both sides of the present border between Poland and Ukraine). His main work, *Dimensio graduum meridiani Viennensis et Hungarici* (Size of the meridian degrees of Vienna and Hungary, 1770) counts among the most important—albeit certainly not the most historiographically highlighted—eighteenth-century contributions to the determination of the shape of the Earth.[92]

Over the nearly twenty years that Hell and Liesganig were neighbor-directors of their observatories, they seem to have been collegial collaborators, although perhaps not close friends or confidants.[93] Their relationship may best be described as one of emulation: because of the topographic conditions, if for no other reason, necessarily marked by elements of competition, but also mutual attention and respect, and a willingness to lend support to as well as learning from one another. At first, Hell, who eventually grew more famous, was not obviously the superior partner. If his appointment and the instructions to him demonstrate that he and his observatory were intended to play a crucial role in attaining objectives set by the Viennese reform-government, Liesganig's geodetic assignments were no less—in a very strict sense, in fact they were more—strategically important. Ever more accurate maps were indispensable for the purposes of the Habsburg military in the large-scale armed engagements of the middle of the eighteenth century—the War of Austrian Succession (1740–47) and the Seven Years' War (1756–63)—and the obtaining of in-depth knowledge of the imperial territory also served the more peaceful ends of economic governance.[94] It was primarily cartographic collaboration with France as Vienna's new coalition partner—specifically, mapping the space between Paris and Vienna—after the famous reversal of alliances of 1756 that brought Cassini de Thury as the director of the Observatoire Royal to the Austrian capital in

92 See the review in *JS* (August 1770): 573–74; cf. Liesganig's letter to John Bevis, dated Vienna, August 4, 1767, printed in the *Philosophical Transactions of the Royal Society* (hereafter: *PTRSL*) 58 (1768; printed 1769): 15–16. Liesganig himself conceived of his own meridian measurements as a contribution to the effort hallmarked by the activities of Charles Marie de la Condamine (1701–74) in Ecuador, Boscovich in the Papal States, and La Caille in France. See Veres, "Constructing Imperial Spaces," 365–66.

93 Thus, among the numerous letters preserved from the expedition to Denmark–Norway, none are addressed to Liesganig. In fact, he is not even mentioned in any letter to Hell's Viennese friends during this period.

94 For a general discussion, see Wolfgang Göderle, "Modernisierung durch Vermessung? Das Wissen des modernen Staats in Zentraleuropa, circa 1760–1890," *Archiv für Sozialgeschichte* 57 (2017): 155–86.

1761.[95] While Hell was the first local astronomer he met there after disembarking the boat that had carried him down the Danube from Ulm, Cassini de Thury joined the observation of the famous transit of Venus before the Sun on June 5, 1761—which will be discussed in detail below—at Liesganig's observatory.

Besides his cooperation with Cassini de Thury, Liesganig was also the main Viennese contact of Boscovich, and this gives occasion to consider the relationship—or rather, the apparent lack of it—between the great Dalmatian savant and Hell. Boscovich stayed in Vienna for long periods in the late 1750s and early 1760s, and during the mid-1760s he held a position as professor of mathematics at the collegium in Pavia, which was under Habsburg rule.[96] It would be hard to imagine that he never met Hell.[97] There are some affinities among their publications, too. In his *Dissertationes quinque ad dioptricam pertinentes* (Five articles on dioptrics [1767]), Boscovich presented a refutation of the existence of a moon of Venus based on similar arguments to those that Hell resorted to in his *De satellite Veneris* (Of the satellite of Venus), published only two years earlier. Boscovich's work was even published by the same publisher as Hell's, Trattner in Vienna (where a German translation by Scherffer also appeared in the same year). However, Boscovich makes no reference at all to the work of his confrère.[98]

95 See, e.g., Sven Widmalm, "Accuracy, Rhetoric, and Technology: The Paris–Greenwich Triangulation," in *The Quantifying Spirit of the Eighteenth Century*, ed. Tore Frängsmyr, John L. Heilbron, and Robin E. Rider (Berkeley: University of California Press, 1990), 179–206; Simone Dumont and Suzanne Débarbat, "Delisle–Cassini III: Deux pèlerins de la cartographie scientifique en Europe centrale et orientale," *Revue XYZ* 18, no. 67 (1996): 70–76; Moutchnik, *Forschung und Lehre*, 86–90; Cassini de Thury's visit and his collaboration with Liesganig was also important for the development of cartographic projects within the Habsburg monarchy, see Veres, "Constructing Imperial Spaces," 364–80. Hell gave an account of this collaboration to Lalande in Paris, in a letter dated Vienna, June 12, 1761, reproduced in Per Pippin Aspaas, "Le père jésuite Maximilien Hell et ses relations avec Lalande," in *Jérôme Lalande (1732–1807): Une trajectoire scientifique*, ed. Guy Boistel, Jérôme Lamy, and Colette LeLay (Rennes: Presses universitaires de Rennes, 2010), 129–48.

96 Boscovich visited Vienna in the period April 1757–March 1758 and again in January–May 1762. Hill, "Roger Boscovich," 47–51 and 79; cf. 79–83 on Boscovich's period in Pavia.

97 According to some of the literature, "Boscovich was in contact with Hell," a claim advanced on the ground of the parallel roles of Hell and Boscovich in the design and construction of astronomical observatories. However, no evidence is presented for such contact. Harris, "Boscovich, the 'Boscovich Circle,'" 538.

98 On these grounds, the monographer of the issue of the moon of Venus concludes that "there is no indication in the literature that Hell and Boscovich were in contact with one another." Kragh, *Moon That Wasn't*, 85. It may be of interest that Hell seems to have tried to make sure Boscovich read his book on the moon of Venus. In a fragmentary draft for a

As for correspondence, there is a single surviving letter from Hell to Boscovich, the wording of which yields clear evidence that the two were not close collaborators. In the letter, Hell thanks Boscovich for a work sent by the latter as a present (adding, "even though this gift, a product of Your Reverence's deeply subtle intellect, was most welcome to me in itself, the most wonderful thing of all was that it made me aware that I, who had so often publicly stated my admiration for Your Reverence, was in fact kept in some sort of remembrance"); he promises to send in return to Boscovich the latest volume of the *Ephemerides astronomicae*, containing Hell's work on the use of Jupiter's satellites for meridian determination; he congratulates Boscovich on his appointment as professor in Pavia, and engages in other "small talk." In short, flattery and humble respect permeate the letter, not the kind of familiarity and frankness that characterize Hell's correspondence with most other colleagues.[99] This single extant letter contrasts with thirty-six surviving letters addressed to Boscovich by Liesganig and thirteen by Scherffer, both Viennese Jesuits engaged in astronomy and related topics.[100] It might be added that in his elaborate *Aurorae borealis theoria nova* (New theory on the aurora borealis [1776]), Hell refers to the theories and observations of a wide range of authors but avoids mentioning that the famous Boscovich had already treated the phenomenon in several works.[101] Boscovich's silence on Hell's *De satellite Veneris* was thus "echoed" by Hell on that occasion.

---

letter apparently addressed to an Italian astronomer (internal evidence points to the second half of the year 1765 as the time of writing), Hell goes into details concerning the *De satellite Veneris*, adding that: "If You get the occasion to meet Father Boscovich, I am confident that he at first sight will raise a lot of objections against my point of view, for he will attempt to defend his own opinion, which is in line with that of Hugenius, but rejected by me on pages 31 and 56. However, if he does so, I should think he will be chasing deer in the treetops." WUS, Manuscripte Hell, 3.

99 Hell to Boscovich in Pavia, dated Vienna, February 27, 1764. The letter can be traced in the online inventory of Boscovich's correspondence, published by the Commissione Scientifica Edizione Nazionale R.G. Boscovich in Milan, http://www.brera.inaf.it/boscovich/progetto-sito/Nuovo_catalogo_lettere.doc (accessed April 15, 2019; digital copy of the letter kindly provided by Luca Guzzardi).

100 Cf. http://www.brera.inaf.it/boscovich/progetto-sito/Nuovo_catalogo_lettere.doc (accessed April 15, 2019).

101 Hell, *Aurorae borealis theoria nova* [...] 1776. Boscovich is known to have published works on the aurora borealis in 1738 (*De aurora boreali*, anonymous dissertation published twice in the same year, Rome); 1747 (*Caroli Noceti e Societate Jesu: De Iride et Aurora boreali Carmina Illustrissimo ac Reverendissimo Praesuli Bernardino Giruadio dicata. Cum Notis Josephi Rogerii Boscovich ex eadem, Societate*, Rome); 1748 ("Dialoghi sull'aurora boreale del P. Ruggiero Boscovich della Compagnia di Gesù lettore di matematica nel Collegio Romano," in *Giornale de' letterati per l'anno 1748*, 192–202, 264–75, 293–302, 239–336, 363–68; also

Returning to the Viennese astronomic universe, besides the two observatory directors, it naturally included a good number of lesser figures, such as assistants and students. One of these at the Imperial and Royal Observatory also led Hell—after and besides his inquiries into electricity—to dip into another neighboring field of astronomy: meteorology. In various editions of the *Ephemerides*, meteorological reports as well as discussions of meteorological instruments were included, chiefly thanks to Hell's assistant in 1762–73, Anton Pilgram (1730–93). Pilgram—who acted as Hell's replacement in his functions, including the edition of the *Ephemerides*, during Hell's absence from Vienna for the Arctic expedition—later published a thick volume entitled "Investigations on What Is Probable in Meteorology" based on daily measurements made at the Imperial Observatory, as well as published observations from elsewhere in Europe.[102] In 1761, upon inspection of the meteorological journals of the Jesuit observatory in Vienna, Hell himself believed that he could predict the weather for years in advance. He even wished to publish an "ephemeris of the weather" (*Ephemerides meteorologicae*) ahead of each year.[103]

When presenting this idea to Van Swieten, however, Hell was made to understand that such a publication would not receive support from the powerful councilor, who would in fact make sure it was never allowed to see the light of day. In an apparently heated conversation, Van Swieten accused Hell of having abused the title of *membre correspondant* by naming himself an ordinary member (*Mitglied*) of the Académie des Sciences, and revealed that he had spoken negatively about Hell and his meteorological theory to Her Highness (i.e., Maria Theresa). Hell's defiant reaction was to outline to Lacaille the rudiments of his theory,[104] in order to make sure that, in case Van Swieten (whom

published as a separate booklet); and 1760 (*Philosophiae recentioris a Benedicto Stay in Rom*[*ano*] *Archigymn*[*asio*] *eloquentiae profess*[*ore*] *versibus traditae Libri X, ad Sylvium Valentium Cardinalem amplissimum, cum adnotationibus, et supplementis P. Rogerii Josephi Boscovich S.J. in Collegio Rom*[*ano*] *publ*[*ico*] *matheseos professore* tomus 2, Rome); cf. e.g. Tolomeo, *Boscovich: Lettere*, 13–14; and the online inventory http://www.brera.inaf.it/boscovich/progetto-sito/opere_a_stampa.pdf (accessed April 15, 2019).

102 Anton Pilgram, *Untersuchungen über das Wahrscheinliche der Wetterkunde* (Vienna: Kurzboeck, 1788). On Pilgram's work, see Thomas Posch and Karin Lackner, "Anton Pilgram: Mitbegründer neuzeitlicher wissenschaftlicher Meteorologie?," in Firneis and Kerschbaum, *Konferenzbeiträge/Proceedings*, 55–69; Steinmayr, "Geschichte der Universitätssternwarte," 246–62.

103 Hell may have changed the name of his almanac to *Ephemerides astronomicae* in this year in order to differentiate it from the intended *Ephemerides meteorologicae*.

104 Hell to Lacaille in Paris, dated Vienna, April 27, 1761 (WUS). Further context is given in his letter to Weiss, dated Vienna, April 1, 1761 (Eötvös Loránd Tudományegyetem, Egyetemi Könyvtár [Loránd Eötvös University, University Library, Budapest—hereafter: ELTE EK], copy in Vargha priv.). The theory itself is set out in an unfinished manuscript at the WUS,

he had until then considered a friend, he added) should steal the theory and publish it under his own name, the members of the Parisian academy would be in a position to detect this fraud and protect Hell's honor as the true inventor of the theory. Lacaille passed away less than a year later, and his correspondence soon found its way to other people's hands. This was apparently how it came about that Hell's theory circulated throughout Europe for years to come, but also without meeting much acclaim. Thus, instead of a means to protect his own honor, Hell's confident letter to Lacaille served as the exact opposite.

It is noteworthy, especially in view of later developments discussed in Chapter 7, that several of Hell's young protégés at the observatory originated from the Hungarian part of the Habsburg monarchy. First and foremost, there was János Sajnovics, already mentioned briefly above,[105] from a relatively well-to-do noble family of Croat ethnic origin, but in his own words "born and raised in Hungary by Hungarian parents" in the village of Tordas near Székesfehérvár (Alba Regia, Stuhlweißenburg).[106] Like Liesganig, he was merely fifteen when he entered the Society of Jesus in 1748. Having lost both of his parents by then, upon entering the Society he also relinquished the Sajnovics estate to his older brother Matthias as sole heir. He stayed in Trenčín as a novice and received his undergraduate schooling in Győr and Buda, before moving to Trnava to study at the philosophical faculty in 1752–54. One of his university teachers was György (Georg) Pray (1723–1801), who was later to become a leading historian in Hungary, and Weiss probably taught him as well. Sajnovics himself went on to teach grammar in Bratislava until 1757, when he moved to Vienna to serve as Hell's assistant (*bidellus*) for three years. His tasks appear to have included secretarial ones: a comparison with the handwriting of the travel diary from the

"Theoria phœnomeni ascensus, et descensus Mercurij in barometris," addressed to the Académie Royale des Sciences but possibly never submitted to Paris. However, in a letter to Röhl in Greifswald, dated Berlin, September 16, 1772, Johann Heinrich Lambert ridicules Hell's meteorological theories, which he had the opportunity to read through. See *Joh. Heinrich Lamberts* [...] *deutscher gelehrter Briefwechsel*, ed. Johann III Bernoulli, 5 vols. (Berlin: Der Herausgeber, Dessau: Buchhandlung der Gelehrten, 1781–87), 2:397–400. As late as 1786, a thirty-page long "Frank Reflections on the Meteorological Theory of Herr Hell" was issued; see Prof. Dätzl [Georg Anton Däzel], *Freymüthige Gedanken über die Witterungslehre des Herrn Hells* (Salzburg: Waisenhausbuchhandlung, 1786).

105 See 65, 75. For key information on Sajnovics's early career, see Emil Kisbán, *Johann Sajnovics: Leben und Werk eines ungarischen Bahnbrechers und Gelehrten* (Budapest: Hungária, 1943); József Erdődi, "Sajnovics, der Mensch und der Gelehrte," *Acta linguistica academiae Hungaricae* 20 (1970): 291–322. See also the Jesuit catalogs *Austria: Catalogi breves 1763–1765* and *1766–1769*.

106 János Sajnovics, *Demonstratio: Idioma Ungarorum et Lapponum idem esse* (Copenhagen: Giese, 1770), [x].

1768 to 1770 Arctic expedition, also put down by Sajnovics, demonstrates that all extant transcripts of Hell's correspondence from the period 1757–59 were prepared by him.[107] His service as a secretary is further corroborated in a letter of late 1758 from Weiss, asking Hell to "make sure that the parts I requested from his *Ephemerides* are copied by the Honorable Magister Sajnovics."[108] After a brief spell of teaching in the gymnasium of Eger, (Agria, Erlau) in 1761–64 we find Sajnovics in Vienna again as a student of theology, ordained as a priest in 1763. While in these years he was not formally associated with Hell's observatory, he nevertheless took part in observations.[109] Completing his third year of probation in Banská Bystrica, in 1765 he was transferred to Trnava as the assistant (*socius*) of Weiss.[110] It was from there that Sajnovics arrived back in Vienna shortly before the outset of the expedition to the Far North to resume his role as assistant of the imperial and royal astronomer.

As we shall see in detail in Chapters 6 and 8, the Arctic journey led the two men into new territories in more than one sense, and their interest in the Hungarian language, its kinship with Sámi (Lapp), and the related issue of Hungarian prehistory was of great consequence to the development of Hell's subsequent career. Besides Sajnovics, Hell extended his mentorship to other young Hungarians, forging contacts that also proved highly important in the period after the suppression of the Society of Jesus. One of these was Máté Balajthi (1732–?),[111] a teacher of mathematics in the town of Eger who had studied in the Jesuit schools of Győr and Košice, but in 1762 was sent to Vienna to further improve his skills under Hell's guidance by the then newly appointed bishop of Eger, Count Károly Eszterházy (1725–99).

Eszterházy was to become a contact of major importance for Hell. Educated by Jesuits in Bratislava, Trnava, and at the Collegium Germanicum et Hungaricum in Rome, the bishop was a devoted adherent of Pope Benedict XIV (1675–1758, r.1740–58), following him in appreciating experimental science and even the work of the philosophes. Eszterházy nevertheless remained a convinced Tridentine Catholic, opposed from the outset to Habsburg ecclesiastical

107 WUS, Manuscripte Hell. Transcripts of correspondence from the year 1760 are missing, whereas the transcripts from 1761 were made by another hand.

108 Weiss to Hell in Vienna, dated Trnava, December 23, 1758 (WUS, secretary's copy). *Ephemerides* might here refer to a diary, or journal of observations, not necessarily the printed *Ephemerides*.

109 Hell, *Ephemerides* 1765 (1764), 322–23.

110 In the *Ephemerides* of Hell, Sajnovics is mentioned among the observers in Trnava from January 1767 onward. Hell, *Ephemerides* 1768 (1767), 272–76.

111 Szinnyei, *Magyar írók*; http://mek.oszk.hu/03600/03630/html/b/b00707.htm (accessed April 15, 2019).

reforms, especially in their Josephian guise.[112] Already in 1762, right after his inauguration at Eger, we find him embracing the plans of his predecessor Ferenc Barkóczy (1710–65)—who in 1762 was promoted to the archiepiscopal see of Esztergom—to develop the local seminary into a university. Although in 1763 Maria Theresa refused to authorize a new university, construction works continued, and in 1769 a medical academy was opened. The new observatory tower of Eger was not ready for use until 1776, but the rudimentary training that Balajthi received during his short stay with Hell, and the full formation as an astronomer given to another student, János Madarassy (1743–1814), sent to Vienna by Eszterházy in 1774, clearly served a grand purpose.

Balajthi's sojourn in Vienna was an occasion for the ambitious and influential prelate and the imperial and royal astronomer to begin a correspondence that lasted, with some intervals, almost until Hell's death. While not a single letter from the bishop seems to have been preserved, those from Hell to him reveal that Eszterházy relied extensively on Hell for obtaining equipment as well as general professional advice. Later on, he would ask Hell to arrange purchases of the best available instruments from England for the new observatory, and even to come to inspect the construction site in Eger in order to give instructions face-to-face.[113] For the time being, some "mathematical and physical instruments for the public school" were ordered, and while duly reporting first on the financial implications and later on the acquisition of the requested items, Hell never missed the opportunity to reassure the bishop about the dedication and diligence of his student. He also expressed his joy over this occasion to serve his "fatherland" (*patria*), and promised to make the name of Eszterházy known throughout the world of learning, and to spare no effort in ordering the instruments the bishop asked for.[114]

Unlike Trnava, with its university and astronomical infrastructure under the able governance of Weiss, Eger in the 1760s was certainly not yet in a position to be included in the purview of the *Ephemerides*, but Hell spared no time and effort in embracing and assisting a local initiative whose aim was to put the

112 László Kádár, "Eszterházy Károly racionalizmusa," *Vigilia* 64, no. 6 (1999): 443–52, here 443–44. On Eszterházy, see further Béla Kovács, ed., *Eszterházy Károly emlékkönyv* (Eger: Érseki Gyűjteményi Központ, 1999), especially István Bitskey, "*Püspökünk, példánk és tükörünk volt* Eszterházy Károly életpályája és egyénisége," 7–22.

113 Hell to Eszterházy in Eger, dated Vienna, November 25, 1774; August 22, 1775; April 23, 1776. FLE, AV, 2629. The same emerges from Madarassy to Eszterházy in Eger, dated Vienna, January 27, 1776; March 3, 1776; April 6, 1776 (Vargha priv.).

114 Hell to Eszterházy in Eger, dated Vienna, August 6, 1762; September 21, 1762; October 24, 1762. Balajthi himself also informed his superior; Balajthi to Eszterházy in Eger, dated Vienna, [September] 21, 1762. FLE, AV, 2629.

town on the scientific map of the imperial and royal space he officially represented. These efforts needed a good decade to bear some fruit. As yet, those spaces—the second tier of concentric circles around Hell's Vienna—boasted new observatories in Graz, Trnava, and Kremsmünster.[115] Mid-eighteenth-century developments at these observatories have already been outlined earlier via the portraits of some of their protagonists: Scherffer, Poda, Weiss, and Fixlmillner, of whom the first three were connected with Hell during his formative years and remained in more or less constant touch with him after his Viennese appointment. Besides them, Joseph Mayr (1720–?), who briefly directed the Graz observatory before Poda, merits attention on account of a single surviving letter by him to Hell, giving an insight into the dynamics within the astronomical community of the Habsburg monarchy.

Little can be ascertained about Mayr,[116] except that he was born in Passau, entered the Society of Jesus in 1736, studied at the universities of Vienna and Graz, and was appointed as professor of mathematics and prefect of the astronomical observatory in Graz in 1755 (i.e., at around the same time as Hell). Mayr still retained this position when Hell issued the first volume of his *Ephemerides*, which he personally distributed to colleagues all over the Austrian province and beyond. Mayr was grateful for his copy, and excused himself for the delay in acknowledging it, stressing that

> I have used them faithfully in this my worn and all but dilapidated observatory, insofar as it was possible, given my [limited] experience in astronomical matters. If only the fellow who, after the death of pious Vanossius, got the task of delivering two practical lessons every week assigned for himself, back in those days when we as colleagues learned the basics of mathematics, had given us at least some instruction [in astronomy]![117]

Recalling the time they spent together completing the philosophy curriculum in Vienna,[118] Mayr complained to Hell that after the loss of a teacher (whose identity could not be established from the sources), there was no one at hand who might have introduced them to the field he was now supposed to supervise

115 Prague, with its traditions going back to Kepler and the astronomical tower in the Clementinum deriving from 1722, is a somewhat separate case. See Zdislav Šíma, *Astronomie a Klementinum/Astronomy and Clementinum* (Prague: Národní knihovna České republiky, 2006).

116 Fischer, "Jesuiten-Mathematiker in der Deutschen Assistenz," 208.

117 Joseph Mayr to Hell in Vienna, dated Graz, October 17, 1757 (WUS, copy in the hand of Hell's secretary).

118 Mayr was in his second year when Hell began in 1741. Lukács, *Catalogi personarum*, 8:465.

in Graz. Given that this was just about the time when Hell began his own apprenticeship with Father Franz, the complaint is a strange one, but it also sheds light on the scarcity of available expertise on which the quickly developed astronomical infrastructure of the Austrian province in the 1740s and 1750s had to rely: Mayr's lack of training could not have been a secret, but he still got the job. (As we have seen, Fixlmillner on the Benedictine side could be a parallel case—with the difference that Mayr abandoned the field just a few years later.) The gap between the task and his skills seems to have caused him considerable frustration, for he continued:

> If only I had been given access to the observatory, either when I followed lectures in theology here in Graz, or when I taught poetry and rhetoric in Vienna! Liesganig, whom I asked quite often [for permission to visit the observatory], always found various pretexts to elude my effort, and in this he followed the example of his patron [presumably, Franz].

Mayr further explained that he wanted to send Hell some occultations, but he had been hesitant because of the unreliability of his observatory's equipment—for which, naturally, his predecessor was to blame:

> The observatory is laboring under its own weight, it was constructed to display the looks of an astronomical tower only (in this and the last year it was saved from total ruin to great expense for the collegium), and its instruments were constructed according to the ideas of the instrument-makers without ever being subjected to professional scrutiny.[119] [...] The very builder of this device, Halloy,[120] who at least on his own accord should have been interested to help, I have asked humbly for assistance many times, but each time he ran off and even caused serious trouble.

Eventually, Mayr still decided to send two observations, however deficient they might be, and avowed to being anxious to finally master the field while feeling compelled to abandon it:

> I do not hate mathematics, as I am fully aware that this discipline ranks highest among the sciences. Astronomy ought to have been a pleasure to me, but I would have liked to have such helpers that were willing to serve the public good by sharing their advice. Indeed, I would be happy to learn

119 Cf. the sceptical assessments of the performance of the observatory above, 68.
120 Peter Halloy (1707–89), director of the Graz observatory in 1753–55.

> from whomsoever, if only I had the chance. Meanwhile, I accept my destiny, and I resort to the same attitude as my predecessors, none of whom were so attached to the observatory in Graz as to prevent them from either seeking immediately to be freed from this burden, or at least congratulating themselves when they were freed from it. I would have loved to accept the name of a colleague that His Reverence [i.e., Hell] gave me so undeservedly, if my contributions had not rendered me totally unworthy of such an honor.

Later in the same year, Mayr indeed left Graz to take up the chair of mathematics in Linz, where he taught until 1760, before moving to Klagenfurt in 1760–61 and then Buda in 1761–62. He did not return to teach mathematics at any of the universities proper, and seems not to have pursued astronomy any further. The substance and the tone of his letter to Hell may to a certain extent be ascribed to the resentment and self-victimization of an embittered man, but it sheds light on the supreme need at the time for the kind of systematic and consistent promotion on behalf of astronomy pursued by the imperial and royal astronomer through publications, networking, training, and instrumentation. The first spectacular result of this activity was the part played and the attention received by Hell, his observatory, and its local context during the 1761 Venus transit observations.

CHAPTER 3

A New Node of Science in Action: The 1761 Transit of Venus and Hell's Transition to Fame

> I reckon there is no one interested in astronomy who does not wait impatiently to learn what was observed during the recent meeting of Venus with the Sun, especially since there is no other encounter between celestial bodies from which we are able to ascertain with a greater degree of exactness the still unknown, or not yet sufficiently well defined, parallaxes of the Sun and Venus.
>
> EUSTACHIO ZANOTTI 1761[1]

1 A Golden Opportunity

The above assessment of Hell's Bolognese colleague Eustachio Zanotti could hardly have been more to the point. The passage (or transit) of Venus in front of the Sun as seen from the Earth is a rare astronomical phenomenon: it comes in pairs separated by eight years, after which it does not take place for more than a whole century. The first transit of Venus observed by means of astronomical equipment was in 1639. Since then, transits of Venus have occurred in the years 1761 and 1769, 1874 and 1882, and 2004 and 2012—but they will not happen again until 2117 and 2125. The 1639 transit of Venus made no immediate impact and (as far is known) was only observed by two amateur astronomers in the English countryside.[2] By contrast, the pre-calculated transits of 1761 and

1 Eustachio Zanotti, *De Veneris ac Solis Congressu Observatio habita in Astronomico Specula Bononiensis Scientiarum Instituti Die 5 Junii MDCCLXI* (Bologna: Laelii e Vulpe, 1761), 1.

2 The observers were Jeremiah Horrocks (*c.*1618–41), observing from outside Liverpool, and his friend Simon Crabtree (1610–40), observing from the Manchester area. See Peter Aughton, *The Transit of Venus: The Brief, Brilliant Life of Jeremiah Horrocks, Father of British Astronomy* (London: Windrush, 2004); Allan Chapman, "Jeremiah Horrocks, William Crabtree, and the Lancashire Observations of the transit of Venus of 1639," in *Proceedings of the International Astronomical Union, Volume 2004, June 2004: Transits of Venus; New Views on the Solar System and Galaxy*, *Proceedings IAU Colloquium*, ed. Don W. Kurtz, no. 196 (Cambridge: Cambridge University Press, 2004), 3–26; Thomas Posch and Franz Kerschbaum, "Kepler, Horrocks, Hevelius und der Venustransit von 1631," in *Astronomy in and around Prague. Colloquium of the Working Group of the History of Astronomy, Prague, September 20, 2004*, ed. Gudrun Wolfschmidt and Martin Šolc (Prague: Univerzita Karlova, 2005), 89–100.

© PER PIPPIN ASPAAS AND LÁSZLÓ KONTLER, 2020 | DOI:10.1163/9789004416833_005
This is an open access chapter distributed under the terms of the CC-BY-NC-ND 4.0 License.

1769 attracted massive public interest, as well as lavish funding from European governments for expeditions into remote regions of the world. The principal scientific reason was that the transits of Venus were seen as unique opportunities to calculate the distance between the Earth and the Sun, a coveted feat in the "quantifying spirit" of the Enlightenment. Early on in the seventeenth century, Kepler's groundbreaking work on the orbits of the planets had laid the foundations for calculations that enabled sky-watchers to be prepared for spectacular events, such as transits of Venus. The Newtonian theory of gravitation and mechanics further improved the methods for calculating the movements of the planets, but there were still considerable uncertainties about the actual distances between the Sun and the various planets. A transit of Venus was seen as the best way to solve the problem. As pointed out by Edmond Halley (1656–1742), who forecasted the 1761 and 1769 transits,[3] observations of Venus in front of the Sun from widely separated sites on the Earth would reveal tiny shifts from which the absolute distance between the Sun and the Earth could be deduced. Once the Sun–Earth distance was known, the distances between all the other planets in the solar system could be inferred as well, by means of Kepler's Third Law.[4]

The stakes were thus nothing less than the very dimensions of the solar system and the place of the Earth within it. Excitement among contemporaries ran high, and no less considerable is the interest paid by modern scholars to what has been recognized as the greatest collaborative effort in eighteenth-century field science.[5] Indeed, already in 1761, at least 130 successful

3 Edmond Halley, "Methodus singularis quâ Solis parallaxis sive distantia à Terra, ope Veneris intra Solem conspiciendæ, tuto determinari poterit," *PTRSL* 29 (1714/16; printed 1717): 454–64. This was an elaboration of a paper read before the Royal Society in 1691, itself based on ideas conceived during Halley's observation of a transit of Mercury at the island of St. Helena in 1677.

4 Kepler had found that "the squares of the times of revolution (periods) of the planets are proportional to the cubes of their mean distances from the sun" (quoted after Woolf, *The Transits of Venus*, 3). Whereas the times spent by each of the then known planets—Mercury, Venus, Earth, Mars, Jupiter, and Saturn—in encircling the Sun were known to Kepler, he could only guess at the distances between them. However, as soon as the distance between the Sun and any of the planets in the solar system was known, the size of the whole system could be deduced by means of this Third Law. For a discussion of the mathematical principles behind the Third Law, see A.E.L. Davis, "Kepler's Angular Measure of Uniformity: How It Provided a Potential Proof of His Third Law," in *Miscellanea Kepleriana: Festschrift für Volker Bialas*, ed. Friederike Boockmann, Daniel A. Di Liscia, and Hella Kothmann (Augsburg: Erwin Rauner Verlag, 2005), 157–73.

5 Historical accounts of past transits of Venus, with ample explanations as to how they were predicted, how they were used for computation of the solar parallax, how they were observed,

observations were made at sixty-seven different places. The results being unsatisfactory, by 1769 the number of observational posts increased to seventy-eight, producing at least 154 individual observation sets.[6]

More will be said about the reasons why and the complex ways in which the eighteenth-century Venus transit enterprise so faithfully reflected emerging notions about the simultaneously competitive and collaborative nature of scientific knowledge production in particular and social interaction in general in Chapters 5 and 6, dedicated to the Arctic expedition led by Hell in 1769. Here, it suffices to recognize that in a good measure thanks to the vast geographic spread (including exotic locations), a substantial part of the literature focuses on the historical significance of a particular expedition, region, or country.[7]

---

etc. are provided by, among others, Harry Woolf's standard *The Transits of Venus* as well as several more recent surveys, in no small measure occasioned by the 2004 transit. See Eli Maor,*Venus in Transit* (Princeton: Princeton University Press, 2004 [2000]); David Sellers, *The Transit of Venus: The Quest to Find the True Distance of the Sun* (Leeds: MegaVelda Press, 2001); Christophe Marlot, *Les passages de Vénus: Histoire et observation d'un phénomène astronomique* (Paris: Vuibert/Adept, 2004); Jean Eudes Arlot and Jean-Pierre Luminet, *Le passage de Vénus* (Les Ulis: EDP Sciences Editions, 2004); William Sheehan and John Westfall, *The Transits of Venus* (Amherst: Prometheus Books, 2004). Several proceedings of international conferences contain historical articles on the transits of Venus. Gotha in 1998: Peter Brosche et al., eds., *The Message of the Angles: Astrometry from 1798 to 1998*, Acta Historica Astronomiae 3 (Frankfurt: Harri Deutsch, 1998); Lancashire in 2004: Kurtz, *Proceedings*; Observatoire de Paris in 2004: David Aubin, ed., *L'événement astronomique du siècle? Histoire sociale des passages de Vénus, 1874–1882*, Cahiers François Viète 11–12 (Nantes: Cahiers François Viète, 2007). For papers occasioned by the 2012 transit, see *Journal of Astronomical Data*, special issue, "Meeting Venus: A Collection of Papers Presented at the Venus Transit Conference in Tromsø 2012," ed. Christiaan Sterken and Per Pippin Aspaas, 19, no. 1. (Brussels: C. Sterken, 2013).

6 For a full list of the observation posts and the observers (as well as their instruments and sponsors) from both 1761 and 1769, see Woolf, *Transits of Venus*, 135–40, 182–87; supplemented by Aspaas, "Maximilianus Hell," 211–18, 269–77.

7 Of the most-celebrated cases, on James Cook's Tahiti expedition, see, e.g., Derek Howse and Andrew Murray, "Lieutenant Cook and the Transit of Venus, 1769," *Astronomy & Geophysics* 38 (1997): 27–30; Wayne Orchiston, "James Cook's 1769 Transit of Venus Expedition to Tahiti," in Kurtz, *Proceedings*, 52–66; on Chappe d'Auteroche's Siberia expedition, Michel Mervaud, ed., *Voyage en Sibérie fait par ordre du Roi en 1761*, 2 vols., Studies on Voltaire and the Eighteenth Century, 2004, no. 3, and 2004, no. 4 (Oxford: Voltaire Foundation, 2004); on Chappe d'Auteroche's California expedition, Doyce B. Nunis Jr., ed., *The 1769 Transit of Venus: the Baja California Expedition of Jean-Baptiste Chappe d'Auteroche, Vicente de Doz, and Joaquín Velázquez Cárdenas de León*, Baja California Travels Series 46 (Los Angeles: Natural History Museum of Los Angeles County, 1982); Iris H.W. Engstrand, "The Transit of Venus in 1769: Launching Pad for European Exploration in the Pacific during the Late Eighteenth Century," *Boletin: Journal of the California Mission Studies Association* 21 (2004): 36–48; on North America, Silvio A. Bedini, "The Transit in the Tower: English Astronomical Instruments in Colonial America," *Annals of Science* 54 (1997): 161–96, here 184–88; on William Wales's (*c.*1734–98) expedition, Don Metz, "William Wales and the 1769 Transit of Venus: Puzzle Solving and the

Hell's Vardø trip was regarded in the eighteenth century as being almost as exotic, and certainly no less scientifically important, as those undertaken by James Cook (1728–79) to Tahiti in 1769 or by Chappe d'Auteroche to Tobolsk in 1761 and Baja California in 1769. For over a hundred years, his sets of data from Vardø featured prominently in debates about the distances of the solar system. The expedition and its scientific results, therefore, figure quite prominently in the scholarship. By contrast, the place of Vienna and Hell in 1761 is more of a footnote in the master narrative. Doing justice to them is not an exercise of merely antiquarian or self-serving interest, but indispensable to the argument of this book about the intertwining of personal agency in the local, regional, and transnational spaces where Hell exerted his talents.

Before providing an account of astronomical activity in the Habsburg territories during and in the aftermath of the 1761 transit, some technicalities need to be considered. The astronomical unit to be obtained from the Venus transit observations was based on the so-called parallax: the difference in the apparent position of an object against a background when viewed from different angles. The observation of the passage of the tiny disc of Venus, when viewed from different positions against the background of the Sun as various astronomers spread themselves over the Earth, made it possible to determine a parallax—called the solar parallax—provided that the distance between various observation sites was accurately measured, and the observers at each location properly kept the time. In sum, two sets of data were necessary: first, the geographical position of each observer, and second, the exact divergence of Venus's path in front of the Sun as seen from the various stations. The figure of the solar parallax was really just a compressed, internationally acceptable way of expressing the distance between the Earth and the Sun, without having to choose between English, French, or various German miles, the Russian *verst*, the French *toise*, or (later) the kilometer.

Determination of the Astronomical Unit," *Science and Education* 18 (2007): 581–92; on Australia, R.J. Bray, "Australia and the Transit of Venus," *Proceedings of the Astronomical Society of Australia* 4 (1980): 114–20; on the Dutch East Indies, Robert H. van Gent, "Observations of the 1761 and 1769 Transits of Venus from Batavia (East Indies)," in Kurtz, *Proceedings*, 67–73; on Ireland, C. John Butler, "Observations of Planetary Transits Made in Ireland in the 18th Century and the Development of Astronomy in Ireland," in Kurtz, *Proceedings*, 87–99; on France, Harry Woolf, *Les astronomes françaises, le passage de Vénus et la diffusion de la science au XVIII^e siècle* (Paris: Université de Paris, 1962); Jean-Claude Pecker, "Jérôme de Lalande and International Cooperation," in Brosche et al., *Message of the Angles*, 52–62; Suzanne Débarbat, "Venus Transits: A French View," in Kurtz, *Proceedings*, 41–51; on Scandinavia, Per Pippin Aspaas, "Nordiske amatørastronomers bidrag i forbindelse med venuspassasjene 1761 og 1769," in *Mellom pasjon og profesjonalisme: Dilettantkulturer i skandinavisk kunst og vitenskap*, ed. Marie-Theres Federhofer and Hanna Hodacs (Trondheim: Tapir, 2011), 103–27.

A planetary transit can only occur with either of the two planets Mercury and Venus, since the other planets in our solar system have orbits farther out, thus never passing between the Sun and the Earth. However, although transits of Mercury occur fairly frequently (between twelve and fourteen times a century), they are of little use in calculating the solar distance. Mercury is simply too close to the background (the Sun) to offer any substantial parallax, no matter how far apart the terrestrial observers spread themselves.[8] The planet Venus, on the other hand, orbits the Sun much closer to the Earth and should therefore be of far better use, according to the ideas of influential eighteenth-century astronomers.

A transit may last for several hours, depending on how close to the center of the Sun's disc the planet makes its passage. As a result of parallax, the time spent by the planet crossing the disc of the Sun will also vary according to where on the surface of the Earth an observer is situated. The transit of Venus in 1769, for example, as observed by Hell in Vardø, lasted 6^{h} 29′ 34.5″ (six hours, twenty-nine minutes, thirty-four-and-a-half seconds). At the same time, astronomer Charles Green (1735–71) of Cook's crew on Tahiti saw Venus spend 6^{h} 5′ 37″ crossing the Sun (i.e., nearly twenty-four minutes less).[9] This difference in time was a key figure in the calculation of the Sun's parallax. By measuring the exact time spent by Venus in crossing the Sun, astronomers were able to determine how close to the center of the Sun's disc the transit took place as seen from each station. Theoretically, the position of Venus on the Sun's disc could be measured. In practice, such observations turned out to be difficult, and the displacements of Venus insufficiently large to yield a satisfactory result. Exact time-keeping, combined with the determination of each observer's geographical position, therefore came to constitute essential data for the calculation of the solar parallax (see fig. 4).

The crucial stages of the transit were the moments of contact between Venus and the limb of the Sun, commonly designated as the exterior and interior contact of ingress, and the interior and exterior contact of egress, sometimes referred to in order of appearance as the first exterior, first interior, second interior, and second exterior contacts, or sometimes just first, second, third, and fourth contacts (see fig. 5).[10] It was the two interior contacts, that is, the second and third contacts, that were of primary concern to Halley. But what if cloudy

8 See, e.g., Woolf, *Transits of Venus*, 35–51; Marlot, *Les passages de Vénus*, 92, 99.

9 Duration of the entire transit as reported by Hell, *Observatio transitus Veneris* […] *Wardoëhusii* […] *facta* […] 1770, 78–80, and by Charles Green in James Cook, "Observations Made […] at King George's Island in the South Sea […]," *PTRSL* 61, no. 1 (1771; published 1772): 397–421, here 410.

10 The terms immersion and emersion are also used as synonyms for ingress and egress respectively (*immersio* and *emersio* in Latin literally mean "diving in" and "diving out,"

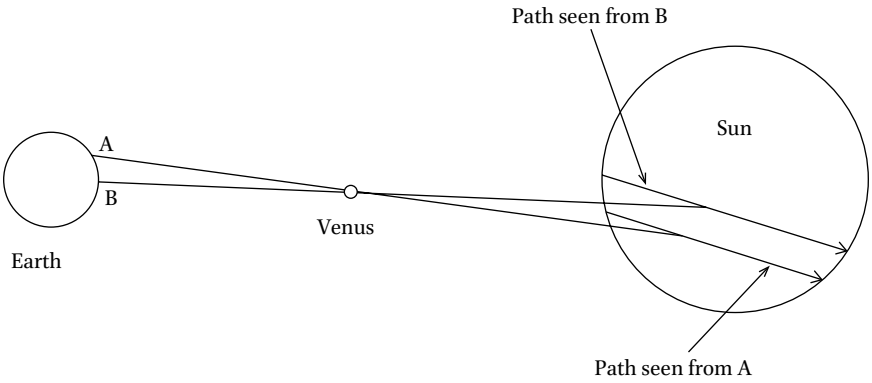

FIGURE 4 The shift of Venus's path from two sites of observation
During a transit of Venus, the path of the planet on the disc of the Sun as seen from A and B would shift, altering the times of ingress and egress as well as the total duration of the transit (note that the degree of shift has been exaggerated here). Illustration and accompanying text by Truls Lynne Hansen

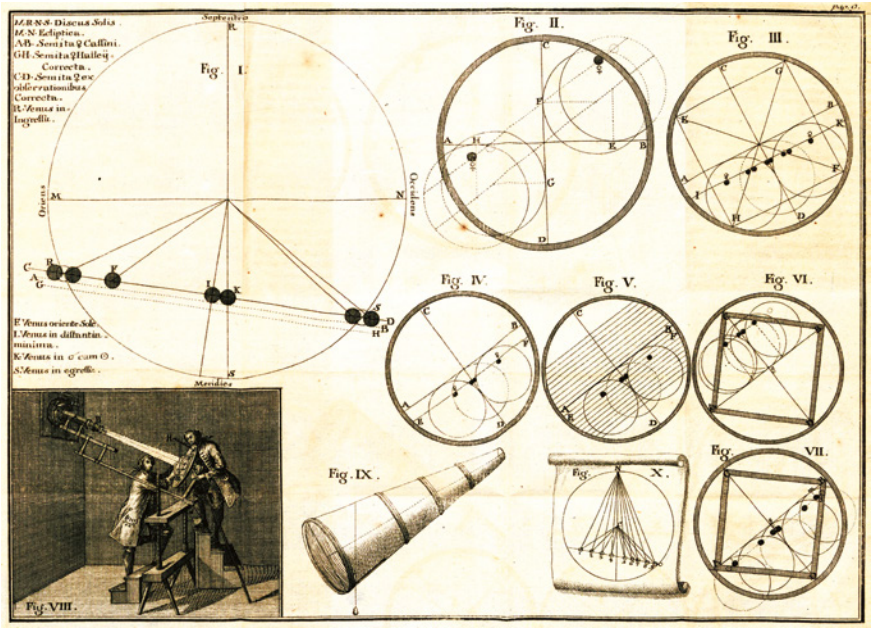

FIGURE 5 From Hell's manual *Transitus Veneris per discum Solis Anni 1761*
Upper left (fig. I.) shows the black spot of Venus at various stages during its transit in front of the solar disc. The crucial moments of contact with the limb of the Sun are clearly marked (the two pairs of contact at ingress and egress are tagged as R and S respectively). Lower left illustrates the use of a camera obscura, with which laymen equipped with fairly modest instrumentation could trace the transit on a sheet of paper. Digitized by the Department of Astrophysics, University of Vienna

weather deprived an observer of one of these crucial contacts, or a station's geographical position made only the ingress or egress of a transit observable? Following Halley's method, precious data from many stations were at risk of having to be discarded. This concern was raised by Delisle, the "grand old man" of European astronomy and a leading figure in the planning of the Venus transit project of 1761, since Halley himself had passed away in 1742. In various memoirs, articles, letters, and unpublished lectures, Delisle presented an alternative method for the computation of the solar parallax. If a single contact of Venus with the Sun's limb was observed from two stations ranging far apart, he argued that the difference in latitude and longitude between the two stations would provide the necessary basis for the computation of the parallax.[11] This suggestion no doubt came as a relief to many astronomers on the European continent. The transit of 1761 was pre-calculated to take place during the night and early morning hours as seen from the heartland of Europe, leaving hope only for the egress (i.e., the end stages of the transit) to be observed. By following Delisle's method, however, data from these observatories would be just as valuable as those from faraway places on other continents.

This is where Hell saw his golden opportunity. Although no expeditions overseas were planned by the Habsburg monarchy, which lacked territories in which the entire duration of the coming transit would be visible, it was still possible—thanks to Delisle's modification of Halley's idea—for the Imperial and Royal Observatory of Vienna to provide the global community of astronomers with crucial datasets for the calculation of the solar parallax. And not only that, Hell could employ his prestigious title of imperial and royal astronomer in combination with his budding fame as editor of the only official astronomical yearbook apart from France's *Connoissance des temps* to organize observations all over the Habsburg lands and beyond. This is exactly what he did.

A concrete step to facilitate this was the publication of a twenty-page printed instruction, written by Hell, explaining how the transit should be observed. Written in a language accessible even to those with relatively little previous

---

ingressus and *egressus* "going in" and "going out"). Furthermore, internal and external are common synonyms for interior and exterior.

11 In one of his manuscripts, read as a memoir to the Royal Academy of Sciences in Paris, April 30, 1760, Delisle explains: "This method consists of using observations of the entry or exit [of Venus] at places where one of these two stages will take place at points of time differing as much as possible between them." Jean-Eudes Arlot, ed., *Les rendez-vous de Vénus/Venus's rendez-vous*, CD-ROM (Les Ulis: EDP Sciences, 2004), caption *Delisle, manuscrits 1753 et 1760*, 10. See also Woolf, *Transits of Venus*, 33–35.

experience in astronomy, this illustrated manual[12] was widely disseminated, even well beyond the Habsburg territories (see fig. 5). In parallel, Hell offered assistance with the placing of orders at the instrument-makers of Vienna, thereby forging new—and consolidating existing—contacts with professionals as well as amateurs of science.[13] An underlying strategic scheme was set in action: this was an opportunity not only for Hell personally but also for Vienna as a "capital of science," and not least for the Austrian province of the Society of Jesus, to manifest itself as a fully integral part of the contemporary Republic of Letters, with its ideological focus on "utility" and the expansion of knowledge through the dissemination of scientific practices to an ever-growing segment of society.

Nowhere in the existing sources is Hell more outspoken on these aspects than in a letter to Christian Rieger (1714–80), who had just left a professorship in Vienna to teach mechanics, astronomy, and other exact sciences at the Colegio Imperial in Madrid. Rieger was one of the Austrian Jesuits who found a career opportunity within the order outside their native province. He was born in Vienna and entered the Society of Jesus in 1731. Having taught for a while, probably at gymnasium level, in Gorizia (Goritia, Görz), he received his first chair as a professor of architecture at the Theresianum in 1748, before switching to experimental physics in the period from 1753 to 1756. Probably as an extension of this, Rieger was employed briefly as the prefect of the Museum Mathematicum in 1756–57, but for the university years 1757 to 1760 he was a professor of mathematics in Vienna. Whether he was called upon or sought himself to go elsewhere is unclear, but in 1760 he made a giant leap to Madrid, where he taught mechanics, mathematics, physics, and astronomy at the Colegio Imperial until 1765. In the 1750s and 1760s, Rieger published textbooks on architecture in Latin and Spanish, as well as a handful of works on astronomy and experimental physics, including electricity. Rieger observed the transit together with Spanish colleagues, and published a report in Spanish that was also summarized in Hell's *Ephemerides*. In 1765, Rieger returned to the Austrian province to become rector of the Jesuit college in Passau and then Ljubljana. After the suppression of the Society, he resumed his teaching at the

12 Maximilian Hell, *Transitus Veneris per discum Solis anni 1761: Die Astronom. 5. Junii calculis definitus et methodis observandi illustratus* (Vienna: Trattner, 1760), also distributed along with most copies of the *Ephemerides* for the year 1761.

13 See, e.g., Hell to Christian Mayer in Heidelberg, February 9, March 12, and April 10, 1761; Hell to Ximenez in Florence, February 18, 1761; Freyherr von Ehrmans zum Schlug to Hell in Vienna, dated Wezlas, May 8, 1761 (all WUS).

Theresianum, though he no longer taught astronomical subjects.[14] In his letter to Rieger, Hell states:

> The method of observing the transit of Venus across the disc of the Sun you have access to in my printed *Ephemerides*. However, since I obviously lack the funds needed to distribute my *Ephemerides* to every single one of my correspondents (who are really quite numerous), I have decided to make a separate edition of my treatise *Transitus Veneris per discum Solis*, six copies of which are here enclosed for you to distribute among your correspondents.[15]

We see here a new node of science in action. Given the strategic importance of the transit of Venus, the *Ephemerides* alone could no longer suffice: Hell employed further means (printing and distributing a manual) to awaken interest in this particular observation. In a scientific culture permeated by the principle of "favor for favor," an implicit message in the distribution of the give-away copies was that recipients were more than welcome to report back to the author what they observed.[16]

In the same letter, misguided notions of scientific inferiority in regard of the Jesuits of the Austrian province are jealously combated:

> Father Liesganig, who sends his greetings, hopes to be able to finish his measure of a degree of meridian by the beginning of this summer.

14 On Rieger, see the entries in Fischer, "Jesuiten-Mathematiker in der Deutschen Assistenz," and in Wurzbach, *Biographisches Lexikon* (1874), 26:113; for the Madrid years, Agustín Udías, "Los libros y manuscritos de los profesores de matemáticas del Colegio Imperial de Madrid, 1627–1767," *Archivum historicum Societatis Iesu* 74 (2005): 369–448; Victor Navarro Brotón, "Science and Enlightenment in Eighteenth-Century Spain: The Contribution of the Jesuits before and after the Expulsion," in O'Malley et al., *Jesuits*, 2:390–404.

15 Hell to Rieger in Madrid, February 6, 1761 (WUS).

16 Similar wording is found in a wide range of letters from January until March 1761; e.g., Hell to Lacaille in Paris, January 31, 1761; Hell to Braun in St. Petersburg, February 8, 1761; Hell to Christian Mayer in Heidelberg, February 9, 1761; Hell to von Condie, March 2, 1761 (all WUS). Also, comments on the *Transitus Veneris* manual were uttered in letters to Hell by Christian Mayer in Heidelberg, April 17, 1761; Lacaille in Paris, April 18, 1761; Messier in Paris to Hell, [May] 1761; Poleni in Padua, May 25, 1761 (all WUS). In his letter to Lacaille, dated January 31, Hell says his work was meant solely for learners in astronomy: "The copies of the *Transitus Veneris per discum Solis* you may distribute as you will among learners of astronomy, it is for their sake only that I decided to write it." That many observers were inspired by the reception of this manual to report their Venus transit observations back to Hell is seen in the report he subsequently compiled and issued as an appendix to the *Ephemerides* for the year 1762 (more on this below).

> Possibly, he will receive assistance in this endeavor from Father Boscovich, whose arrival among us is awaited any day soon. If this turns out to be the case, then our court—along with the rest of our adversaries—will surely be confirmed in their opinion, which we hear uttered every day, that the Jesuits of this [i.e., the Austrian] province are ignorant of the sciences. Surely, in case I had been in Father Liesganig's shoes, I would either have refused to accept help from a foreign province, or refused to take upon my shoulders such a burden, barely sustainable even for the greatest of men.

That Liesganig succeeded, and without the help of Boscovich at that, is another story altogether.[17] What is of interest is that Hell's care for the prestige of Jesuit astronomy—with geodesy as a related field—did not restrict itself to the Austrian province alone. Further on in the same letter, the honor of the Habsburg capital is defended, exactly like Hell had been ordered in his instruction when appointed several years earlier:

> Monsieur Chappe [d'Auteroche] stayed here for a few days until he left us on January 9 to go to St. Petersburg, from where he will proceed to Tobolsk. He was astonished to see how well equipped we are, both at the observatory of the [Jesuit] collegium and at my own. He asked me whether there were any lay practitioners of this science around. When I confirmed this, he retorted that astronomy in this city of ours was held in no esteem whatsoever among foreigners. Overall, during the few days that he stayed in this city he had experienced that, apart from the Jesuits and Prince Liechtenstein, all other persons he had met were fairly ignorant of the hard sciences. […] This extremely friendly gentleman intends, on his return from Muscovy, to pay a visit to the mines of Hungary, in case this is allowed him by the academy [i.e., the Académie des Sciences], and I will gladly join him.

Thus, in his personal encounter with a Venus transit expeditionist commissioned by the Académie des Sciences, Hell's "cultural capital" as the scion of a family of mining engineers is brought to the fore, alongside his role as a "nodal astronomer," inspiring laymen to engage in the noble art of astronomy. His care for the reputation of the Society's Austrian province and the Habsburg capital go hand in hand.

17 See above, 123–25.

2 An Imperial Astronomer's Network Displayed

The Venus transit projects of the 1760s have been described as the first ever instance of large-scale international cooperation in science,[18] despite them taking place amid unprecedented scales of great power rivalry—in 1761, actually at the climax of the Seven Years' War—with the two leading nations of astronomy, France and Britain, at the helm of rival coalitions. While astronomers themselves managed to cooperate, the military events created some contingencies and disruptions: the French astronomer Guillaume le Gentil de la Galaisière (1725–92), for instance, set out to carry out the observation from the fortified town of Pondicherry on the Coromandel Coast in Southeast India, but before his arrival the town fell to the British who razed it to the ground. (Thanks to the 1763 Treaty of Paris, by the 1769 transit the town was in French hands again; Le Gentil duly returned and constructed a small observatory among the ruins of the former governor's palace, to be thwarted this time by the clouds.) Despite such difficulties, the number of successful endeavors was quite impressive. A *mappemonde* indicating where the transit would be visible had been issued by French astronomers and given worldwide distribution ahead of the transit,[19] and in 1761 astronomers—most of them British and French—took up positions in places as exotic as Tobolsk in Siberia (Chappe d'Auteroche), Jakarta in the Dutch Batavia (Johan Maurits Mohr [1716–75]), and St. Helena in the Southern Atlantic (Nevil Maskelyne [1732–1811]).

The informal center of coordination lay in Paris, where senior astronomer Delisle, assisted by his colleagues Messier, Cassini de Thury, Lacaille, and Lalande (all characters with whom Hell corresponded regularly), were pulling the strings. They were all active in the planning of the project, distributing

18 "The conjunction of enlightened interest and scientific practice, actually achieved in the observations of the transits, also gave rise to the first international, co-operative scientific expeditions in modern history." Woolf, *Transits of Venus*, 4. Others include the project of cartography, mentioned above, between Vienna and Paris that started in 1761, on the initiative of Cassini de Thury, as one of three international projects of cooperation in eighteenth-century science—the other two being the Venus transit project of the 1760s (counted as a single project) and the Societas Meteorologica Palatina of Mannheim, founded in 1780. See Moutchnik, *Forschung und Lehre*, 18. The cartographical project of Cassini de Thury, however, included far fewer participants from a limited area and cannot be compared to the universal interest invested in the Venus transit project from the entire scientific community. A similar, small-scale but international undertaking of much greater geographical distribution than Cassini de Thury's cartography project would be the lunar parallax project of 1751–52, in which several astronomers from at least five countries took part (see further Aspaas, "Maximilianus Hell," 223–24.).

19 Reprint in Woolf, *Transits of Venus*, fig. 8, 98–99, cf. the distribution list, 209–11.

scientific papers and letters containing practical counsel and encouragement to astronomers both in French provinces and abroad, and making arrangements that enabled their colleagues to obtain the best astronomical equipment available. Consequently, in the days, weeks, and months after the 1761 transit, observations came trickling in to the Académie des Sciences in Paris for the academicians to assess, adjust, and publish. Another center that received numerous Venus transit reports was the Royal Society in London, where a series of articles was subsequently printed in the society's *Philosophical Transactions*. Accordingly, the 1761 Venus transit enterprise figures in most accounts as a predominantly Franco-British story. However, a third center also contributed quite significantly to the instigation, organization, and subsequent publication of Venus transit observations all over the world: the Imperial and Royal Observatory of Vienna.

Perhaps more important than Hell's personal participation in the 1761 Venus transit observations is the brokerage role he played in the encounter, which naturally did not come to an end with his contributions to the preparatory moves, but loomed especially large with the subsequent collection and publication of data. The greatest public display of the imperial astronomer's network to date—or, more specifically, of his role as an inspirer, organizer, and publisher of observations—emerged in the autumn of 1761, in the form of a 124-page report: "Observation of the Transit of Venus in Front of the Disc of the Sun on June 5, 1761, with Observations of the Same Venus Transit Made by Various Skilled Observers throughout Europe, and an Appendix of Several Other Observations," published as an appendix to the *Ephemerides* for the year 1762.[20] Internal evidence indicates that it was printed some time during the autumn of 1761, the last dated reference in the text being to August of that year.[21] By then, Hell had received letters and printed reports stating the results of observations in Central Europe as well as Russia, Sweden, Italy, France, Spain, and even England, despite the war. Several observers referred to Hell's handy little manual when they reported their observations.[22] The ability of Vienna, and the Austrian province of the Society of Jesus in particular, to provide scientific

20 Maximilian Hell, "Observatio transitus Veneris ante discum Solis die 5ta Junii 1761 […]: Adjectis observationibus ejusdem transitus Veneris factis à variis per Europam viris in observando exercitatis, cum appendice aliarum nonnullarum observationum," *Ephemerides* 1762 (1761).

21 Hell, "Observatio transitus Veneris […] 1761," 89: "Anno 1761. […] mense Augusto." Unfortunately, we have been unable to track down letters written in the autumn/winter of 1761–62 that might have shed light on the exact date of publication.

22 Cf. Hell, "Observatio transitus Veneris […] 1761," 89, where Hell states his sources for the data of other observers scrupulously. Many of the handwritten reports on the 1761 transit

observations of global significance was no longer questionable. At the helm of it all, incidentally, was the Jesuit Maximilian Hell. Not all observers reported directly to the astronomical giants of Paris and London. Some shared their data with Hell, leaving it to him to assess and publish their observations.

The report included in the *Ephemerides* for the year 1762 was not the only instrument of promoting Hell's (and Vienna's) reputation. As already mentioned, around the time of the 1761 transit of Venus, the scholarly community in Vienna received prominent visitors from Paris: following Chappe d'Auteroche's visit en route to Siberia in January, the director of the Observatoire Royal, Cassini de Thury, arrived in mid-May. Principally on a geodetic mission sponsored by the two new diplomatic and military allies, France and the Habsburg monarchy, Cassini de Thury stayed long enough to observe the transit of Venus in the early morning hours of June 6 from Liesganig's observatory. Cassini de Thury already held Hell in high esteem, and the reason for his choice of location is probably as simple as given in his own account of his trip: the Jesuit observatory was "preferable to that of Father Hell because of its situation and because of the abundance of instruments."[23] While it was Hell who bore the title "imperial and royal," the dynasty chose to follow Cassini de Thury in honoring the Jesuit observatory with the presence of one of its members. As Cassini de Thury reports:

> As I was waiting for the reappearance of the Sun impatiently, [...] the august archduke Joseph [arrived], who left Laxenburg at four o'clock in the morning in order to witness my observations; luckily, the Sun revealed itself again, and this prince looked at Venus several times, and posed me several questions that testified to the range of his knowledge.[24]

---

that were delivered to Hell are still preserved among his manuscripts at the Universitätssternwarte Wien.

23 César-François Cassini de Thury, *Relation de deux voyages faits en Allemagne par ordre du Roi: Par rapport à la figure de la Terre* [...] *Par rapport à la geographie* [...] *Par rapport à l'astronomie* [...] (Paris: Durand, 1763), xiv. Cassini de Thury's appreciation for Hell as a colleague who has "given great proofs of his competence and exactitude in the practice of astronomical observations" is expressed on viii. On the location, cf. also Cassini de Thury, "Observation du passage de Vénus sur le Soleil, faite à Vienne en Autriche," *Histoire de l'Académie Royale des Sciences* 1761 (published 1763): 409; Hell, "Observatio transitus Veneris [...] 1761," 17–20, 41. The claim that Cassini de Thury observed the transit "from the comfortable quarters of the Vienna Observatory" in the company of "the observatory's director, Father Maximilian Hell" (Maor, *Venus in Transit*, 87, repeated in Wolfgang Steinicke and Wilhelm Brüggenthies, "Maximilian Hell und der Venustransit von 1769: Eine abenteuerliche Reise nach Vardø," *VdS-Journal* 15 [2004]: 78–81, here 78) is mistaken.

24 Cassini de Thury, "Observation," 410.

The imperial heir's attendance at the Jesuit observatory confirms the status of Cassini de Thury's journey as not only a scientific one but a visit of first-rate diplomatic significance. It also involved meetings with top decision-makers like Kaunitz, and an audience with Maria Theresa herself, who lavished on the astronomer such honors that "I can hardly comprehend, still less am I able to express."[25]

Despite the fact that in Hell's observatory high buildings nearby blocked part of the view to the east, where the rising Sun was expected to display Venus as a tiny spot on its disc, three observers were present at that site—the Viennese professor of physics, Joseph Herbert (Herberth [1725–94]) of the Society of Jesus, along with two of Hell's students. The imperial astronomer himself, however, took up his position in a tower of the nearby Jesuit library.[26] All these sites of observation lay within a few hundred meters of each other and provided the astronomical community with independent data from a total of nine observers from virtually the same geographical point.[27] What is important to note, however, is that—with the single exception of Liesganig—none of the professional observers in Vienna managed to observe the interior contact of egress, due to clouds. All they could see were parts of the planet's path across the Sun's disc, as well as the moment of exterior contact.

Returning to Hell's report, the general failure to observe the interior contact at ingress in Vienna did not render the observations futile. Altogether, thirty-two pages are devoted to the observations in the Habsburg capital and the conclusions drawn from them. On the level of scientific prestige, Hell's scheme arguably entailed a massive success. In his letter to Rieger, quoted above, Hell confessed that he found Chappe's comments on the seeming ignorance of astronomy among the Viennese disturbing. Not surprisingly, in his report he goes to some lengths when reporting the endeavors of the local amateurs introduced in Chapter 2. Sambach took up position on the top of his house in the suburb of Spittelberg "with a seven-foot telescope fabricated by himself and instructed by me with a micrometer, mounted on a stand that resisted all kinds of motion, and having moreover a pendulum clock to hand," but failed to see anything whatsoever of the crucial contacts due to clouds.[28] The "highly illustrious Mr. Müller" was prepared to observe in the St. Leopold district, with his

25 Cassini de Thury, *Relation de deux voyages*, xi.

26 Hell, "Observatio transitus Veneris [...] 1761," 1–20, here 1.

27 The authors are indebted to Prof. Maria G. Firneis of the Institut für Astrophysik at the University of Vienna for information concerning the positions of these historical sites (guided tour during the conference "Astronomie in Wien: 250 Jahre Eröffnung der Universitätssternwarte," September 29–October 1, 2006).

28 Hell, "Observatio transitus Veneris [...] 1761," 20–21.

three-foot telescope equipped with a micrometer and a lens that he himself had darkened. However, according to Hell, Müller's observation of the final contact of Venus with the limb of the Sun was not exact enough, "probably because the correction of the clock's time-keeping had not been made in the way it should."[29] The third amateur mentioned by Hell was an anonymous merchant (*Mercator quidam*), who had observed the transit in a suburban garden, using "an exquisite telescope." However, since this merchant had no more than the public clock (indicating only the minutes, not the seconds) at his disposal, his successful observation of both the interior and exterior contact at egress was of little scientific value.[30]

The rhetorical value of the account of these Viennese amateurs, none of whom had contributed anything of substance, worked in tandem with another public purpose: that of demonstrating the capability of members of the Society of Jesus, and of the Austrian province in particular, to instigate, coordinate, and publish scientific observations. In the historiography of the transits of Venus, the Jesuit involvement has generally not been emphasized. A closer look at Hell's report gives ample reason to reconsider the master narrative, in which the Venus transit projects of the 1760s are depicted as predominantly Franco-British—and secular—endeavors. Hell's text is partitioned according to the designations Germania (including Austria), Gallia (France), Anglia, Hispania, Italia, Hungaria, Polonia, Svecia (Sweden, including Finland), and Moscovia (Russia). Yet this seemingly innocent division conceals a bias, which merits some consideration. No deconstruction can, however, take away from Hell his success in demonstrating the important contributions of Jesuit science, and of Vienna as a capital, to the international Venus transit project of 1761.

Alongside the above-mentioned Jesuit professor Herbert, the transit was observed in the imperial observatory by Hell's assistant, the Jesuit magister Ignaz Rain (dates unknown), titled *repetens matheseos* (assistant teacher of mathematics). At their side was the young canon Dominik Lysogorski, who had been sent to Hell as a student by the archbishop of Lviv in 1758 or 1759.[31] Having

29 Hell, "Observatio transitus Veneris [...] 1761," 21.

30 Hell, "Observatio transitus Veneris [...] 1761," 21.

31 Hell, "Observatio transitus [...] 1761," 17. Lysogorski's identity is somewhat obscure. Several years later, in a letter to the bishop of Eger, Károly Eszterházy (cf. above, 129–30), Hell mentions that a priest by the name of Lysogorski had been sent in 1758 to study mathematics with him by the archbishop of Lviv, Wacław Hieronim Sierakowski (1700–80). Hell to Eszterházy in Eger, Vienna, February 17, 1777. FLE, AV, 2629; in Hell, "Observatio transitus [...] 1761," 89, the year 1759 is stated. In a letter to the professor of geography at the College Royal (now Collège de France) in Paris, Hell explains that "the friar Lysogorski [...] lived in my observatory as a guest for two years, where I instructed him in both kinds of

spent more than two years in Hell's observatory, Lysogorski left Vienna soon after the observation of the transit with the intention to lay the foundations for an astronomical observatory at his home university of Lviv, which—as Hell was careful to remark—already hosted a decent number of Jesuit professors.[32] Lviv belonged at the time to the Kingdom of Poland–Lithuania. Only one publicly known observation from this realm—namely from Kraków—was mentioned by Hell, who suppressed the identity of its author and without further ado rejected it as "highly imperfect" (*valde imperfecta*).[33] The hope for the future there lay entirely with the Society of Jesus: not only was (the Jesuit-taught) Lysogorski in place at the (Jesuit-dominated) university of Lviv but also

> two mathematicians of our Society have been called from France, the professors Rossignol and Fleuret, who will begin to cultivate astronomy in Vilna [...]. It is therefore to be hoped that, with these three men in place in Poland—which thus has in its ranks intellects no less brilliant than those of other kingdoms—a substantial number of new astronomers will be created.[34]

In this way, two entire pages are spent on Poland, without any transit observations whatsoever being reported from there.

The Jesuit aspect is similarly emphasized in other regions within the Habsburg monarchy and its sphere of interest. Given Hell's later expressions of patriotism on behalf of his Hungarian *patria*, the subchapter titled "Observatio Tyrnaviensis in Hungaria (Observation of Trnava in Hungary)" is surprisingly

---

astronomy [i.e., both theoretical and practical]. In July of this year, he returned to Poland with the necessary instrumentation; we expect very good observations from him in the future." Hell to Zannoni in Paris, dated Vienna, December 16, 1761. Transcript of the original made by Bigourdan, kept at the Bibliothèque de l'Observatoire de Paris.

32 Hell, "Observatio transitus [...] 1761," 17, 89–90.

33 The printed report in question was surely Jakub Niegowiecki, *Transitus Veneris per discum Solis post peractas revolutiones tam synodicas quàm periodicas intrà annos circiter 122. iterum anno domini 1761. die 6. Junii. celebratus et per mathematicos universitatis Cracoviensis sub elevatione poli gr. 50. min. 12. observatus* (Kraków, 1761), cf. Barbara Bieńkowska, "From Negation to Acceptance: The Reception of the Heliocentric Theory in Polish Schools in the 17th and 18th Centuries," in *The Reception of Copernicus' Heliocentric Theory*, ed. Jerzy Dobrzycki (Dordrecht: Reidel, 1972), 79–116, here 88–89.

34 Hell, "Observatio transitus Veneris [...] 1761," 89. As for the two characters, Rossignol and Fleuret, we have failed to find more information. They certainly do not figure in the official lists of Jesuit mathematicians working at the Collegium Vilnense during the eighteenth century. Karl A.F. Fischer, "Die Jesuiten-Mathematiker des Nordostdeutschen Kulturgebietes," *Archives internationales d'histoire des sciences*, 34 (1984): 124–62, here 133–34.

brief, merely four-and-a-half pages.[35] Here, Hell exclusively reports the observations of his confrère Weiss in Trnava, without even mentioning the existence of able observers such as the Calvinist Hatvani or the Lutheran Schumacher in the same territory. Instead, the imperial astronomer is careful to extol the Trnava university as an institution run entirely by the Society of Jesus. At the end of this account, he explains that Weiss has already shared the details of his Venus transit observation with the illustrious Cassini de Thury, "when he, accompanied by myself, visited the observatory in Trnava [i.e., shortly after the transit had taken place]." Furthermore, Hell himself made sure to dispatch a transcript of Weiss's observation to Lacaille in Paris, "for him to include in his collections."[36] The message resonates clearly: the one and only Jesuit-run observatory in Hungary is fully integrated in the Republic of Letters; any activity by scholars belonging to other denominations is not worthy of mention.

A longer subchapter entitled "Observationes per Germaniam factae," or observations made throughout the German-speaking parts of Europe, gives further evidence of confessional as well as imperial concerns.[37] The abovementioned amateur, Baron zum Schlug, is accorded no fewer than six pages, consisting of full length quotations from a letter addressed to Hell, followed by the imperial astronomer's corollary:

> If only the brightest of intellects, the kind of which our flourishing territories [...] are teeming with (in much the same way as France, England, Italy, etc.), would become inspired by this uniquely illustrious nobleman's example to engage both in astronomical works, worthy as they are of the capacity of sublime minds, and in activities more useful than any other pastime![38]

Next in line after the illustrious Austrian baron, we find seven-and-a-half pages devoted to the Jesuit Georg Kratz (or Kraz [1713–66]) of Ingolstadt (taken from a letter); two pages consisting of a summary of a printed report by an anonymous team in the Catholic stronghold of Munich; two pages with a similar summary of a printed report by Hell's associate, the Jesuit Franz Huberti in Würzburg; and two-and-a-half pages on yet another associate, the Jesuit Christian Mayer, who observed the transit in the company of Prince-Elector Charles Theodore (1724–99, r.1742–99) in Schwetzingen (a letter is here again the

35 Hell, "Observatio transitus Veneris [...] 1761," 84–89.
36 Hell, "Observatio transitus Veneris [...] 1761," 88.
37 Hell, "Observatio transitus Veneris [...] 1761," 62–84.
38 Hell, "Observatio transitus Veneris [...] 1761," 67.

source). A brief, less than half-page mention of the Jesuit philosophy and mathematics professor Berthold Hauser (1713–62) in Dillingen is then included (source not given), followed by less than a page on Tobias Mayer in Göttingen and the Dresden amateur Christian Gotthold Hoffmann (1713–78), respectively. Finally, half a page on the Jesuit Johann Baptist Schöttl (1724–?) in Ljubljana rounds off the account of "German" observations of the 1761 transit. Or not quite: Hell also mentions that the Jesuit father Stepling in Bohemian Prague has seen nothing due to clouds. The message is again clear. Jesuit and Catholic observers from Germania have been found worthy of a good twenty pages, including some cases when they have not seen anything whatsoever, whereas observers of other creeds—even someone as famous as Tobias Mayer—are hardly noticed. A curious omission from the report is the university observatory of Graz, with which relations of the Jesuit astronomers of Vienna were lukewarm. Another omission is the high-standard observatory of the Benedictines at Kremsmünster, where the transit was indeed observed.[39] The absence of Graz and Kremsmünster in the report does not spoil the general picture, however.

Much of the material forming the basis of Hell's report has been found among his surviving manuscripts in Vienna. Included there is a fine original drawing of the path of Venus across the Sun's disc as observed by Hoffmann, a Lutheran finance officer in Dresden. Hoffmann was an enthusiast of natural inquiry, with an avid interest in botany, geology, and meteorology; nor was he ignorant of astronomy, having also observed Halley's Comet in 1759. In his polite, less-than-one-page mention of Hoffmann in the printed report, Hell describes him as "a man already famous, thanks to other observations made in the same city" and characterized by "a singular friendliness toward men of learning." However, the account is soon cut short by the remark that in Dresden "the egress could not be exactly observed due to clouds."[40] Curiously, there is no mention of clouds in the illustrated manuscript in Hoffmann's own hand, which is preserved among Hell's manuscripts.[41] Even the exact moment of interior contact at egress is recorded. Perhaps the account of bad weather was

39 According to the website www.transitofvenus.nl/history.html edited by Steven van Roode (accessed via the Wayback Machine at https://web.archive.org [June 1, 2019]), Fixlmillner's predecessor Eugen Dobler observed the transit "accompanied by prelate Bertholdi and other clergymen." As for Graz, the *Ephemerides* did not publish observation results from there regularly until 1767. Before then, the only instance was a report on a lunar eclipse of March 17, 1764 by Poda's successor Karl Tirnberger (1732–80), prefect of the Graz observatory from 1764 to 1771.

40 Hell, "Observatio transitus Veneris [...] 1761," 82–83.

41 WUS.

found in some—now lost—accompanying letter. Another possibility is that Hell was deliberately brief and dismissive regarding the reliability of Hoffmann's observation. After all, this "friendly" colleague was not only Lutheran but a high-profile propagandist at that: Hoffmann was the man who in 1756 published the account of Johann Ludewig, the "learned farmer" in Protestant Saxony, to which Hell and Weinhart offered their portrait of Peter Anich as a Catholic counterpart.[42]

Preceding the twenty-two pages on Germany, there are thirteen pages covering "observations made in Italy."[43] Again, Hell's Jesuit network emerges from these pages clearly. In Bologna, a group dominated by Jesuit astronomers and spearheaded by the observatory director Zanotti had produced a report that Hell reprinted, interspersed with his own comments, over nearly six pages. Similarly, two-and-a-half pages from a printed report by Leonardo Ximenez (1716–86) in Florence was found worthy of insertion. Again, the depiction of cutting-edge observational astronomy as a largely Jesuit affair is striking. The sheer amount of space devoted is quite spectacular, given that several places, such as Padua (where a substantial group of Jesuits had prepared themselves) and Venice (where perhaps the most famous of all, Boscovich, was present), had overcast weather. Furthermore, some places had not yet submitted any report to Vienna, such as Milan, where—as Hell points out—a team of Jesuit astronomers ran the famous Brera Observatory. One may interpret this name-dropping as a sign of Hell's eagerness to demonstrate the importance of Jesuit science to the project. The close political and dynastic relations between Habsburg-ruled Vienna and various Italian territories may also have influenced the imperial astronomer's account.

In Hell's 1761 transit of Venus report, we find that Jesuit, Catholic, and imperial concerns manifest themselves both in the selection of materials and in the space and nature of the commentary dedicated to the various observations. These concerns are mostly recognizable in regard of Habsburg, or at least Holy Roman, territories. The bias is less conspicuous, it partly even dissipates, as the concentric rings move farther away from Vienna. France is extolled as "the highly fertile parent and nurse of the most eminent astronomers of our age" and the Académie des Sciences as a "mother of astronomers."[44] Over the six-page coverage of Gallia, there is no particular Jesuit coverage. The emphasis on nobility and Catholicism, so visible in the account from Germany, is, however,

42 Ludewig, *Der gelehrte Bauer. Mit D. Christian Gotthold Hoffmanns* […] *Vorbericht*. Cf. above, 117–18.

43 Hell, "Observatio transitus Veneris […] 1761," 49–61.

44 Hell, "Observatio transitus […] 1761," 36–42 (quotations on 36).

combined in the two personae of the Cardinal de Luynes, archbishop and honorary member of the Académie des Sciences (Paul d'Albert de Luynes [1703–88]) and the duke of Chaulnes (Michel Ferdinand d'Albert d'Ailly [1714–69]), who observed the transit from Sens. A full page is spent on the archbishop and duke at the outset of the account of French observations, but in the end no details of their observation are revealed,

> for since [...] the work that the highly famous friar de Lacaille is preparing for publication will include the outstanding observations of the elevated prince of Chaulnes, they could not possibly be referred here by me, utterly inferior to these men with regard to dignity that I am, without incurring the crime of preposterousness.[45]

There follows a long series of observations from France. Most details are taken directly from letters from Lacaille and Lalande, both of whom receive their share of praise from the Viennese court astronomer. Apart from the various observatories in the French capital, however, the Jesuit observatory in Lyon is the only location outside Paris from which Hell presented any datasets.

Following in line after France, Britannia receives its praise as well. At the opening of a four-page account, Britain is singled out as "the parent of the sublimest of intellects, including astronomers."[46] Summaries of observation sets from Greenwich, London (multiple locations), and Liskeard in Cornwall are included. There is no particular praise of Sweden, except that the importance of observations from this northern territory is evident from the fact that astronomers here had the opportunity to witness both ingress and egress. Three pages spent on three observers—Wargentin, Samuel Klingenstierna (1698–1765), and Johan Carl Wilcke (1732–96)—at a single site, the Royal Observatory in Stockholm, is still a fairly spacious coverage for a Lutheran territory.[47] Orthodox Russia is also offered coverage on the same account: the advantageous geographical location of St. Petersburg merited a couple of pages in Hell's report.[48] The only country outside of the vicinity of the Habsburg lands in which the imperial and confessional factor is again reiterated is Spain. Here, Hell's acquaintance and ally from Vienna, Rieger, is praised. Ample space—three-and-a-half pages—are given to him and other Jesuits in Madrid, in particular Father Weindling (Jan/Juan Wendlingen [1715–90]), originally called from

45 Hell, "Observatio transitus [...] 1761," 37.
46 Hell, "Observatio transitus [...] 1761," 42–45.
47 Hell, "Observatio transitus [...] 1761," 89–92.
48 Hell, "Observatio transitus [...] 1761," 92–94.

Bohemia by King Ferdinand VI (1713–59, r.1746–59) to fill the post as royal astronomer.[49]

If we look more closely at how Hell assembled information for his report, we find that in Russia, a correspondent of Hell's, physicist Joseph Adam Braun (1712–68), provided data from his own private observation as well as those made at the Imperial Observatory in St. Petersburg. Information concerning the various English observations was assembled by the Swedish astronomer Bengt Ferner (later nobled Ferrner [1724–1802]), who was in Paris at the time of the transit.[50] He sent extracts from his correspondence with English astronomers to Hell, who in turn included these extracts in the report. Information on the Swedish observations took another detour: the section on observations from Stockholm was based entirely on a letter from Lacaille and an article in the *Journal étranger* (Foreign journal) of Paris.[51] As far as the German-, French-, and Italian-speaking regions are concerned, more direct routes of communication were obviously used: Hell communicated directly with most observers, who sent him their elaborate observation data either in manuscript (as did Braun from St. Petersburg) or in the form of printed brochures (as did Zanotti from Bologna).

On the final analysis, the operation of the Jesuit network in 1761 was extremely helpful in underpinning Hell as an astronomer of international reputation, but it was not the only leverage to which he could resort. His connections in the Society's Italian and German assistancies were particularly effective in providing him with a considerable number of observations for his Venus transit report. Elsewhere, his contacts were still developing as of 1761. His conspicuous status as imperial and royal astronomer probably counted more than his membership in the Society of Jesus when astronomers in places like St. Petersburg and Paris bothered to supply information for his journal. It is the combination of the two roles—Jesuit *and* court astronomer—that gave Hell a prominent position in the Venus transit project of 1761.

As mentioned, Hell published a sequel to the report two years later, filling eighteen pages of a longer list entitled "Observationes astronomicae anni 1761 & 1762: Viennae, et aliis locis factae" (Astronomical observations from the year

49 Hell, "Observatio transitus [...] 1761," 45–49.

50 In the *Ephemerides*, his name is misspelled as "Fermer." At the latest by May 1761, he was a correspondent of Hell's. Cf. Bengt Ferrner, *Resa i Europa: En astronom, industrispion och teaterhabitué genom Danmark, Tyskland, Holland, England, Frankrike och Italien 1758–1760* (Uppsala: Almqvist & Wiksells, 1956), 388–90.

51 Lacaille's letter has not been found. The article in the *Journal étranger*, however, titled "Observations du passage de Vénus sur le disque du Soleil, faites à Stockholm, à Gottingue, à Rome & à Vienne," can be found in the issue of July 1761, 195–214.

1761 and 1762, made in Vienna and elsewhere).[52] In this addition to the Venus transit coverage in the *Ephemerides*, we find observations from Tranquebar and the Cape of Good Hope along with the observations of the two most famous French expeditionists of 1761, Pingré on the Isle of Rodrigues (taken from a letter by Messier) and Chappe d'Auteroche in Tobolsk (taken from a printed report as well as a letter "benevolently communicated to me by that author").[53] Finally, with the publication of a calculation of the solar parallax based on virtually the entire range of the 1761 Venus transit observations by Anders Planman, an astronomer and professor of physics at the University of Åbo (Turku), the full harvest of the global enterprise eventually found its way to print in Hell's *Ephemerides*. Grateful users of the annual could hardly have avoided the conclusion that access to all this stock of knowledge was largely thanks to the spider in the web: Hell, in whom the faithful Jesuit, the loyal servant of the Austrian dynasty and government, and the diligent, competent, and useful member of the "republic of astronomy" were inextricably intertwined as building blocks of a carefully constructed public persona.

3 Lessons Learned

The main interest of contemporary astronomers, as stressed by Zanotti in the quote at the beginning of this chapter, was to calculate the size of the solar parallax. For the attainment of this goal, it was vital to have as many reliable observations from sites ranging as far apart as possible. Logistical and political obstacles aside, it ought to have been a straightforward process. However, not only the weather but also a range of technical and optical challenges complicated the project and made a seamless calculation of the solar parallax impossible. As a broad generalization, there turned out to be at least three sources of error involved in the delicate process of observing a Venus transit.

First, regardless of whether the method of Halley or that of Delisle was chosen, exact time-keeping was a crucial factor. John Harrison (1693–1776) invented the chronometer just on the eve of the transits of Venus. However, only prototypes of the technology were at hand, and these were widely held to be insufficiently tested for scientific use.[54] Thus, pendulum clocks were the only

52 Hell, *Ephemerides* 1764 (1763), 208–25.

53 Hell, *Ephemerides* 1764 (1763), 221.

54 Cf., e.g., Jim Bennett, "The Travels and Trials of Mr Harrison's Timekeeper," in *Instruments, Travel, and Science: Itineraries of Precision from the Seventeenth to the Twentieth Century*, ed. Marie-Noëlle Bourguet, Christian Licoppe, and H. Otto Sibum (London: Routledge, 2002), 75–95.

aid available, both in 1761 and in 1769. Cook did not even take a chronometer on his first circumnavigation of the globe: the moments of ingress and egress were determined by means of standard pendulum clocks.[55] A pendulum clock, however, cannot be transported while it is running and needs to be corrected astronomically over several days in order to be held reliable. Besides, its retardation or acceleration compared to the Sun would vary from day to day, depending on the temperature. For most purposes, George Graham's (1675–1751) temperature-compensated mercury pendulum solved this problem, but a retardation or acceleration of a few seconds every twenty-four hours was still common. For the delicate observations of a transit, where each moment needed to be determined to the exact second, this uncertainty was unacceptable, which is why so many of the Venus transit reports include tables of time-keeping stating the retardation or acceleration of the clock over many days. To pick another example from 1769, Hell used two pendulum clocks in Vardø: one from Vienna, the other from Copenhagen. Both were constructed with temperature-compensated pendulums, so as not to be too severely affected by climatic factors. Nevertheless, they had to be tested against astronomical observations over several weeks leading up to the transit.[56] The problem regarding clocks was particularly acute in the case of temporary observation sites set up during expeditions. However, as shown by the case of Caspar Müller above, lack of proper time-keeping also rendered the data of some amateur observers questionable.

As a second difficulty, the moments to be observed were particularly the second, third, and fourth contacts of Venus with the Sun's limb. The very first contact, that of Venus's exterior contact at ingress, was generally held to be too difficult to observe. (Venus being invisible on a daytime sky, the observer would simply not know where to look for it until the contact had taken place and the ingress had in fact started.[57]) However, during the transit of Venus in 1761, a

55 See, e.g., Peter Aughton, *Endeavour: The Story of Captain Cook's First Great Epic Voyage* (Moreton-in-Marsh: Windrush, 1999), 11.

56 Only a small extract of these tests found inclusion in the Venus transit report (*Observatio transitus Veneris* [...] *Wardoehusii*, 61–69). Hell's manuscript "Observationes astronomicæ et Cæteræ in itinere litterario Viennā Wardoëhusium usque factæ" (from 1768 to 1769, preserved at the WUS) contains a longer series of tests, starting April 26 and ending June 4, 1769. Another description containing extracts from these tests is extant in an untitled manuscript of Hell, starting with the words "NB De Horologijs" (1769, WUS).

57 Halley in fact insisted that only the interior contacts were to be used, i.e., the time span between the occurrence of the second and third contacts was the focus of his attention (cf. Halley, "Methodus singularis"). Later astronomers extended their attention to the exterior contacts as well, particularly the fourth and last contact of Venus with the limb of the Sun.

totally unexpected problem occurred. Instead of entering and leaving the Sun in the form of a well-defined round spot, Venus was seen to take the form of a black drop around the moments of second and third contact. To some observers, this phenomenon seemed to last for almost a whole minute. There may have been several causes of the "black-drop effect": disturbances in the Earth's atmosphere or that of Venus; some diffraction of light in the astronomical tubes of that time; astigmatism in the eye of the observer; or merely the standard blurring of an image when two objects are very close to each other and the light is too dim for the human eye to distinguish between them. In any case, "a combination of solar limb darkening and telescopic point-spread functions" has been a matter of dispute right up to the present time,[58] and whatever the cause, the phenomenon contributed to making the results of 1761 ambiguous. For the 1769 transit, the astronomical community was better prepared, and several reports include illustrations detailing the optical difficulties involved (see fig. 6). This did not eradicate the ambiguity of the data, but it was helpful when the observations of various observers were compared.

The third problem was that the path of Venus in front of the Sun as seen from widely separated sites turned out to shift far less than anticipated by Halley. There was no way that the difference in latitude between stations could suffice: knowledge of each station's longitude was required as well. In theory, the difference in longitude between two places could be measured simply by transporting a running clock between them. The difference in local time, as revealed by simple observations of the Sun or stars, would then reveal the difference in longitude between the two places. However, as mentioned earlier, this is an impossible procedure when using a pendulum clock. Hence, astronomers on expeditions did their best by adjusting their clocks to local meantime and then used celestial phenomena such as occultations of the moons of Jupiter or eclipses of the moon or the Sun, compared to observations of the same event communicated by other astronomers in faraway places, to compute the longitude: a very delicate and time-consuming process indeed.[59] For the 1769 transit of Venus, however, a solar eclipse was predicted to take place on the

58 See, e.g., Maor, *Venus in Transit*, 95–97; Bradley Schaefer Jr., "The Transit of Venus and the Notorious Black Drop Effect," *Journal for the History of Astronomy* 32, no. 4 (2001): 325–36; J.M. [Jay Myron] Pasachoff, Glenn Schneider, and Leon Golub, "The Black Drop Effect Explained," in Kurtz, *Proceedings*, 242–53; quotation from J.M. Pasachoff and Naomi Pasachoff, "Helge Kragh, *The Moon that Wasn't*" (review), *Physics in Perspective* 12 (2010): 105–8, here 107.

59 Even at a foremost center of astronomical research like Paris, astronomers spent almost the entire eighteenth century defining the exact position of the observatory. See Moutchnik, *Forschung und Lehre*, 101. Bearing this in mind, it should come as no surprise that the

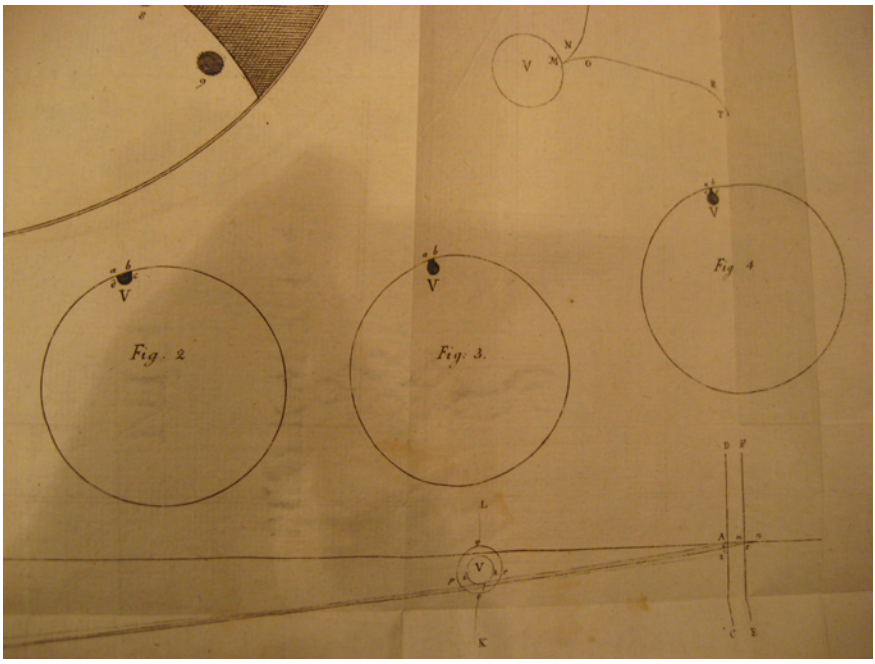

FIGURE 6 The black drop effect as depicted by Daniel Melander
Daniel Melander (later ennobled Melanderhielm [1726–1810]), professor of astronomy at Uppsala, included this illustration in his 1769 report "Uttydning på de Phænomener, hvilka åtfölja Planeten Veneris Passage genom Solen" (Interpretation of the phenomena that follow the transit of the planet Venus through the Sun). Melander's figures 2, 3, and 4 show formations of Venus (V) during interior contact at ingress. Digitized by Per Pippin Aspaas

very day after the event. Most observers therefore used observations of this eclipse as the basis for their longitude determination. Again, however, when observing the eclipse, a similar set of sources of error had to be accounted for: atmospheric disturbances during the eclipse, minute inaccuracies in timekeeping, resulting from sudden changes in temperature, the subjective discernment and skill of the observer, and so on.[60]

meridian for temporary observatories in faraway places was liable to a certain degree of error.

60 "It is true that the method which M. Delisle has substituted [to the one of Halley] presupposes that the difference of the meridian between two observatories is known. Every error committed in the difference of meridians will affect the result that can be deduced from the observations"—the editors acknowledged in the *Histoire de l'Académie Royale des Sciences pour l'année 1757* [1762], 85.

The three main sources of error mentioned above were also the "weapons" with which astronomers challenged each other in the debates ensuing after the 1761 transit. In order to bring all the data into harmony, it was necessary to consider some features of various observations doubtful. The longitude might have been erroneously determined, the clocks wrongly adjusted, or the practical skills of the observer(s) insufficient. Given the ambition, publicity, and the sheer amount of money invested in the project, it may well be that such assessments aroused a certain degree of anger among those whose observations were deemed unreliable. The discussion of the even more complex 1769 Venus transit ventures in Chapter 7 will give occasion to reflect in greater detail on what this enterprise reveals about the nature of eighteenth-century scientific culture, especially the notions and practices of sociability that governed it. For now, it suffices to point out that, judging from the tone of the main papers on the solar parallax published in the aftermath of 1761, it seems to be an exaggeration to describe this as a "quarrel between French and British astronomers."[61] Quite the contrary: the astronomers involved were generally careful to use polite language when discussing their colleagues' observations and calculations. This strategy was a prudent one: most astronomical datasets are useless when not compared with other observations.[62] Cutting off correspondence by giving offense risked a loss of access to precious material for future research, especially as the next transit was approaching within just a few years.

Halley's predictions included ones relating to the expected precision of the calculations to be made. He famously anticipated that his method would result in a calculation of the solar distance with a margin of error of no more than 0.2 percent.[63] However, given the sources of error listed above, it is small wonder that computations of the solar parallax based on all the 1761 observations

61 For contemporary claims about a "(scientific) quarrel" between British and French astronomers occasioned by the 1761 transit, see Christian Mayer, *Ad Augustissimam Russiarum omnium Catharinam II: Alexiewnam Imperatricem expositio de transitu Veneris ante discum Solis d. 23 Maii, 1769* [...] (St. Petersburg: Academia Scientiarum, 1769), preface, [v]; Maximilian Hell, "De parallaxi Solis ex observationibus transitus Veneris anno 1769," *Ephemerides* 1773 (1772), 1–116, here 113–14.

62 For more on this aspect of early modern astronomy, see, e.g., Sven Widmalm, "A Commerce of Letters: Astronomical Communication in the 18th Century," *Science Studies* 5 (1992): 43–58; Peter Brosche, "Korrespondierende Beobachtungen," in *Wissenschaftskommunikation in Europa im 18. und 19. Jahrhundert: Beiträge der Tagung vom 5. und 6. Dezember 2008 an der Akademie gemeinnütziger Wissenschaften zu Erfurt*, ed. Ingrid Kästner (Aachen: Shaker Verlag, 2009), 95–99.

63 Halley, "Methodus singularis," 460.

varied from 8.28″ (Planman),[64] 8.33″ (Stepan Yakovlevich Rumovskii [1734–1812]),[65] 8.615″ (Lambert Heinrich Röhl [1724–90]),[66] and 8.69″ (James Short [1710–68])[67] to 9.00″ (Hell, Lalande),[68] 9.26″ (Giovanni Battista Audiffredi [1714–94]),[69] 9.89″ (Thomas Hornsby [1733–1810]),[70] and 10.24″ (Pingré).[71] Expressed in kilometers, the figures of Planman and Pingré equal 158,884,000 and 128,472,000 kilometers, respectively—twenty percent, a far cry from Halley's prediction of 0.2, and an unacceptable degree of uncertainty to the contemporary "quantifying spirit."[72]

Despite the discrepancies between the various attempts to determine the solar parallax, the 1761 transit project was far from being a complete failure. Several features of the phenomenon were investigated, and although some observers missed ingress as well as egress, their observations were still of use for purposes other than the solution of the parallax problem. As Zanotti noted, the transit was useful not only for the definition of the solar parallax: "Also, if we turn to the knowledge of the planet Venus itself, this observation is no doubt to be preferred to any other method that can possibly be attempted in

64 Anders Planman, "A Determination of the Solar Parallax Attempted, by a Peculiar Method, from the Observation of the Last Transit of Venus: By Andrew Planman [...] Together with a Letter from Him to Mr. James Short [...]," *PTRSL* 58 (1768; published 1769, paper written in 1767): 127.

65 Stepan Rumovskii, "Investigatio parallaxeos Solis ex observatione transitus Veneris per discum Solis Selenginski habita, collate cum observationibus alibi institutis," *Novi commentarii Academiae Scientiarum Imperialis Petropolitanae* (hereafter: *NcASIP*) 11 (1765; published 1767): 487–538, here 510.

66 Lambert Heinrich Röhl, *Merkwürdigkeiten von der Durchgängen der Venus durch die Sonne* (Greifswald: Röse, 1768), 110.

67 James Short, "Second Paper concerning the Parallax of the Sun Determined from the Late Observations of the Late Transit of Venus [...]," *PTRSL* 53 (1763; published 1764): 340.

68 Hell, *Ephemerides* 1764 (1763), 225; Lalande, *Astronomie*, 1st ed. (Paris: Desaint & Saillant, 1764), 800.

69 Audiffredi's mean value of the solar parallax as calculated in *De Solis parallaxi ad V. Cl. Grandjean de Fouchy* [...] *Commentarius* (Rome, 1766), was 9.26 seconds, according to Luisa Pigatto, "The 1761 Transit of Venus Dispute between Audiffredi and Pingré," in Kurtz, *Proceedings*, 74–86, here 83.

70 Thomas Hornsby, "A Discourse of the Parallax of the Sun [...]," *PTRSL* 53 (1763; published 1764): 467–95, here 494; Hornsby's calculation of "a parallax of the Sun on the day of the transit" of 9.736 seconds represents a mean horizontal parallax of 9.89 seconds; cf. Andreas Verdun, "Die Bestimmung der Sonnen-Parallaxe aus den Venus-Transits im 18. Jahrhundert," *Orion* 322 (2004/3): 4–20, here 12.

71 Alexandre Guy Pingré, "Nouvelle recherche sur la determination de la parallaxe du Soleil par le passage de Vénus du 6 Juin 1761," *Histoire de l'Académie Royale des Sciences pour l'année 1765* (published 1768): 32.

72 We are indebted to Truls Lynne Hansen (personal communication) for calculating these figures, using the present value of Earth's equator radius (6,378 kilometers).

order to adjust the nodes of its orbit."[73] This was commented upon in Hell's report on the 1761 transit, both by Hell himself and by several other observers.

Another feature of most reports on the 1761 transit was the measurement of the size of Venus as seen on the Sun's disc, which had been a matter of dispute since the 1639 observations. Several observers also noticed a luminous ring around Venus at certain stages of the transit, which—sometimes in conjunction with the black-drop effect—inspired them to engage in speculations concerning a possible atmosphere surrounding Venus. One of those to do so was the Russian polymath natural philosopher, historian, and poet Mikhail Vasil'evich Lomonosov (1711–65), who observed the transit of Venus from his private home in St. Petersburg in 1761. However, his report was only printed in limited numbers as a booklet in Russian and German. It was never included in the official periodical of the St. Petersburg Academy and was poorly distributed, if at all, outside Russia. Hence, it seems to have been largely ignored until the late nineteenth century, when it was republished in conjunction with the Venus transit of 1874.[74] This late nineteenth-century publication has led Russian historians to hail Lomonosov as the discoverer of the atmosphere of Venus.[75] However, reflections on a possible atmosphere of Venus can be found in numerous reports from several countries, all published in the immediate aftermath of the transit and—unlike Lomonosov's booklet—distributed far and wide in the Republic of Letters.[76] Indeed, the possibility of an atmosphere surrounding Venus was mentioned in several of the observations compiled by Hell, who allowed the observers to speak for themselves on this issue, although he concluded early on in his 1761 report that the planet was not at all likely to have an atmosphere.[77]

---

73 Eustachio Zanotti, *De Veneris ac Solis congressu*, 1.

74 T.P. Kravets and V.L. Chenakal, eds., *M.V. Lomonosov: polnoe sobranie sochinenii*, vol. 4, *Trudy po fizike, astronomii I priborostroeniiu, 1744–1765 gg*, general editor S.I. Vavilov (Moscow: Izdatel'stvo Akademii Nauk, 1955), 353–76; 767–74. See also Vladimir Shiltsev, "Lomonosov's Discovery of Venus Atmosphere in 1761: English Translation of Original Publication with Commentaries," https://arxiv.org/abs/1206.3489 (accessed April 15, 2018).

75 In the more recent literature, this claim is sometimes taken as indisputable; cf., e.g., Maor, *Venus in Transit*, 88–91; Mikhail Ya. Marov, "Mikhail Lomonosov and the Discovery of the Atmosphere of Venus during the 1761 Transit," in Kurtz, *Proceedings*, 209–19; Hans Ullmaier, *Puncta, particulae et phaenomena*, 146. For a vindication of Lomonosov, see Vladimir Shiltsev, "The 1761 Discovery of Venus' Atmosphere: Lomonosov and Others," *Journal of Astronomical History and Heritage* 17, no. 1 (2014): 85–112.

76 For a list of examples, see Aspaas, "Maximilianus Hell," 202n44.

77 Hell, "Observatio transitus [...] 1761," esp. 21, 26, 92–94.

One conspicuous element of the transits of Venus, which had already been noted by the two amateur astronomers who observed the transit of 1639, was that the planet's size appeared to be considerably larger in the night sky than it did in front of the Sun during a transit. In fact, observers of the transit reported that Venus appeared to have a diameter of less than one arc minute; most micrometer determinations gave about fifty-eight seconds, or just short of a hundredth part of the Sun's disc. In his 1761 report, Hell explains how, during the nights before and after the transit, Venus appeared in the sky as a bright star of approximately one arc minute and seventeen seconds,[78] or almost thirty-three percent larger than when viewed against the disc of the Sun. What could be the cause of this sudden diminution? Hell discusses various hypotheses that might explain the phenomenon and concludes that it was most likely to be caused by a certain optic tendency, causing dark objects to appear smaller when viewed against a light background and light objects to appear larger in front of a dark background. This tendency, combined with other optical factors caused by the lenses of the astronomical tubes and the smoked glasses that were used for observations of the Sun, seemed to Hell to be the most likely reason for the change of size of Venus. Further research was needed, however, and his wording in this context is very cautious.[79] As to the adjustment of the nodes of the planet's orbit, Hell used various observations of the path of Venus across the Sun's disc to determine the coming transits of Venus in the years 1769 and 1874 as seen from the center of the Earth. He also calculated the visibility of the solar eclipse that was to take place on June 4, 1769.[80]

A final inference that could be drawn from the transit was that Venus probably had no moon. From time to time, various astronomers had argued its existence, among them the conseiller au Grand Conseil Armand-Henri Baudouin de Guémadeuc (1734/37–1817). In a lecture held at the Académie Royale des Sciences in Paris on May 20, 1761 and printed immediately afterward, Baudouin reported observations made by his friend Jacques Montaigne (1716–85?) in Limoges, who had seen a gleaming object beside Venus on four occasions earlier the same month. Montaigne—and his patron Baudouin—interpreted this as the much-sought moon of Venus.[81] The most likely appearance of such an

78 Hell, "Observatio transitus [...] 1761," 24–25, 99–100.

79 Hell, "Observatio transitus [...] 1761," 24–28.

80 Hell, "Observatio transitus [...] 1761," 110–15.

81 The full title was *Mémoire sur la découverte du satellite de Venus, & sur les nouvelles observations qui viennent d'être faites à ce sujet; Lu à l'Academie Royale des Sciences le 20 Mai 1761*. On this memoir and its reception, see Kragh, *Moon That Wasn't*, esp. 44–56. To his references, we may add J.G. [Johann Georg?] Krünitz, "Verzeichniß der vornehmsten Schriften von der Venus und dem Merkur, und dem Durchgange dieser Planeten durch

object as a moon of Venus would be a minuscule spot somewhere on the disc of the Sun just before, during, or after the transit. In the 1760 preparatory manual, Hell had in fact reminded observers that

> finally, both on the day preceding the transit, and on the day of the transit itself, the disc of the Sun should be investigated frequently, to see whether perhaps some smaller, perfectly round spot is there to be seen on the disc of the Sun, a spot moving either in the same or the opposite direction as Venus, but at a speed either exceeding, or at least equaling—certainly not trailing behind—that of Venus. Such a spot, moving in such a way, should represent the moon of Venus, which various observers believe they have seen long ago, under other circumstances.[82]

Many did look for it, but no one reported having seen such a thing.[83] Hell also remained silent about the possible existence (or non-existence) of this moon in his report of 1761.

In 1765, however, a refutation of all "observations" of the moon of Venus as nothing more than optical illusions was issued in Vienna with the title "On the Moon of Venus" (*De satellite Veneris*). The author of this rather sensational publication was none other than Maximilian Hell. There were two factors that had led him to publish this work, he explained. One was that a few years earlier he had presented his thoughts on the non-existence of the "Venus moon" in a letter to Lacaille, his formal contact at the Académie des Sciences in Paris. After Lacaille's death in 1762, this letter was transferred to the hands of others, and Hell felt embarrassed that the preliminary thoughts he had intended to ventilate to Lacaille alone were now being discussed by several savants in France. The other stimulus was that, in 1764, another set of "observations" of the "Venus moon"—this time from Copenhagen—was published, and since

---

die Sonnenscheibe," *Neues Hamburgisches Magazin* 6, no. 37 (1769): 114–56, esp. 119, and Marlot, *Les passages de Vénus*, 101–4. Baudouin's memoir—remarkably, given its date—is referred to by Hell in a letter to Lalande dated Vienna, June 12, 1761. It is also mentioned in his printed report on the transit ("Observatio transitus Veneris [...] 1761," 38). Neither of these references is accompanied by any criticism on Hell's part.

82 Hell, *Transitus Veneris*, 10.

83 See, e.g., Fer[r]ner, "An Account of the Observations on the Same Transit Made in and near Paris [...]," *PTRSL* 52, no. 1 (1761; published 1762): 225; or Wargentin's assessment of the results of the Swedish Venus transit observations, "Anmärkningar öfver Planeten Veneris gång genom Solens Discus," *KVAH* 23 (July–September 1761): 179. For further references, see Kragh, *Moon That Wasn't*.

even Baudouin now urged Hell to publish his work, the time was ripe for an elaborate engagement of the subject.[84]

Hell's argumentation was based on experiments whereby he had succeeded in creating optical illusions, where a tiny, illusory bright spot was produced beside a larger, real gleaming object, viewed through a tube in a dark chamber. Most astronomers realized that with this, the case was settled. As one reviewer remarked about Hell's "sagacious remarks and experiments" (*scharfsinnigen Bemerkungen und Versuchen*): "It is a shame that the moon of Venus has disappeared: some of the jokers here had already decided to call it by the witty name of 'Cupid.'"[85] In 1768, Hell's treatise was reissued in the *Nova acta eruditorum* of Leipzig.[86] Even so, there were observers looking—naturally, to no avail—for traces of this moon during the 1769 transit as well.[87]

84 Maximilian Hell, *De satellite Veneris* (Vienna: Trattner, 1765), 3–15.

85 Krünitz, "Verzeichniß," 117–18.

86 *Nova acta eruditorum* (February–March 1768): 49–126.

87 The observers organized by the Russian Academy in 1769 were given specific orders to look for the moon of Venus. Cf. Stepan Rumovskii, *Nabliudeniia iavleniia venery v solntse v rossiiskoi imperii v 1769 godu uchinennyia s istoricheskim preduvedomleniem* (St. Petersburg: Imperatorskaia Akademia Nauk, 1771), 45. Christian Mayer in his report on the Venus transit of 1769 also explains that he has been on the lookout for the moon of Venus but saw no trace of it; see Christian Mayer, "Expositio utriusque observationibus et Veneris et eclipsis Solaris factae Petropoli in specula astronomica," *NcASIP* 13 (1768; published 1769): 559. In the more elaborate treatise addressed to Catherine II, he denies the existence of this moon, see Mayer, *Ad* [...] *Catharinam* [...] *Imperatricem expositio*, 285; cf. 140. Likewise, two Uppsala astronomers looked for the moon of Venus in 1769 but saw no trace of it. Eric Prosperin, "Utdrag af Observationerna på Veneris inträde i Solen, d. 3 Jun. 1769, som blifvit gjorda på observatorium i Upsala," *Kongliga Vetenskaps Academiens Handlingar* (hereafter: *KVAH*) 31 (April–June 1769): 158–59; Fredric Mallet, "Berättelse om det som kunnat observeras uti Pello, vid Veneris gang förbi Solen, den 3 och 4 Junii 1769," *KVAH* 31 (July–September 1769): 222–23. The British observers also seem to have been instructed to look for the moon of Venus in 1769; cf. Kragh, *Moon That Wasn't*, 58. Despite the universal failure to see a moon besides Venus on the Sun's disc, the debate arose again in the mid-1770s when an astronomer at the Berlin Academy of Sciences, Johann Heinrich Lambert (1728–77), produced an article criticizing Hell's monograph ("Essai d'une théorie du satellite de Vénus," *Nouveaux Mémoires de l'Académie Royale des Sciences et Belles-Lettres* [1773; published 1775]: 222–50) and even went as far as announcing, in the Berlin *Astronomisches Jahrbuch* for the years 1777–78, that the moon of Venus would be visible in front of the Sun on June 1, 1777. Hell refutes this prediction in the *Ephemerides* 1778 (1777), 7, and in several contributions to the *Wienerisches Diarium* and the *Realzeitung*. He also mentions Lambert's prediction unfavorably in some of his letters (see the letters to Fixlmillner, dated Vienna, August 31, 1776, November 27, 1776, and February 15, 1777; published with comments by Rabenalt, "Astronomische Forschung," 119–23). For further sources, see also Kragh, *Moon That Wasn't*, esp. 80–84.

The debate on the notorious "moon of Venus" was soon followed by another one in which Hell was involved. As mentioned, Hell added as a sequel to his 1761 memoir some remarks about the visibility of Venus during the coming transits of 1769 and 1874. One of his conclusions was that the 1769 transit was not going to be visible in Vienna because the Sun would then be below the horizon. This conclusion was not obvious to every contemporary specialist, including the French astronomer Claude-Étienne Trébuchet (1722–84). When in 1764 Trébuchet published a work in which he argued against the conclusions of Hell, this provoked a brief review by the Viennese astronomer in the appendix of his *Ephemerides*.[88] Trébuchet, for his part, defended his position in a lengthy letter published in the *Journal des Sçavans* for October 1766, concurring with the editors of the journal in their praise for the 1765 issue of the *Ephemerides*, but maintaining his disagreement. A summary of Hell's reply was then published in the *Journal des Sçavans* in August 1767; Trébuchet's rejoinder to this was also printed separately in 1770 and even personally sent by the author to Hell—though by this time Hell had been proven right, as the 1769 transit of Venus was indeed not visible in Vienna.[89] However, although the core of the debate was a disagreement about the exact orbit of Venus, it soon also involved the existence (or non-existence) of the "moon of Venus," the feasibility of solar eclipses for longitude determination, the methods of Halley and Delisle for computing the solar parallax, the correct interpretation of a *mappemonde* of the transit of 1769 that had been published by Lalande, and so on.[90] Trébuchet's doggedness in the affair may have been fueled by more than purely scientific concerns. Introduced in the "Lettre à Messieurs les auteurs de *Journal des Sçavans*" (Letter to the gentlemen authors of the *Journal des Sçavans*) as an "old servant of the queen" from the town of Auxerre, he was in fact a *calculateur* employed at the *Connoissance des temps* by Lalande.[91] While *Connoissance*

88 Hell, "Observatio litteraria," in *Ephemerides* 1765 (1764), 364–68.

89 Trebuchet, "Lettre à Messieurs les auteurs du *Journal des Sçavans* sur les passages du Vénus, & sur l'eclipse de Soleil arrivée en 1764," *JS* (October 1766): 644–57; Hell, "Extrait d'une lettre du R.P. Hell [...] sur le passage de Vénus observé en 1761," *JS* (August 1767): 624–26; Trebuchet, *Lettre à Messieurs les auteurs du* Journal des Sçavans *sur le passage de Vénus* [separate reprint, with additions] (Bouillon: Société Typographique, 1770). The second *Lettre* of Trebuchet was—according to a handwritten message in the hand of Trebuchet on the back page of Hell's copy (WUS), dated Auxerre, September 16, 1770—written in 1768 and published in a *Recueil philosophique*. Only a brief resumé appeared in the *Journal des Sçavans*, as late as February 1771, 118–19.

90 Trebuchet, "Lettre à Messieurs les auteurs"; Hell, "Extrait d'une lettre." See also Alexandre Guy Pingré, "Mémoire sur la parallaxe du Soleil, déduite des meilleurs observations de la durée du passage de Vénus sur son disque le 3 juin 1769," *HARS* (1775): 398–420.

91 Guy Boistel, "Nicole-Reine Lepaute et l'*Hortensia*," *Cahiers Clairaut* 108 (2004): 13–17.

des temps was Europe's astronomical almanac of the most illustrious pedigree, by the late 1760s the *Ephemerides* was emerging as a dynamic rival, and as we shall see, by the aftermath of the 1769 transit—when the original stakes of the controversy were undermined but Trébuchet still kept up the fight—the personal animosity between Lalande and Hell was out in the public domain. There is no evidence to corroborate the assumption that Lalande was sending Trébuchet into the field, but the possibility remains open.

4 "Quonam autem fructu?": Taking Stock

We now move beyond the 1761 transit of Venus as such, to take another look at Hell's reputation as it developed during the course of the 1760s. Trébuchet's gesture toward Hell's stature even while engaging in a controversy with him leads us to the question of the returns on the investment into the fashioning of Hell's observatory and Vienna as a node of astronomical knowledge. From the map of contemporary European astronomy as reflected in the pages of the *Ephemerides*, we turn to the question of the place of Hell, the Imperial and Royal Observatory of Vienna, and the *Ephemerides* itself on that map. Were one to judge merely by local responses, the imperial and royal astronomer was already "world famous in his home" by 1762, when the *Wienerisches Diarium*—an official gazette, no doubt prioritizing information reflecting positively on the Habsburg monarchy—reviewed Hell's memoir of the transit of Venus and simply referred to him as "our renowned astronomer," adding that "whoever is familiar with his works, is convinced well in advance that deep insight, reliability, order, and precision will be found in the present one." The author of the review hastened to express his agreement with Hell's view, advanced in the introduction, that the contemplation of the condition of astronomy in a state allows one to assess accurately the general progress of the sciences there—naturally implying that in Austria the situation was reassuring.[92] The journal followed Hell's activities in astronomy and other fields quite closely and reported on them from time to time, even before the sensational invitation from

92 *WD*, no. 54 (July 7, 1762): appendix, 9. It must be added that if, in our engagement with Hell's report above, the "national" element was played down in order to enable a more nuanced assessment of the confessional element in the 1761 Venus transit enterprise, the review's tone is unabashedly "Austrian." The very first astronomer mentioned by name after Hell is "our Rieger" in Madrid, closely followed by "another famous Austrian astronomer" whose "rare efforts and services" should cause the reader delight—none other than the amateur Ehrmann zum Schlug. Right next to the report on Hell's "Observatio," the paper brings an account on Weiss's Trnava observation reports.

Copenhagen. These included announcements, and then a review of the booklet on magnets in 1762;[93] a report on attempts made by Hell and others at healing patients suffering from toothache by magnetism in 1766;[94] exchanges between Hell and Weiss about a comet Weiss observed in 1766, and about meteorological measurements in 1767.[95] The journal and the authorities behind it clearly regarded it important to keep the public abreast of developments in the observatory and the activities of its director.

To be sure, Hell's own judgment of his own stature dovetailed nicely with the opinion of the journalist about his "renown." The manner of address and tone of the treatise on the moon of Venus is worth recalling here. An initial name-dropping is undoubtedly intended to locate the author in the august company of colleagues such as the "famous" (Wargentin and the French "comet hunter," Messier) and the "brilliant" (the geophysicist and astronomer Jean-Jacques Dortous de Mairan [1678–1771]), some of them identified as his "intimate friends" (Lacaille) or simply as "our father" (Joseph Louis Lagrange [Giuseppe Luigi Lagrangia (1736–1813)]—actually sixteen years Hell's junior, but already recognized as one of the greatest mathematicians of the age; "father" here refers to his status as a Jesuit), with all of whom he maintains a mutually inspiring correspondence and who have proved themselves to be a captive audience for his corrections of their research results.[96] This might well create an aura of presumptuousness, were it not for the tone of elegant, subtle irony in Hell's addressing the celebrities who are his putative interlocutors: a tone not of upstart self-assertion, but one of dignified self-confidence on the part of a scholar who is firmly aware of his status on the map of contemporary learning.

For a final apparently self-congratulatory assessment, one might turn to the balance struck by Hell about the impact of the *Ephemerides* in the preface to its twentieth volume (1776). While this was published several years after the purview of the present chapter, the achievements Hell boasted about there were more or less in hand by the late 1760s:

> The present, 1776 year of these *Ephemerides*, is the *twentieth* in an uninterrupted series published since 1757 for the use of the public by the Imperial and Royal Observatory of the University of Vienna. But what are

93 *WD*, no. 75 (September 18, 1762): 7; no. 79 (October 2, 1762): 9–10.

94 *WD*, no. 26 (March 29, 1766): 10–12. Cf. the discussion on Hell's engagement with Franz Anton Mesmer below in Chapter 7, 357–61.

95 *WD*, no. 31 (April 16, 1766): 9–11; no. 4 (January 14, 1767): 7–8; no. 6 (January 21, 1767): 7–8.

96 Hell, *De satellite Veneris*, 13.

> the fruits [*quonam autem fructu*]? This whoever wishes to know, may understand from reading the famous periodicals of France, the *Journal des Sçavans*, *Journal étranger*, or Ephem. Astronomicae Parisinae [i.e., the *Connoissance des temps*], as well as of Germany, the *Göttingische Anzeigen*, and other astronomical books.[97]

Hell's satisfaction was not unfounded. From 1758, the *Journal des Sçavans* reported on the appearance and the contents of the *Ephemerides* each year,[98] at varying length, but usually in substantial detail. As hinted above, the awakening of French interest in the *Ephemerides* may be ascribed to the operation of the "Jesuit network," with two of Hell's German Jesuit contacts, Mayer and Huberti, bringing the first volume to the attention of Parisian astronomers on the occasion of a visit in 1757 at the observatories of the French capital.[99] In any case, given that the number of astronomical works reported and reviewed in this most widely circulated French review journal was a maximum of about half a dozen every year, the coverage it secured for the *Ephemerides* is quite noteworthy. From the point of view of publicity, polemical engagement with Hell's positions in the *Journal des Sçavans*, as in the case of Trébuchet, was also far from being obviously of adverse effect:[100] being regularly reported in the *Journal des Sçavans*, engaging responses from reputed figures of the French academic public, the *Ephemerides* and Hell earned as much notice among that public as was possible. A private, but very important response by Lalande—by this time, the most renowned French astronomer of his age, himself a highly prolific science writer and editor of the *Connoissance*, the French counterpart of the *Ephemerides*—in a letter to Weiss couched the French astronomer's admiration for Hell in a comparison of his own significant textbook, the *Astronomie* (1764), with the famous *Almagestum novum* (New almagest [1651]) of Giovanni Battista Riccioli (1598–1671):

---

97 Hell, *Ephemerides* 1776 (1775), 2 (Monitum). To the titles mentioned, Hell could have added the Leipzig-based *Nova acta eruditorum* as well, which also published reviews of the *Ephemerides* from 1762 on.

98 See, e.g., the review of the *Ephemerides* for the year 1761 in the *JS* (October 1761): 672–75. This volume was sent by Hell to the editors of the journal with an explicit request for a review (letter from Hell to the editors of the journal, dated March 18, 1761; WUS). Shortly afterward, a review of the *Ephemerides* for 1762 appeared in the *Nova acta eruditorum* (February 1762): 49–58.

99 Huberti to Hell, October 3, 1757. WUS, Manuscripte Hell, vol. 3.

100 Another case was, more significantly, the critical letters of Lalande himself in February 1773 concerning the parallax calculations of both Hell and Lexell from the 1769 Venus transit, to be discussed below. *JS* (February 1773): 90–93, 113–15.

> I would have liked to follow in the footsteps of Riccioli and produce a work of the same length as his, but I would never have found a publisher to cover the costs of its printing. It is difficult for us in Paris to publish books on mathematical subjects; an author could hardly expect to receive a copy or two from the typographer in return for a voluminous manuscript: I admire how our friend father Hell, however famous and erudite, is able to publish a quite lengthy volume of his *Ephemerides* every single year.[101]

As the role of the *Göttingische Anzeigen von gelehrten Sachen* (Göttingen reports on learned matters), in which the *Ephemerides* was also mentioned at generous frequency, was similar on the German scene to the *Journal des Sçavans* on the French one, the same assumption of wide recognition probably holds for Germany, too. The *Ephemerides* was first reported in the *Göttingische Anzeigen* in 1764—possibly thanks to the extensive 1761 Venus transit coverage—and was specifically commended on account of the lasting value of the materials published in it besides the astronomical tables for the year.[102] Thereafter, the "excellent annual" (*vortreffliche Jahrbuch*), in which the material is "very conveniently arranged" (*sehr bequem eingerichtet*),[103] was reviewed regularly (although not each year). The special attention given to the appendices demonstrates that its distinctiveness did not escape the attention of the reviewer, the Göttingen mathematician, professor of geometrics and physics (and enlightened polymath), Abraham Gotthelf Kästner.[104] Kästner would later express his grave concern in commenting on the 1776 volume that as Hell's efforts to replace the leverage of the Society of Jesus through the foundation of a scientific society (academy) by the monarch became thwarted, the *Ephemerides*—which in regard of the "accuracy of its calculations, its richness of detail, and its serviceableness has been superior to all others"—might be discontinued.[105] One might also add that today copies of the *Ephemerides* (for the most part, of the entire series) are available in at least fifteen academic libraries in Germany—another indicator of wide dissemination.

---

101 Lalande to Weiss in Trnava, dated Paris, June 10, 1764, in Vargha, *Correspondence de Ferenc Weiss*, 1:57. As noted and will be developed, Lalande's attitude to Hell was soon to change.

102 *Göttingische Anzeigen von gelehrten Sachen* (hereafter: *GAgS*) [12]:2, no. 98 (August 16, 1764): 788–90.

103 *GAgS* [20]:2, no. 134 (November 7, 1772): 1138; [17]:2, no. 97 (August 14, 1769): 879.

104 On the highly complex character and diverse activities of Kästner, see Rainer Baasner, *Abraham Gotthelf Kästner, Aufklärer (1719–1800)* (Tübingen: Niemeyer, 1991).

105 *GAgS*, [25]:1 no. 3 (January 6, 1777): 24.

As for the avenues of this dissemination, once again we possess little conclusive evidence. Whatever documents on the trade of the imperial printing house Trattner, which was also the publisher of the *Ephemerides*, still exist, we have been unable to access them. Hell's correspondence is a testimony that he was himself highly active in the circulation of the annual: in several of his letters, we find the clause "herewith I am sending a copy of my latest *Ephemerides* [...]."[106] Hell was a well-organized and systematic man. We may safely assume that each of his correspondents regularly received their personal copies. Some of them, like Kästner, were not content just using the *Ephemerides* in their work but faithfully reported on each volume at important venues, thus contributing substantially to the journal's circulation and growing reputation.

In contrast to the impressive coverage of the achievements of the *Ephemerides* in the French and the German scientific public sphere, there is virtually no trace of any awareness of it in Britain. Given the character of the *Nautical Almanac*, it is little surprise that it makes no reference at all to the Viennese annual (nor does it pay attention to any astronomical work done anywhere else than Greenwich). However, the *Philosophical Transactions of the Royal Society* published texts by astronomers or accounts of their work on a regular basis, including a great many non-British figures with whom Hell maintained contact, but scarcely to Hell himself.[107] In view of the fact that the work of Nevil Maskelyne and other English astronomers is quite extensively reported and used in the *Ephemerides*, and that the 1769 transit of Venus was a central concern for both journals, this lack of reciprocity is a puzzle and needs further attention.[108] However, even if British lack of interest was real, Hell was successful

106 In a letter of March 18, 1761, Hell explicitly asked the editors of the *Journal des Sçavans* to review the *Ephemerides* (WUS). See further Hell to Franz Weiss, January 11, 1783 (Pinzger, *Hell emlékezete*, 2:137); Hell to Abraham Gotthelf Kästner, March 6, 1785; Hell to Kästner, January 26, 1788 (Niedersächsische Staats- und Universitätsbibliothek in Göttingen, hereafter: NSUBG. See Hungarian translation in György Gábor Csaba, ed., *A csillagász Hell Miksa írásaiból* [Budapest: Magyar Csillagászati Egyesület, 1997], 58).

107 The only exception we found is a passing reference to the *Ephemerides* of 1765 and Hell's calculation of the longitude of Vienna by the Swedish astronomer Pehr Wilhelm Wargentin. "A Letter from Mr. Wargentin, F.R.S. and Secretary at the Royal Academy of Sciences at Stockholm, to the Rev. Mr. Maskelyne, M.A. F.R.S. and Royal Astronomer at Greenwich Containing an Essay of a New Method of Determining the Longitude of Places, from Observations of the Eclipses of Jupiter's Satellites," *PTRSL* (1766): 280, 284.

108 Yet, as Maskelyne's account books for 1773–85 demonstrate, throughout 1776 and 1777 he had astronomical equipment manufactured by London instrument-makers upon orders by Count Károly Eszterházy, bishop of Eger, for the new observatory there. Hell was the chief advisor of the building of this observatory (for details, see below). Copies of Maskelyne's accounts (held at the archive of the Royal Greenwich Observatory, RGO 35/134) are

in carving out an international presence for the *Ephemerides* just by consolidating its status in the French and the German academic scene.

"What astronomer does not know of the excellent *Ephemerides* of Vienna?," the astronomer royal of Berlin, Johann (Jean) III Bernoulli, exclaimed in the first issue of his remarkable compendium for astronomers in 1771.[109] Bernoulli had a strong point. Closely associated with the almanac that he almost singlehandedly raised among the top-ranking ones in the field (and in certain respects, superior to all others), Hell had become a leading international personality in contemporary astronomy as the transit of 1769 approached. No doubt, this was made possible in good measure by the unity of purpose that existed between a reform-minded government that was (still) sufficiently well disposed to the Society of Jesus to lend patronage to its endeavors in modern learning, and Hell as an eminent Jesuit man of science. Not only was he widely known as an accurate calculator and an assiduous compiler of others' observations but also as one—illustrated by his writings on the theory of Venus—who discussed with authority several of the central themes of theoretical astronomy, and contested the theories of others with stamina and convincing force. He was recognized as an able observer as well as an important networker, helping colleagues in the provinces to obtain high-quality instruments, coordinating the activities of both professional and amateur observers, and exchanging data with astronomical centers abroad. It was certainly not out of peripheral obscurity that he emerged as one of the emblematic figures in the 1769 Venus transit observations. He was almost destined to do so.

---

in Vargha priv. Cf. also Ottó Kelényi B., *Az egri érseki líceum csillagvizsgálójának története* (Budapest: Athenaeum, 1930), 6.

109 Johann (Jean) III Bernoulli, *Recueil pour les astronomes* (Berlin: Chez l'Auteur, 1771–73), 1:154.

CHAPTER 4

The North Beckons: "A desperate voyage by desperate persons"

In September 1767, Maximilian Hell was invited by the court of Copenhagen to lead an expedition for the observation of the 1769 transit of Venus to the Island of Vardø, the site of a fortress and a small garrison in the remote northeastern corner of the Danish–Norwegian realm. He set forth in April 1768 along with his assistant Sajnovics, the servant Sebastian Kohl, and a dog[1]—not to speak of a massive array of scientific equipment that was to be substantially supplemented in Copenhagen, Christiania (Oslo), and Nidaros (Trondheim) as the group progressed northward. The resources offered to Hell for his expedition indicate the prestige of the project: he was given the best wagons and ships available; he got all the personnel and material he needed to construct his observatory in Vardø; he was provided with his own cook and sufficient supplies for a whole year for his period north of Trondheim; and he got natural historian Jens Finne Borchgrevink (1737–1819) attached to the expedition as a scientific assistant, translator, and "guide" in northernmost Norway.[2] A hibernation in Vardø in 1768–69 was followed by another long rest in Copenhagen in 1769–70. Not until August 1770 did the group return to Vienna. In the meantime, Hell and Sajnovics had successfully observed the transit of Venus from Vardøhus (as the fortress at Vardø was called), carried out a significant amount of field research in other areas of knowledge, and been elected full members of the Royal Societies of Sciences in both Copenhagen and Trondheim. They had interacted with leading characters in Danish–Norwegian civil, ecclesiastical, and military administration, and with professionals as well as amateurs of

1 Studies in the history of science have emphasized the role of the nameless and faceless participants in the shaping of canonized scientific knowledge, usually obliterated in the standard accounts based on the perspective of the project leader. See, e.g., Neil Safier, *Measuring the New World: Enlightenment Science and South America* (Chicago: University of Chicago Press, 2008), especially 57–92; Klemun and Hühnel, *Nikolaus Joseph Jacquin*, 88–90. Unfortunately, we know nothing about Kohl except the name—and not even the name of the dog.

2 Nils Voje Johansen, "Vitenskap som springbrett: Jens Finne Borchgrevink satset og vant," *Fjellfolk: Årbok for Rørosmuseet* 29 (2004): 20–29; Per Pippin Aspaas, "Maximilian Hell og Johannes Sajnovics om folkeliv og natur i Øst-Finnmark anno 1769," in *Forpost mot øst: Fra Vardø og Finnmarks historie 1307–2007*, Rapport fra det XXXII nordnorske historieseminar Vardø 21.–23. september 2007, ed. Randi Rønning Balsvik and Jens Petter Nielsen (Stamsund: Orkana forlag, 2008), 61–72.

© PER PIPPIN ASPAAS AND LÁSZLÓ KONTLER, 2020 | DOI:10.1163/9789004416833_006
This is an open access chapter distributed under the terms of the CC-BY-NC-ND 4.0 License.

science. All travel costs had been covered by the king's treasury, and several scientific treatises pertaining to the expedition had been published by the Royal Society of Sciences in Copenhagen.

The Hell expedition of 1768–70, considering the multiplicity of the motives of the diverse agents who participated in its instigation and realization, the complexity of its endeavors, and the range of the responses to it, is an especially suitable means for highlighting the contingencies that shaped the nature of knowledge production in the Age of Enlightenment. As such, its study underscores the now widespread concern with the history of science not merely as the evolution of bodies of specialized disciplinary knowledge but as a set of social and cultural practices embedded in contexts that lay outside the domain of "science" itself.[3] The recognition that the loyalties and agendas of the practitioners of science depend on such contexts, and that their goals and achievements have implications beyond the augmentation of scientific knowledge, leads to a more sophisticated understanding of what actually *happens* in their cultivation of the ethos of pursuing knowledge. Such contexts of the Hell expedition were manifold, and while they powerfully delineated certain paths to tread for the protagonists, they operated in a way that retained for them a fair scope of active engagement and agency. These contexts include stately self-assertion on the part of a Scandinavian kingdom; a peculiar type of transnational collaboration in eighteenth-century field science; trans-confessional exchange; broader processes of European expansion and exploration both in distant territories and in internal borderlands; self-fashioning by savants from a nodal place of astronomical research in the geographic margins of learned Europe, and their forging of identities on personal–professional, national as well as global scales; in its repercussions—to be discussed chiefly in Chapter 8—even political conflict in a Central European composite monarchy. Besides a consideration of the material practices and the actual results of the expedition, the task of this chapter is to establish this pivotal episode in Hell's career firmly in the intersection of these contexts.[4]

3 Most famously and perhaps pioneeringly, see Bruno Latour, *Science in Action: How to Follow Scientists and Engineers through Society* (Cambridge, MA: Harvard University Press, 1987); also Steven Shapin, *A Social History of Truth: Civility and Science in Seventeenth-Century England* (Chicago: University of Chicago Press, 1994). For an earlier attempt to analyze Hell's expedition in this perspective, see László Kontler, "Distances Celestial and Terrestrial: Maximilian Hell's Arctic Expedition, 1768–1769; Contexts and Responses," in *The Practice of Knowledge and the Figure of the Savant in the Eighteenth Century*, ed. André Holenstein, Hubert Steinke, and Martin Stuber (Leiden: Brill, 2013), 721–50.

4 The nature of the sources unfortunately does not allow any meaningful engagement in the case of the Hell expedition with the equally important question of the "native voices" that

1 Scandinavian Self-Assertions

For reasons intrinsic to the substance of Venus transit observations, the role of Scandinavia ought in principle to be eminent in any of them.[5] This is not only because of the basic requirement of obtaining data from stations located as far apart as possible; in the case especially of the 1769 transit, which was predicted to take place during the European night, it was necessary to dispatch observers to the regions of the midnight Sun in order to catch the entire duration of the phenomenon. As a result, these parts received considerable attention from the international astronomical community.

Even apart from this, it has been forcefully argued and colorfully illustrated in a now sizeable body of scholarship that an outstanding contribution to the expansion of natural knowledge was understood and pursued in the eighteenth century by the Scandinavian kingdoms with increasing vigor as a substitute for expansion in a different sense, namely territorial aggrandizement at the expense of immediate neighbors, let alone meaningful participation in the European project of building colonial empires in the overseas world (despite several important outposts under both Danish–Norwegian and Swedish control). "Linnean empire"—the symbolic ordering of the world through the elaborate taxonomic system developed by the famous botanist Carl von Linné (Carolus Linnaeus [1717–78]), capable of embracing the whole of creation, and the attempt of the practical application of this system to the domestication of crops and species within the confined boundaries of Sweden—was an endeavor to create a "local modernity" and an enlightened counterpart to the erstwhile military might of Gustavus Adolphus (1594–1632, r.1611–32) and Charles XII (1682–1718, r.1697–1718).[6] Von Linné's 1732 Lapland expedition was motivated by "the utility of scientific journeys within the fatherland"—sponsored

may be detected in its record. Such aspects of scientific travel are now rightly becoming a preoccupation for scholars; see, e.g., Safier, *Measuring the New World*, 59–92.

5 For a comprehensive discussion of the contribution of northern Europe (following eighteenth-century notions, including not only Denmark–Norway and Sweden–Finland but also Russia) to the Venus transit enterprise of the 1760s, see Aspaas, "Maximilianus Hell," 219–78. Only the presentation of the immediately relevant Danish antecedents there has been revised for the purposes of this book.

6 Lisbet Koerner, "Purposes of Linnean Travel: A Preliminary Research Report," in Miller and Reill, *Visions of Empire*, 117–52; Koerner, "Linnaeus' Floral Transplants," *Representations* 47, special issue, "National Cultures before Nationalism" (1994): 144–69; and, more comprehensively, Koerner, *Linnaeus: Nature and Nation* (Cambridge, MA: Harvard University Press, 1999). Let us note a close resemblance to the rationale behind the Habsburg government's sponsorship of the von Jacquin expedition to the West Indies in 1755–59. See Klemun and Hühnel, *Joseph Nikolaus Jacquin*, 52–53.

by the Uppsala Royal Society for Science, it was a patriotic venture to explore resources (all deemed "natural") from minerals through plants and animals to local technologies and ethnography, with an eye to the "economical" and to classifying the finds as national secrets.[7] Scientific travel in this guise, targeting less than fully explored corners of the kingdom, was a means of the cognitive—intentionally leading to real—appropriation of territories within the notional boundaries of the realm where the sovereignty of the monarchy was precarious because it was not properly anchored in "knowledge": a tool of empire building in the ancient sense of *imperium*, plenitude of power and exclusive jurisdiction over a stretch of land irrespective of its size. At the same time, the regions of the Far North were subject to a scientific exoticism that in certain respects is reminiscent of the curiosity about distant continents. A case in point is the French–Swedish team headed by Maupertuis that traveled to northern Scandinavia ("Laponie" as they exoticized the Torne Valley where they carried out their triangulations) in 1736–37 for a geophysical survey, intent on determining the shape of the Earth.[8] In yet a different perspective, Hell's expedition was a reverse of the cases of "scientific hitch-hiking" by "Linnean apostles" that took several eighteenth-century Swedish scholars under British, Dutch, Russian, Spanish, and other sails to the waters of the Pacific and the forests of Amazonia.[9] But the agenda and the yields were not different.

In a similar fashion, the explorations sponsored by the Danish crown were intended to raise a stock of cultural capital that would place the country on the map of learning and thus enhance its national reputation.[10] An expedition that traversed "Arabia Felix" (more or less modern-day Yemen) in the early

7 For the cameralist-style preoccupation of "Linnean travel" with an endeavour to explore and establish a frame for rationalistically governed autarchy, see, besides the work of Lisbet Koerner (see above), Tore Frängsmyr, *Linnaeus: The Man and His Work* (Berkeley: University of California Press, 1985); Sverker Sörlin, "Scientific Travel: The Linnean Tradition," in *Science in Sweden: The Royal Swedish Academy of Sciences 1739–1989*, ed. Tore Frängsmyr (Canton, MA: Science History Publications, 1989), 96–123.

8 Terrall, *Man Who Flattened the Earth*, 88–129.

9 The Swedish-language literature is voluminous. For English contributions, see, e.g., Edward Duyker, *Nature's Argonaut: Daniel Solander 1733–1782; Naturalist and Voyager with Cook and Banks* (Melbourne: Melbourne University Press, 1998); Marie-Christine Skuncke, *Carl Peter Thunberg: Botanist and Physician* (Uppsala: Swedish Collegium for Advanced Study, 2014); and the eleven-volume book *The Linnaeus Apostles: Global Science & Adventure*, ed. Lars Hansen et al. (London: IK Foundation, 2007–12).

10 Sverker Sörlin, "Ordering the World for Europe: Science as Intelligence and Information as Seen from the Northern Periphery," *Osiris*, special issue, "Nature and Empire: Science and the Colonial Enterprise," ed. Roy MacLeod, 15 (2000): 51–69 (esp. 65–67); Sörlin, "Science, Enlightenment, and Empire: Geographies of Northern Field Science," *European Review of History/Revue d'histoire européenne* 13, no. 3 (2006): 455–72.

1760s represented these ambitions to a great extent. Prompted by the famous Göttingen biblical scholar Johann David Michaelis (1717–91) and usually associated with the name of its sole survivor, mathematician and cartographer Carsten Niebuhr (1733–1815), this undertaking was built around cosmopolitan figures and took place against a background of international scientific communication, but it also enjoyed the enthusiastic sponsorship of Christian VII's predecessor Frederick V (1723–66, r.1746–66). It aimed at charting the natural history, geography, and history of the territory by collecting documents and specimens for the greater enlightenment of the world and the greater glory of the Danish crown.[11] An aura of internationalism and stately self-promotion smoothly reinforced each other: the expedition, mobilizing Danish scholars as well as Swedes born in Finland and educated in Göttingen, and Germans who studied in Copenhagen, was to receive a research agenda—questions—from learned institutions across Europe, such as the Académie des Inscriptions et des belles Lettres of Paris. However, the answers to these research questions, together with the objectifiable results—sketches, drawings, charts, manuscripts, natural specimens—and thus the sum of the knowledge culled by the expedition—was then to be sent to and deposited in Copenhagen (the royal library in particular). Altogether, these were unmistakably the building blocks of a coherent project organized around the recognition that science possesses the capacity to confer status on the international scene.[12] For a Scandinavian

11 On the trials and accomplishments of the expedition, see Thorkild Hansen, *Arabia Felix: The Danish Expedition of 1761–1767* (London: St. James, 1964); more recently, Stig T. Rasmussen, ed., *Den Arabiske Rejse 1761–1767: En dansk ekspedition set i videnskabshistorisk perspektiv* ([Copenhagen]: Munksgaard, 1990); Lawrence J. Baack, *Undoing Curiosity: Carsten Niebuhr and the Royal Danish Expedition to Arabia 1761–1767* (Stuttgart: Franz Steiner, 2014). Baack's important book makes no mention of Niebuhr's engagement with Hell during the latter's time in Copenhagen, although as we shall see they were quite close. Baack claims that the Niebuhr expedition was "the only major scientific expedition emanating from Northern Europe in the 18th century age of exploration" and also that it "was the only major European expedition of the 18th century that was scientific and multidisciplinary, and at the same time harboured no geopolitical or commercial aims." Baack, *Undoing Curiosity*, 369, 399. We believe that the Hell expedition answers each of these criteria. See also the interesting comparative analysis in Han F. Vermeulen, "Anthropology in Colonial Contexts: The Second Kamchatka Expedition (1733–1743) and the Danish–German Arabia Expedition (1761–1767)," in *Anthropology and Colonialism in Asia and Oceania*, ed. Jan van Bremen and Akitoshi Shimizu (Richmond, Surrey: Curzon Press, 1999), 13–39. For the Danish context in particular, see Allan Sortkær, "Hvilken fortræffelig gave fra den danske nation til videnskaben! Fremkomsten af internationale videnskabelige ekspeditioner i 1700-tallet," *Den Jyske Historiker* 119 (2008): 5–25.

12 Sörlin, "Ordering the World."

kingdom, the uncharted and unwelcoming territories of the north offered unbounded, quasi-domestic opportunities to cultivate aspirations arising from this recognition.

The observation of the 1761 transit of Venus was, in fact, also an item on the extensive to-do list of Niebuhr and his associates, although naturally they were supposed to accomplish this task not from the north but from Tranquebar, a Danish fort and trading settlement on the Coromandel Coast in southwest India. Christian Gottlieb Kratzenstein (1723–95), formally a professor of medicine and experimental physics, who was asked to comment on the mathematical and astronomical sections of the program for the expedition, ended his detailed report of November 28, 1760 by stressing:

> Finally, the transit of Venus in front of the Sun belongs to the mathematical observations that may be conducted upon arrival in Tranquebar [...]. The farther apart the two observations are, the more useful they will be. [...] On this issue, I am pointing out that it would be a great honor to the nation with regard to astronomy if another observer was sent to Trondheim or Vardøhus.[13]

In a lecture in March 1761 at the Royal Danish Society of Sciences, alongside Vardøhus, Arkhangelsk (in the Russian north), Iceland, Japan, and Batavia (now Jakarta), Kratzenstein again mentioned Tranquebar as a potential site for observations[14] and continued to lobby for bringing a Danish observer there. This was, however, ever more desperate: Niebuhr and his team, having set out from Copenhagen on January 4, had hardly even left Marseille by the time of the transit. Niebuhr thus saw the phenomenon from the midst of the

13 Kratzenstein, report on the plans for the Arabia Felix expedition, dated Copenhagen, November 28, 1760 (translated from German into Danish in Rasmussen, *Den Arabiske Rejse 1761–1767*, 46–58, here 58). On Kratzenstein, see Susan Splinter, *Zwischen Nützlichkeit und Nachahmung: Eine Biografie des Gelehrten Christian Gottlieb Kratzenstein (1723–1795)* (Frankfurt am Main: Peter Lang, 2007).

14 In the protocol of the Royal Society of Sciences in Copenhagen (hereafter: DKDVS), it is stated under the entries for March 2, 9, and 16, 1761 that "Professor Kratzenstein read his piece on the transit of Venus through the Sun [which is to take place] in the month of June." In the entry for February 9 in the same protocol, we find that Kratzenstein has delivered the manuscript of his lecture to the society as well as a map of the various transit sites. The lecture was later published as Christian Gottlieb Kratzenstein, "Afhandling Om Veneris Gang igiennem Solen aar 1761. med En Beskrivelse af nye og bequaemme Maader at betragte same," *Skrifter, som udi det Kiøbenhavnske Selskab af Lærdoms og Videnskabers Elskere ere fremlagte og oplæste* (hereafter: *Skrifter Kiøb.*) 9 (1765): 520–40, here 527.

Mediterranean, admitting that an observation on the open sea would be of little if any astronomical value.[15]

To be sure, there were "real" observations of the transit prepared under Danish auspices, if not from Vardø, as Kratzenstein proposed, then from Trondheim as a fairly northerly location, and Copenhagen itself. In the capital, the observation was led by Christian Horrebow (1718–76), who had inherited the post of director of the famous Rundetårn (Round tower) Observatory as well as the title *Kongelig Astronom* (astronomer royal) in 1753 from his father, Peder (1679–1764), who had in turn taken over the legacy of the illustrious Ole Rømer (Olaus Roemer [1644–1710])—not to speak about the entire proud tradition of astronomy in Denmark reaching back to Tycho Brahe. While the younger Horrebow was an able observer, he clearly lacked the strategic flair of his Swedish counterpart, Wargentin, thanks to whose efforts the Academy of Stockholm was able to distribute astronomical equipment to a total of five local academies and colleges throughout the country, in addition to the observations it organized in the northern parts of Sweden and Finland.[16] On June 6, 1761, prominent visitors showed up at Rundetårn only to find obsolete instruments and poor-quality clocks.[17] The head of the observatory had made no attempt to apply for extra funding to acquire new instruments, or at least to repair those that were not functioning. This situation could probably have been avoided, had the royal astronomer solicited the government and emphasized the international prestige involved in the project. Admittedly, Horrebow did what he could with the equipment he had. He and his staff carefully examined the path of Venus across the Sun's disc and—at least some of them—also managed to observe the moments of egress (the ingress took place during the night and was not observable in Copenhagen). But when the data were sent to Paris, Horrebow forgot to reduce the observed times to Local Mean Time (LMT), a blunder that rendered the crucial moments of contact of Venus with the limb of the Sun incorrect.[18] This was despite the fact, as we learn from Horrebow's own

15 Carsten Niebuhr, *Reisebeschreibung nach Arabien und andern umliegenden Ländern*, 3 vols. (Graz: Akademische Druck- und Verlagsanstalt, 1968 [1774–78]), 1:12–15.

16 Nordenmark, *Pehr Wilhelm Wargentin*, 164–81; Nordenmark, *Astronomiens Historia i Sverige intill år 1800* (Uppsala: Almqvist & Wiksell, 1959), 221–23. Sweden organized a total of twenty-one successful observations from twelve stations, eleven of them within the borders of Finland or Sweden. "Surprisingly enough the Swedes [...] displace the British from the second position which one would have expected them to occupy, for the British could muster only nineteen successful observations," Woolf comments, adding that "the displacement seems to be one of quality." Woolf, *Transits of Venus*, 141.

17 Claus Thykier, Kjeld Gyldenkerne, and Per Barner Darnell, *Dansk Astronomi Gennem Firehundrede År*, 3 vols. (Copenhagen: Rhodos, 1990), 1:93; see also 2:251.

18 Thykier, Gyldenkerne, and Darnell, *Dansk Astronomi Gennem Firehundrede År*, 2:251.

account,[19] that the procedure involved three trained observers—each with their assistant, in addition to a fourth assistant paying attention to the clocks.

Thus, the Copenhagen observation was of little value to Lalande, who mentions it only in a tiny notice in the memoirs of the Académie Royale des Sciences.[20] At his time of writing, Lalande was still awaiting the adjustment of the time to LMT. Horrebow had, however, assured him by letter that the difference between the observed time and LMT for Copenhagen "could be but very insignificant."[21] Several years were to pass until Horrebow finally published an article (in Danish) in which he adjusted the time-keeping of his observation. The adjustment, of almost three minutes, turned out to be anything but insignificant.[22] However, no trace of these "second thoughts" is to be found anywhere else in the contemporary literature on the solar parallax, thus internationally Horrebow failed to make any impact.[23]

As for Trondheim, this northernmost city of Denmark–Norway at the time was one of the locations where the entire duration of the 1761 transit was going to be visible. Since 1760, a new Society of Sciences had flourished there, but as its founding fathers were mainly devoted to history, philosophy, agriculture, and natural history,[24] the Royal Society of Copenhagen dispatched two young

19 Christian Horrebow, *Dissertatio de semita, qvam in Sole descripsit Venus per eundem transeundo die 6 Junii Ao. 1761* [...] (Copenhagen: Nicolai Christian Höppfner, 1761) in two parts, originally presented as a dissertation at the University of Copenhagen on July 28 and 29, 1761. One of the assistants was Christian's brother Peder the younger, who had submitted a dissertation to the university on the upcoming transit of Venus and its significance a mere two days before the event itself. See *Dissertatio de transitu Veneris per discum Solis, quam publico opponentium examini submittet Mag. Petrus Horrebow* [...] (Copenhagen: Nicolai Christian Höpffner, 1761).

20 Lalande, "Remarques sur les observations du passage de Vénus, faites à Copenhague & à Drontheim en Norwège, par ordre du Roi de Dannemarck," *HARS* (1761; published 1763): 113–14.

21 Lalande, "Remarques sur les observations du passage de Vénus," 113.

22 Cf. Lalande, "Remarques sur les observations du passage de Vénus," 113: $2^h\ 3'\ 30''$ and $2^h\ 21'\ 0''$, versus Christan Horrebow, "Tidens Bestemmelse i Henseende til de Observationer, som skeede i Solen og Venere, da Venus anno 1761. den 6te Junii passerede igiennem Solen," *Skrifter Kiøb* 9 (1765): 387–88: $2^h\ 6'\ 20''$, 44 and $2^h\ 23'\ 50''$, 52.

23 Axel V. Nielsen (1902–70) attempted to vindicate Horrebow's Venus transit observation of 1761 by examining the procedures presented in the article of 1765; see "Christian Horrebows observationer af Venuspassagen i 1761," *Nordisk Astronomisk Tidsskrift* (1957): 47–50.

24 Cf., e.g., Monica Aase and Mikael Hård, "'Det norska Athen': Trondheim som lärdomsstad under 1700-talets andra hälft," *Lychnos* (1998): 37–74. Nils Gilje and Tarald Rasmussen, *Norsk Idéhistorie*, vol. 2, *Tankeliv i den lutherske stat*, ed. Trond Berg Eriksen and Øystein Sørensen (Oslo: Aschehoug, 2002), 2:376–96; Håkon With Andersen et al., *Aemula Lauri: The Royal Norwegian Society of Sciences and Letters, 1760–2010* (Sagamore Beach, MA:

astronomers, Bugge and Urban Bruun Aaskow (1742–1806)—recommended by Kratzenstein upon the request of the president of the society and director of the University of Copenhagen, Count Johan Ludvig Holstein (1694–1763)—to Trondheim. Bugge and Aaskow left Copenhagen on May 5 and reached their destination on the thirtieth of the same month, barely a week before the transit took place.[25] The observation of Bugge and Aaskow was partially spoiled by bad weather, however, and despite the advantageous geographical position of Trondheim, their contribution is—like that of Horrebow—mentioned only briefly by Lalande in the memoirs of the Académie Royale des Sciences.[26]

The meager output of the Danish transit observations in 1761 was all the more remarkable as not too much skill was required to contribute to it. The key was to be in possession of a good astronomical tube and a reliable clock for the time-keeping. In principle, it was possible to learn the rest within a few weeks or months of practice.[27] Arguably, Denmark–Norway as a seafaring nation had

---

Science History Publications, 2009); Rolv Nøtvik Jakobsen, *Gunnerus og nordisk vitskapshistorie* (Oslo: Scandinavian Academic Press, 2015).

25 Lalande, "Remarques," 114. Kratzenstein was also given the task of providing Bugge and Aaskow with the necessary instruments, cf. Egil Snorrason, *C.G. Kratzenstein: Professor physices experimentalis Petropol. et Havn. and His Studies on Electricity during the Eighteenth Century*, Acta historica scientiarum naturalium et medicinalium edidit bibliotheca universitatis Hauniensis 29 (Odense: Odense University Press, 1974), 86.

26 Lalande, "Remarques," 114. As for the claim about the bad weather, see Thykier, Gyldenkerne, and Darnell, *Dansk Astronomi Gennem Firehundrede År*, 2:261. This is confirmed not only by Lalande but also by a Latin poem consisting of twenty elegiac couplets published by the mayor of Trondheim, Niels Krogh Bredal (1732–78), just after the transit had taken place. It tells how the two observers struggled with adverse weather during the transit and had to content themselves with the end stages of the transit alone; cf. Niels Krogh Bredal, "Amicis summo honore suscipiendis scientiæ astronomicæ peritis Dominis Bugge et Aaskov, ad Nidrosiam Veneris Solem transeuntis videndæ gratia iter facientibus per iniuriam nebulosæ athmosphæræ ut plurimum spe frustratis inter otia has lineolas posuit," *Kiøbenhavnske Nye Tidender om lærde Sager* (June 18, 1761): 203–4.

27 That laymen were encouraged to participate in the project is evident (besides exchanges cited in Chapter 2 above between Hell and amateurs in and around Vienna) from the pedagogical nature of several treatises published on the eve of the transits of the 1760s. Besides Hell's *Transitus Veneris per discum Solis anni 1761* and Röhl's *Merkwürdigkeiten von den Durchgängen der Venus durch die Sonne*, already mentioned, such works include James Ferguson, *A Plain Method of Determining the Parallax of Venus by Her Transit over the Sun* (1761), cf. Sellers, *Transit of Venus*, 122–23; Benjamin Martin, *Venus in the Sun: Being an Explanation of the Rationale of That Great Phœnomenon; Of the Several Methods Used by Astronomers for Computing the Quantity and Phases Thereof; And of the Manner of Applying a Transit of Venus over the Solar Disk, for the Discovery of the Parallax of the Sun, Settling the Theory of That Planet's Motion, and Ascertaining the Dimensions of the Solar System* (London: W. Owen, 1761); Nevil Maskelyne, *Instructions Relative to the Observation of the Ensuing Transit of Venus over the Sun's Disk, on the 3rd of June 1769* (London:

an unexploited resource in its captains of the navy, since a rudimentary knowledge at least of practical astronomy was required in order to navigate on the open sea. Furthermore, the 1761 transit took place in the midst of a joint Swedish–Danish project of geodesy, by which various surveyors were measuring the still undetermined border between Norway and Sweden/Finland.[28] To refer to the Swedish counterpart again, there an amateur of astronomy and veteran of the boundary surveying, Anders Hellant (1717–89) in Torneå (now Haparanda, Tornio), was not only invited to participate but was even sponsored by the Royal Academy to do so.[29] Other participants on the Swedish side included various captains of ships, teachers at academies and colleges, and at least one instrument-maker, as well as other civil servants and officials with a general interest in science.[30] By contrast, nothing comparable took place in Denmark or Norway, where no one took responsibility for planning, coordinating, or publishing such observations. Instead, non-professional astronomers were left to act on their own initiative, and the few who seem to have done so have not left a significant mark either.[31]

Richardson and Clark, 1768); *A Copper Plate and Discourse of the Transit of Venus, on the 3d of June 1769: Most Humbly Inscribed to His Royal Highness George Prince of Wales* (n.p.: n.p., 1769). In 1769, Hell allowed natural historian Borchgrevink to use one of his three telescopes to observe the transit, although the latter had no previous experience in astronomy (see Aspaas, "Maximilianus Hell," 300–1). Another natural historian and pupil of Linnaeus, Daniel Solander (1733–82), was also observing the transit alongside Captain Cook and astronomer Green on Tahiti, presumably without having any previous experience in astronomy either.

28 A border treaty was signed between the two countries in 1751. In an additional document (*kodicill*), it was agreed that the border measurements that had started during the 1740s were to continue for seven more years. In fact, the measurements were not finished until 1767. See, e.g., Erik Tobé, *Anders Hellant: En krönika om sjuttonhundratalets märkligaste Tornedaling*, Tornedalica 49 ([Luleå]: Tornedalica, 1991) 59–61; Sven Widmalm, *Mellan kartan och verkligheten: Geodesi och kartläggning, 1695–1860* (Uppsala: Institutionen för idé- och lärdomshistoria, 1990).

29 Osmo Pekonen, "The Amateur Astronomer Anders Hellant and the Plight of His Observations of the Transits of Venus in Tornio, 1761 and 1769," in Sterken and Aspaas, *Meeting Venus*, 49–57.

30 Pehr Wilhelm Wargentin, "Observationer På Planeten Veneris gång genom Solens Discus, d. 6 Junii 1761," *KVAH* 23 (April–June 1761): 143–66; Anders Hellant, "Venus i Solen, Observerad i Torne Den 6 Junii 1761," *KVAH* 23 (July–September 1761): 180–84; cf. Oseen, *Johan Carl Wilcke*, 152, 362. For an analysis of the "research politics" involved, see Sven Widmalm, "Science in Transit: Enlightenment Research Policy and Astronomy in Sweden," in Sterken and Aspaas, *Meeting Venus*, 21–32.

31 See Aspaas, "Maximilianus Hell," 246–47. Also, Per Pippin Aspaas, "Denmark–Norway 1761–1769: Two Missed Opportunities?," and Christiaan Sterken and Per Pippin Aspaas, "A Synoptic Overview of Selected Key People and Key Places Involved in Historical Transits of Venus," in Sterken and Aspaas, *Meeting Venus*, 39–48, 3–18.

Thus, the outcome of the 1761 Venus transit observations confirmed the then low reputation of Danish astronomy. The editor of the *Histoire de l'Académie Royale des Sciences* (History of the Royal Academy of Sciences) for the year 1757 (published 1762), in pointing out that the king of Denmark would be in a position to provide data of the utmost utility by dispatching astronomers to northern Norway in 1769, immediately added, with hardly concealed skepticism: "If there are, in his estates, observers sufficiently experienced, and equipped with instruments of sufficient quality to make this grand observation with adequate precision."[32] In Lalande's 1764 colored *mappemonde* of the visibility of the coming transit, northern Norway, including "Wardhus," emerged as an ideal place for observations, but in an accompanying memoir the author expressed his expectation that astronomers from Sweden and Russia would penetrate the region, saying nothing about their colleagues from Denmark–Norway.[33] During the winter of 1766–67, another influential French astronomer, Pingré, presented to the Académie Royale des Sciences a memoir "On the Choice and State of Sites Where the Passage of Venus of June 3, 1769 May Be Most Advantageously Observed." Like Lalande, Pingré pointed to Lapland, where he expected great things of the Swedes and the Russians, while barely mentioning the Danes at all.[34]

By the same token, on January 5, 1768, the British astronomer royal sent a letter to Wargentin, urging the Swedish Academy of Sciences to send observers to "Wardhus" and "Lapponiæ caput septentrionale" (the northern Cape of

32 "Du passage de Vénus sur le Soleil, qui s'observera en 1769," *HARS* (1757; published 1762): 99–108, here 106.

33 Joseph Jérôme de Lalande, *Explication de la figure du passage de Venus sur le disque du Soleil, qui s'observera le 3 Juin 1769; Avec les résultats du passage observé en 1761* (Paris: Jean-Thomas Hérissante, 1764), esp. 14–17.

34 Alexandre Guy Pingré, *Mémoire sur le choix et l'état des lieux où le passage de Vénus du 3. Juin 1769 pourra être observé avec le plus d'avantage; Et principalement sur la position géographique des isles de la mer du Sud* [...] *Lu à l'Académie des Sciences, le 23 Décembre 1766 & en Janvier & Février 1767* [...] (Paris: P.G. Cavelier, 1767), esp. 12–13, 17–18. As for the opinions of astronomers in other countries on the matter, a similar memoir by Lagrange, read at the Royal Academy of Berlin on November 12, 1767, is more limited in its geographical scope: apart from several locations in Germany, Lagrange mentions only Paris and a couple of places in the Middle East. Cf. Joseph Louis de Lagrange, "Mémoire sur le passage de Vénus du 3 Juin 1769," *Histoire de l'Académie Royale des Sciences et des Belles-Lettres de Berlin* (1766; published 1768): esp. 265–301. There seems, however, to have been plans for an expedition by Berlin's astronomer royal, Johann III Bernoulli, to Lapland at an early stage, but these plans had already been dropped by the time Lalande mentions them in a letter dated Bourg-en-Bresse, October 4, 1768 (UBB, LIa701). Printed in Simone Dumont and Jean-Claude Pecker, eds., *Mission à Berlin: Jérôme Lalande, lettres à Jean III Bernoulli et à Elert Bode* (Paris: Vrin, 2014), 53–54.

Lapland)—both of which lay, as he must have been well aware, within the confines of the Danish–Norwegian kingdom. Maskelyne's letter was written after the Royal Society of London, at a meeting on November 19, 1767, had singled out Vardø and North Cape as possible sites for British Venus transit observations, "unless it was learned that Swedish or Danish astronomers were planning to make use of these stations."[35] The letter to Wargentin reveals that the Royal Society had no idea about the prospective expedition by Hell at this stage. What is more, Maskelyne apparently had such low faith in the abilities of Danish astronomers that he found it futile to encourage them to make observations from these important stations. This explains why he insisted that the Swedes should go to northern Norway to make Venus transit observations in 1769, instead of the Danes:

> The Royal Society wishes strongly that the coming transit of Venus through the disc of the Sun be observed correctly and in the places necessary for computation of the solar parallax. Accordingly, it is likely that it will dispatch observers to regions overseas, but in the meantime, it wishes to know in what places the Swedish observers will conduct their observations [...]. Suitable places for observing the transit of Venus in your country or not far away from it, are Torneå, Kittis, Vardøhus, and the northern Cape of Lapland [i.e., the North Cape]. In these places, the duration of the transit will extend eleven or twelve minutes in time because of the parallaxes. The last of the places mentioned—that is, the extreme Cape of Lapland—fits perfectly well for this observation, since there the altitude of the Sun will rise to eight or nine degrees during both interior contacts, which is higher than in any of the other places; although it will not be considerably lower in Vardøhus, the altitude of the Sun will in Kittis hardly be any higher than five degrees, and in Torneå, hardly higher than four and a half. If only Swedish astronomers would take upon themselves to make observations in all these places! Most of all, however, I sincerely wish that either You, most learned and well experienced man,

35 Woolf, *Transits of Venus*, 164. Among English astronomers, Halley had already pointed to "the northernmost parts of Norway" as an ideal place for observations because of the midnight sun in the *Philosophical Transactions* for the year 1716. Halley, "Methodus singularis," 464. Then, "Wardhuys" or "Wardhus" was specifically mentioned in similar papers from the mid-1760s by a later generation of fellows of the Royal Society. See James Ferguson, "A Delineation of the Transit of Venus Expected in the Year 1769 [...], Read Feb. 10, 1763," *PTRSL* 53 (1763; published 1764): 30; Thomas Hornsby, "On the Transit of Venus in 1769 [...] Read Feb. 13, 1766," *PTRSL* 55 (1765; published 1766): 326–24. Hornsby's paper was also translated into German and published in the *Neues Hamburgisches Magazin* in 1767.

> or the most learned and in astronomical observations so well versed Mr. Mallet, astronomer of the Royal Observatory in Uppsala, would take upon Yourselves to conduct this highly wished-for observation in one of the two above-mentioned places—that is, the Cape of Lapland and Vardøhus—or rather, if possible, one of You at this, and the other at the other site. The task will then certainly be conducted with the highest care, and provide the richest harvest. […] If You and Your highly worthy assistants are willing to take upon Yourselves this task, the Royal Society will be in a position to concentrate its efforts, all the more eager on conducting observations in several other places. […] May I suggest that You, if You agree to observe the transit from the Cape of Lapland or Vardøhus, may also be willing to observe the transit with Gregorian telescopes similar to the English ones, that is, two-feet long? In that way, comparison between the observers will be more eminent and secure.[36]

As to Maskelyne's emphasis on northernmost Norway as a region better suited for observations of the Venus transit than Swedish Lapland, the British astronomer royal in fact contradicted Wargentin, who in the application one year earlier to the Swedish king for extra funding to sponsor the 1769 Venus transit observations had stressed that for this purpose "no place in the whole of Europe, Asia, or Africa is better suited than Swedish Lapland."[37] It might seem strange that Wargentin, as an able astronomer, did not judge the advantages of the northernmost parts of the region in the same way as his British counterpart. For political reasons, however, Denmark–Norway was not likely to allow Swedish astronomers to make expeditions within its territories anyway. Thus it may have been the political man, rather than the astronomer Wargentin, speaking on the above occasion. In other words, a quite consistent blend of internal-scientific and diplomatic considerations lay at the heart of the "research policy"[38] of the lobbyists and decision-makers in Stockholm. Given the negative publicity surrounding Danish–Norwegian activity in 1761, Copenhagen's decision to equip a high-profile Venus transit expedition led by an astronomer of international standing in 1769 is perfectly logical.

---

36 Maskelyne to Wargentin, dated Greenwich, January 5, 1768 (Centrum för vetenskapshistoria, Kungl. Vetenskapsakademien, Stockholm; hereafter: CVH).

37 Wargentin in a letter to the Swedish king, dated January 14, 1767, quoted from Nordenmark, *Pehr Wilhelm Wargentin*, 374.

38 For this term applied to the history of astronomy in eighteenth-century Sweden, see Widmalm, "Science in Transit."

2 The Invitation from Copenhagen: Providence and Rhetoric

One thing must have been clear to the Copenhagen government: Denmark–Norway should seize the opportunity offered by the publicity surrounding the upcoming transit and arrange for a qualified observer to be stationed somewhere in far northern Norway. Vardø was as good a choice as any. For ages, a fortress and a garrison had been stationed there, signaling the strategic importance of this northeasternmost village in Norway.[39] As for selecting the man who would be up to the challenge, the exact reasons why the Copenhagen court cast its eyes on Vienna in search of an astronomer of international reputation to observe the transit of Venus are not spelt out in the available sources. From a strictly internal point of view, by the mid-1760s Hell's credentials as a key figure in European astronomy and an expert specifically on the transits of Venus had been firmly established, so generally speaking he was a fully eligible candidate. Hell being a Jesuit, confessional scruples could have been a hindrance. However, on the eve of the dissolution of the Society of Jesus, anti-Jesuit sentiment was a more live issue in Catholic than in Protestant countries. While the letter of the law strictly forbade the presence of Jesuits on Danish and Norwegian soil,[40] by the eighteenth century it was long since the Reformation had triumphed and consolidated its positions in Scandinavia. Effective measures were still in place to prevent Catholicism from taking root, yet various pragmatic accommodations were in place, such as the tolerance of resident Jesuits in Copenhagen offering services to foreign diplomats and mercenaries.[41] In any case, the Viennese astronomer was going to stay in the realm for only a

39 On the historical significance of the military presence at Vardøhus, see, e.g., G.I. Willoch, ed., *Vardøhus Festning 650 år. Jubileumsskrift* (Oslo: Generalinspektøren for Kystartilleriet, 1960); Randi Rønning Balsvik, "Pomorbyen Vardø og Russland," in *Pomor: Nord-Norge og Nord-Russland gjennom tusen år*, ed. Einar Niemi (Oslo: Gyldendal, 1992), 99–116; Rune Blix Hagen, "Vardøhus som sentrum for dansknorsk statsmakt i nord 1550–1738," in *Forpost mot øst: Fra Vardø og Finnmarks historie 1307–2007*, ed. Randi Rønning Balsvik and Jens Petter Nielsen (Stamsund: Orkana forlag, 2008), 45–60.

40 In the Danish and Norwegian Codes (*Kong Christian den Femtes Danske Lov* and *Kong Christian den Femtes Norske Lov*)—both in effect since the 1680s—the following regulation is found (book 6, chapter 1.3): "Every monk, Jesuit, or member of the catholic clergy, is forbidden, under pain of death, to inhabit or to make any stay in the Danish dominions." Translation in *Report from the Select Committee: Appointed to Report the Nature and Substance of the Laws and Ordinances Existing in Foreign States, Respecting the Regulation of Their Roman Catholic Subjects* [...] ([London]: House of Commons, 1816), appendix, 433.

41 For an analysis of the religious aspect of Danish–Norwegian state politics in the early modern period, see Sølvi Sogner, "Fromhed styrker rikene," in *Norsk innvandringshistorie*, ed. Knut Kjeldstadli (Oslo: Pax forlag, 2003), 1:240–58; English summary in Grete

limited period. The prestige involved in the international quest to determine the size of the solar system obviously mattered more than religious concerns. Economic considerations may have been an issue as well: after all, members of Catholic orders were known to subsist on modest means.

The decision to contact Hell was taken in the foreign ministry on August 18, 1767, with the first meeting between Hell and the Danish ambassador taking place in Vienna on September 5.[42] In the subsequent correspondence between ambassador Johann Friedrich Bachoff von Echt (1710–81) and the Danish foreign minister, Johann Hartvig Ernst Bernstorff (1712–72, in office 1751–70), the ambassador stressed that "just as little as any religious person is mindful to acquire riches for himself, neither will Father Hell demand any payment, except coverage of all the costs of the voyage itself." Furthermore, "as far as the costs of the voyage are concerned," the ambassador had reason to believe that, "considering the frugality in which the Jesuits are accustomed to live," no huge expenses would be incurred.[43] With backing from the government in Copenhagen, Bachoff then made direct contact with Kaunitz.[44] The invitation was a question of diplomacy at the highest level, as the purpose was to obtain for Hell a temporary leave from his post as court astronomer. But Hell was not only a servant of the court in Vienna; he also needed to obtain permission from the Society of Jesus. Regrettably, the correspondence between Hell and the Jesuit superior general, Lorenzo Ricci (1703–75, in office 1758–73), apart from the drafts for a couple of letters written by Hell while already in Vardø, has not been found.[45] In any case, by December 10, 1767, three months after the first meeting between Hell and the ambassador (during which period they consulted regularly not only about necessary formalities but also about practicalities

---

Brochmann and Knut Kjeldstadli, *A History of Immigration: The Case of Norway 900–2000* (Oslo: Universitetsforlaget, 2008).

42 "[Bachoff, the Danish ambassador in Vienna] will be ordered to make confidential, preliminary talks with Father Hell to see if, and under what conditions, he could be willing, on His Majesty's costs, to observe the transit of Venus in front of the Sun from Vardøhus." Tyske Cancelli, kopibogen, entry under August 18, 1767, Rigsarkivet, Copenhagen (hereafter: RA); Privatarkiv no. 1846. Andreas Schumacher. "I talked the day before yesterday to Father Hell, who made no difficulty whatsoever about visiting me." Tyske Kancelli, Udenrigske Afdeling, Kejseren, Gesandtskabsrelationer 1767–68, letter from Bachoff to Bernstorff in Copenhagen, dated Vienna, September 7, 1767 (RA). Further comments on the invitation of Hell are made in letters from Bachoff to Bernstorff, dated Vienna, September 3, October 29, and December 10, 1767 (RA).

43 Bachoff to Bernstorff (RA), dated Vienna, September 7, 1767, and Vienna, December 10, 1767.

44 Bachoff to Bernstorff (RA), dated Vienna, December 10, 1767.

45 A visit to the Archivum Romanum Societatis Iesu in Rome in October 2005 yielded no results.

like the best timing of the trip), permission from both Superior General Ricci and from the Austrian authorities had been secured.[46] The official letter of commission by the Viennese court was issued on February 24, 1768.

At this point, it is also worth making an attempt to reconstruct Hell's own perspective on the matter. The few autograph sources that are extant all originate from a later date, and contain a few puzzles.

From one angle, as Hell commented in one of the relevant accounts published later on, the invitation was certainly "worthy of [his] soul born for the obtaining of merit in the realm of the sciences."[47] However, as he confessed in the same retrospect, "in the year 1767 nothing was further from my thoughts, than to leave—even for a moment—my post at the observatory in order to observe the transit of Venus in front of the Sun that was going to take place in 1769, invisible to me in Vienna." He would have been content to confine himself this time to the role of a theoretical astronomer, relying on the results of others in doing his own calculations.[48] He had good reason for this resignation. He must have thought that his belonging to the Society of Jesus apparently made his chances of traveling to the (Protestant) realm of the midnight Sun, where the transit was visible, as meagre as seeing anything of it in the Austrian capital, especially "at a time when the Society endured the severest of persecutions in Catholic kingdoms."[49] The invitation from the Danish ambassador also came as a surprise because, as Hell alleged, he "had so far never cultivated any scientific correspondence [*commercium litterarium*] with anyone in Denmark." This is a point that receives special emphasis in Hell's rendering: as he further explains, he was convinced that no one had even heard of his name "in that country, especially not in Copenhagen, and even less so among the highest ministers at the king's court."[50]

Hell was here ignoring—hardly innocently—a letter in his own hand, dated Vienna, October 5, 1766 and addressed to Bugge, already mentioned as a participant in the failed Danish Venus transit efforts of 1761.[51] Hell thanked Bugge

46 Bachoff to Bernstorff (RA), dated Vienna, December 10, 1767.

47 Maximilian Hell, *Observatio transitus Veneris ante discum Solis die 3 junii anno 1769* […] (Copenhagen: Gerhard Giese Salicath, 1770), 1.

48 Hell, *Observatio transitus Veneris* […] *1769*, 1.

49 At the time when Hell received the invitation, the general suppression of the Society (and thus its demise in the Habsburg realms) in 1773 was still a matter of the future, but it had already been accomplished in Portugal (1759), France (1764), and the countries of the Spanish crown (1767). The quotation is from the unfinished "Introductio ad Expeditionem litterariam ad Polum Arcticum," published with an English translation in Aspaas, "Maximilianus Hell," 383–417 (here 409).

50 Aspaas, "Maximilianus Hell," 408–9.

51 See Pinzger, *Hell Miksa*, 1:3–5.

for a previous letter "especially because You, by means of that letter, have wished to initiate a truly erudite scientific correspondence from Your part."[52] It emerges that Bugge had sent Hell his observation of a lunar eclipse on February 24, 1766 in Copenhagen, and Hell now urged him to observe the moons of Jupiter as well, and to communicate these as well as other observations to him in the future: "Trust me, nothing more agreeable happens to me, than when I, through scientific correspondence [*per commercium litterarium*] obtain works by means of which I am able to make my *Ephemerides* precious and useful to others."[53]

The flattery evidently worked, as correspondence between Hell and Bugge continued over the years to come.[54] While still very young, in the 1760s Bugge was emerging on the Copenhagen academic scene as a figure of some weight. As early as 1759, at the age of nineteen, he was involved in the official survey of Denmark; in February 1761, he presented the results of his work to the Danish Royal Society, which then hired him for future surveying; and later in the same year he became entrusted with the task of observing the transit of Venus from Trondheim.[55] In 1777, after the death of Christian Horrebow and the subsequent removal of the *professor designatus* (*designatus* implied being formally appointed but not yet in office), Peder Horrebow the Younger (1728–1812), Bugge was to emerge as astronomer royal of Denmark. He was clearly a man with influential supporters, including, as we have seen, the prominent member of Copenhagen's Royal Society Kratzenstein, and quite probably also the society's president, Otto Thott (1703–85). In a report dated January 8, 1768 and preserved among Thott's papers, Bugge refers to Hell as "the most learned and diligent astronomer of our age."[56] Thott who was also the highest secretary of Det

52 Pinzger, *Hell Miksa*, 1:3.

53 Pinzger, *Hell Miksa*, 1:4–5.

54 Not all letters are extant. Among those that have been available for the present study are Hell to Bugge in Copenhagen, dated Vienna, April 14, 1768, July 12, 1777, and March 5, 1788; and Bugge in Copenhagen to Hell in Vienna, dated January 1784, April 18, and August 4, 1788 For a full list of letters, see https://doi.org/10.18710/CVW8YU.

55 Asgeir Lomholt, *Det Kongelige Danske Videnskabernes Selskab 1742–1942: Samlinger til Selskabets Historie* (Copenhagen: Munksgaard), 1 (1942): 511, 530; 4 (1961): 15–32; Thykier, Gyldenkerne, and Darnell, *Dansk Astronomi*, 2:254–57; Helge Kragh, *Dansk Naturvidenskabs Historie*, vol. 2 (with contributions from Frank Allan Rasmussen, Anja Skaar Andersen, Henrik Kragh Sørensen, and Michael Sterll), *Natur, Nytte og Ånd 1730–1850* (Århus: Aarhus Universitetsforlag, 2005), 93–100.

56 Thomas Bugge, "Observatio eclipseos lunaris, quæ anno 1768 tempore astronomico die 3 Januarii, tempore autem civili die 4 Januarii contigit, factæ Havniæ," manuscript signed "Havniæ d: 8 Januarii 1768" (KB Copenhagen, MS Thott 822. 4°): "I used the same method to observe the lunar eclipse of February 24, 1766, which I shared with the most enlightened and diligent astronomer of our age, Father Maximilianus Hell of Vienna. This highly

Danske Kancelli (in effect, interior minister of Denmark), and—on Hell's own account—one of the three men responsible for Hell's invitation (the other two being Foreign Minister Bernstorff, already mentioned, and Privy Councilor Count Adam Gottlob Moltke [1710–92]).[57] Not only is Hell's claim of having had no scientific correspondence with anyone in Denmark before 1767 incorrect; his Copenhagen interlocutor also had access to the decision-makers, and may well have prompted them to consider Hell for the Vardø expedition (a hypothesis that, in lack of sources, cannot be corroborated).

The other puzzling claim Hell made at the beginning of the *Observatio transitus Veneris* [...] *1769* is that by the time he first met the Danish ambassador on September 5, 1767, he "had already rejected two invitations to go abroad" for the 1769 Venus transit observation.[58] Hell gave reasons for these rejections, referring to his "failing bodily strength"[59] but nowhere revealed the identity of those who had allegedly invited him. This is not surprising. Administrative documents demonstrate that the authorities in Copenhagen asked for secrecy when they gave the Viennese ambassador orders to contact Hell.[60] Had he declined the Danish invitation, it would certainly have been very difficult to find evidence for it.

One may speculate that, even though the Society of Jesus was already experiencing troubles, one of the mysterious invitations arose from the Jesuit network. As early as 1766, Boscovich was planning an expedition to North America for the upcoming transit of Venus under the auspices of the Royal Society of London, of which he was a member. Baja California in present-day Mexico was later fixed as the site of his observation.[61] In the same year, the Spanish

famous man compared these observations of mine with his own, and found from this comparison that Copenhagen lies seventeen minutes twenty-seven seconds in time west of Vienna."

57 Hell, "Introductio ad Expeditionem litterariam," in Aspaas, "Maximilianus Hell," 406–7.

58 Hell, *Observatio transitus Veneris* [...] *1769*, 1. Cf. Hell, "Introductio ad expeditionem litterariam," in Aspaas, "Maximilianus Hell," 416–17.

59 Hell, "Introductio ad Expeditionem litterariam," in Aspaas, "Maximilianus Hell," 408–9. However, in the other relevant account, the number of his years and the feebleness of his body soon appear as factors overcome by the exhilaration caused by the Danish invitation: "As though I had been weakened by a surprising slap, not laying much weight on my already well-advanced age, nor on the difficulties of traveling, the risks to your life, or the danger imposed upon my feeble bodily strength by the inclemency of the climate in the Arctic [...], I embarked upon the journey to the Arctic in a lofty and fearless spirit." Hell, *Observatio transitus Veneris* [...] *1769*, 1–2.

60 "Unter der Hand," Tyske Kancelli, kopibogen, entry under August 18, 1767 (RA); "Sonder sous main," Bernstorff to Bachoff in Vienna, dated Copenhagen, August 18 1767 (RA).

61 The secretary of the Royal Society, Charles Morton (1716–99), sent Boscovich a letter of invitation early in 1766. In his response, dated Pavia, May 9, 1766, Boscovich expressed

government also informed the Royal Society that they would allow Boscovich to travel through its dominions along with "another member of the Jesuit order."[62] Could this fellow have been Father Hell? Given the circumstance, already reiterated in Chapter 3, that Boscovich and Hell were no close associates, Hell can hardly have ever been a candidate of Boscovich for a companion on his expedition. On the contrary, Liesganig—who along with Scherffer appears to have been Boscovich's main Viennese contact—was approached by the Dalmatian savant.[63] Liesganig eventually failed to obtain permission to participate in the expedition from Chancellor Kaunitz, who moreover was also reluctant to grant Boscovich the necessary leave from his position in Pavia.[64] Boscovich then turned to the Jesuit Christian Mayer, court astronomer of Mannheim and—like himself—a fellow of the Royal Society of London, asking him to join in the expedition instead of Liesganig.[65] However, the expulsion of the Jesuits from Spain and all its colonies in April 1767 finally brought an end to these plans, and in a letter to Boscovich dated May 12, 1767, the president of the Royal Society effectively withdrew the invitation.[66] There appear to have been

willingness to undertake the expedition. See Rita Tolomeo, ed., *Ruggiero Giuseppe Boscovich: Lettere per una storia della scienza* (*1763–1786*), Accademia Nazionale delle Scienze detta dei XL: Scritti e documenti 9, Documenti Boscovichiani 3 (Rome: Accademia Nazionale delle Scienze detta dei XL, 1992), 283–86. Only then was the formal decision to invite Boscovich taken by the Royal Society, in a meeting on June 5, 1766. See Woolf, *Transits of Venus*, 163. Rumor then spread quickly, and the plan for Boscovich's expedition is mentioned, for example, in a letter from Lalande to Weiss in Trnava, dated Paris, October 14, 1766. See Vargha, *Correspondence de Ferenc Weiss*, 61–62.

62 Morton to Boscovich in Pavia, dated London, December 22, 1766, see Tolomeo, *Boscovich: Lettere*, 298–99.

63 See Tolomeo, *Boscovich: Lettere*, section entitled "Ruggiero Giuseppe Boscovich: Carteggio con corrispondenti diversi su un'ipotesi di viaggio in California (1766–1767)," containing twenty-eight letters (without Hell mentioned in any of them), 281–386; cf. 29–35, 355–58.

64 After nearly three months of lobbying, Liesganig in a letter to Boscovich in Pavia, dated Vienna, February 26, 1767, finally found himself forced to say "adieu Amerique!" See Tolomeo, *Boscovich: Lettere*, 311–12.

65 Boscovich to Morton in London, undated but probably—to judge from Morton's answer of May 12, 1767—dated April 22, 1767. Tolomeo, *Boscovich: Lettere*, 319–20; cf. 321. Mayer mentions plans to accompany Boscovich on this expedition in his long treatise on the Venus transit: "That I, having quitted America, where I was supposed to travel two years ago, financed by the Royal Society of England, arrived in this city [i.e., St. Petersburg] instead." *Ad Augustissimam Russiarum omnium Catharinam II Alexiewnam Imperatricem expositio de transitu Veneris*, 84.

66 Morton to Boscovich in Pavia, dated London, May 12, 1767. See Tolomeo, *Boscovich: Lettere*, 320–21.

no other plans for Venus transit expeditions involving Jesuit astronomers put forward before September 1767.

In the end, it was Chappe d'Auteroche—whom Hell had known since his visit to Vienna in 1761—who went to Baja California along with two Spanish observers. They managed to observe the Venus transit, but most of the company—Chappe included—perished soon after from an epidemic disease.[67] Boscovich stayed in Italy and saw nothing of the transit, whereas Mayer, upon advice from Lalande, became one of the Venus transit observers financed by the Russian Academy of Sciences in 1769. He was, however, not invited until late 1768.

As for other possible inviters of Hell—governments or scientific societies—one might proceed by elimination. Sweden is not likely to have reckoned with foreign observers, since the Swedish Academy of Sciences had sufficient personnel within its own ranks and was in any case reluctant to engage foreigners for patriotic reasons.[68] The same applies to France. As for Britain, Hell was neither a fellow of the Royal Society of London nor is he known to have been in personal contact with British astronomers before the 1770s.[69] Further possible sponsors asking the Viennese court astronomer to travel to faraway territories would be Portugal or Spain, but the fact that the expulsion of the Jesuits from their lands took place in June–September 1759 and February–April 1767 respectively makes such an invitation highly unlikely.

Paradoxically, if Hell received an invitation from a national government or ruler, the situation in Catholic countries around 1766–67 makes a non-Catholic power more likely to have been the inviter. One such power with overseas

67 Chappe's observations and journal was published by Cassini de Thury as the *Voyage en Californie* (Paris, 1772). Portions of this work and formerly unpublished accounts of Chappe's travel companions have been collected in Nunis, *1769 Transit of Venus*.

68 In a remark in his application for funding to the Swedish king, Wargentin plays the patriotic card in a way that almost amounts to blackmail: "Most gracious King! Able men are to hand in our country, but the academy possesses no funding either for their travel gear, when that time comes, or for acquisition of the necessary number of instruments. Instead, the academy will some day soon be forced to admit to the foreign academies its inability to fulfil their wishes in this matter, so that the foreign academies may have the time to consider dispatching some astronomers to us themselves […]. His Royal Majesty's great care for the sciences, his grace for his academy and care for the honour of his kingdom in such an extraordinary case, would hardly allow the academy to make to foreigners such a confession of its poverty." Quoted from Nordenmark, *Wargentin*, 375–76.

69 When contact had finally been established in the context of Hell's assignments connected with the construction and equipment of the new observatory in Eger, the other party's response was slow and meagre, suggesting that contact with Hell may not have been top priority for Maskelyne. For details, see below, Chapter 8.

colonies would be the Dutch Republic. Indeed, the Dutch United East India Company (Verenigde Oostindische Compagnie [VOC]) is known to have cooperated with Delisle concerning the planning of a Venus transit observation from the beaches of Batavia in 1761. By 1769, however, this situation had changed. The resident amateur astronomer Johan Maurits Mohr had in the meantime, on his own initiative, constructed a private observatory and acquired high-standard instruments from Europe, without financial support from either the VOC or the state. No other observations are known to have been made from Dutch colonies in 1769, and given the business-oriented emphasis of the VOC, it appears unlikely that it would be prepared to spend money recruiting foreigners for such a task.[70]

One last possible inviter of Father Hell would be the Imperial Academy of Sciences in St. Petersburg. The academicians of Russia had already started planning their expeditions in the spring of 1767, and they were quick to call for help from abroad. With the strong links between the St. Petersburg Academy and the German-speaking world, a tempting conjecture would be that the leading astronomer of the Austrian Empire might have been among those invited. However, no evidence of contact between Hell and the Academy of St. Petersburg in this period has been found.[71] To be sure, one cannot exclude the possibility that Hell—or perhaps some correspondent of his—interpreted the announcement of Empress Catherine (1729–96, r.1762–96) in the spring and summer of 1767 as an invitation aimed at the likes of himself.[72]

---

70 Huib J. Zuidervaart and Robert H. van Gent, "'A bare outpost of learned European culture on the edge of the jungles of Java': Johan Maurits Mohr (1716–1775) and the Emergence of Instrumental and Institutional Science in Dutch Colonial Indonesia," *Isis* 95 (2004): 1–33; Van Gent, "Observations of the 1761 and 1769 Transits of Venus from Batavia (Dutch East Indies)," in Kurtz, *Proceedings*, 67–73.

71 Hell did in fact cultivate some contact with members of the academy in St. Petersburg in the early 1760s, as is evident from some volumes of the *Ephemerides* (cf., e.g., the appendix of the 1762 volume [published 1761], 92–94). Among the manuscripts of Hell at the WUS, letters exchanged between Hell and Gerhard Friedrich Müller (1705–83) as well as Joseph Adam Braun have been found: Müller to Hell, St. Petersburg, June 6, 1761; Hell to Braun, Vienna, February 8, March 31, April 10, and May 5, 1761; Braun to Hell, St. Petersburg, May 5, 1761. These letters all concern the Venus transit of 1761. Unfortunately, evidence for Hell's correspondence in the years 1765–68 is far more meagre than for the period around 1761; cf. the overview in https://doi.org/10.18710/CVW8YU.

72 In March 1767, Empress Catherine issued a letter, distributed widely across the Republic of Letters, asking for immediate action to be taken in order to ensure a proper Venus transit observation program, with observers dispatched all over the Russian realm. Aspaas, "Maximilianus Hell," 230–33. Translation of Catherine's letter in *Authentic Memoirs of the Life and Reign of Catherine II: Empress of All the Russias; Collected from Authentic MS's* [...] (London: B. Crosby, 1797), 72–73.

Hell's own retrospective, cryptic testimonies in the *Observatio transitus Veneris* (published February 1770) and the drafted introduction to the *Expeditio litteraria* (written around 1772–73) are thus the only sources to support his allegation of having received and rejected two invitations for Venus transit observations before receiving the one from Copenhagen, leaving the matter highly obscure. Therefore, there is reason to believe that the invitations are fabricated. As shown above, Hell also misrepresented his connectedness in Denmark—something he normally would have taken pride in. One may surmise that both the denial of contact and the assertion of invitations were rhetorical devices intended to amplify an important aspect of Hell's meaning in the relevant parts of these two texts, the function of which was to contextualize his scientific contribution in terms of his identity as a Jesuit. The invitation conveyed by Ambassador von Bachoff, and the consequent opportunity for him to lead the expedition, is consistently represented by Hell as *Deus ex machina*: as a demonstration that God had a purpose for him, and that the planned expedition was under providential dispensation. Pretending that no human networking activity (especially on his own side) had prepared it was one way of accentuating this message. Claiming that he had remained firm in his determination not to leave his post in Vienna even in the face of two previous (unspecified) invitations, but grasped the import of the third one, was another. Immediately after the vague hint in the introduction to the *Expeditio litteraria* at the two rejected invitations, and immediately before the claim of not having had any correspondence in Denmark, Hell confesses to have been "overwhelmed by the unexpected proposal presented by His Excellency Count von Bachoff. Confused, I began suspecting that some hidden plan of Divine Providence was behind this experience of mine."[73] His subsequent account of brooding over the restricting conditions despite which he was chosen by the Danish government—like his being a Jesuit, or the severe competition posed by excellent French and British astronomers for such a distinction—is described by Hell as a conversation with his soul about the ways of providence: a Jesuit-style spiritual exercise:

> As I rolled over in my mind these and whatever additional dispositions from the part of Divine Providence that may be at work in this summoning, I was overcome with doubt concerning what I should answer. At last, however, focusing all my concentration on Divine Providence, I decided

73 "Introductio ad Expeditionem litterariam," in Aspaas, "Maximilianus Hell," 408–9.

> to declare my thoughts in such a way that all further development in this matter would be depending on the Will of God, not on myself.[74]

In practical terms, this meant that while Hell signaled to von Bachoff his willingness to accept the invitation, he left it to the ambassador to negotiate with Hell's own Viennese superiors the necessary permissions. Once these were secured, Hell's account reaches its rhetorical climax:

> As I heard of this assent, which so easily and readily had been obtained from Her Highness our Empress (without any effort from my part), I at once started pondering this strange and exceptional plan of Providence, which caused my spirit to be lifted with a lively hope of a complete success in this highly strenuous expedition. Hence, free from all fear associated with being exposed to the utmost dangers to my life and health, I found myself expecting nothing but luck and success in every respect; so completely convinced was I that this invitation, which had come about in such a strange manner and without any interference of my own, was altogether the work of Divine Providence. I should like to stress this, in order that those who have nurtured suspicions that this expedition was made to happen through a hidden and not very honorable scheming of some sort, should realize that nothing whatsoever came about as a result of any actions from my part. The rulers were the protagonists, whereas the means and end of this whole expedition is to be attributed solely to GOD's Providence and planning.[75]

Hell's rhetorical defense of his integrity as a person, as a scholar, and as a Jesuit needs to be read against the background of the centuries-old stereotypes about Jesuits as especially given to plotting and conspiracy ("a not very honorable scheming of some sort"), as well as the subsequent rumors and allegations about his "falsification" of the data gained from the 1769 Venus transit observation. To avert suspicion regarding the circumstances of his invitation, Hell enunciated a rendering of it in which it appeared as nothing other than the work of divine providence. Thus, placing his fate in the hands of God, Hell expressed willingness to go to Vardø already during his very first meeting with the ambassador of Denmark.

---

74 "Introductio ad Expeditionem litterariam," in Aspaas, "Maximilianus Hell," 410–11.

75 "Introductio ad Expeditionem litterariam," in Aspaas, "Maximilianus Hell," 413–14.

3 From Vienna to Vardø

The Arctic part of the expedition might have lasted only a few months, but already in the negotiating phase, von Bachoff reported home that he had requested that Hell consider the importance of the mission and not wait with the journey until 1769, and that the astronomer himself was thinking of departing already in the autumn of 1768.[76] The proposition of the Danish court was to set the date even earlier: the spring, so that the summer could be carefully turned to preparations in Copenhagen, and observations could be carried out en route in Trondheim, where he could conveniently spend the winter before proceeding north to Vardø early in the spring of 1769.[77] Von Bachoff was instructed not to be thrifty on advances, and he duly provided Hell with an acquittance on 1,314 florins (the full cost of the expedition being estimated at 6,398 *Reichsthalers*).[78] With regard to the aftermath of the expedition itself, Hell had even more ambitious plans. In March 1768, just a few weeks before his departure from Vienna, he sent the following letter to the pope:

> Most humble prayers to His Holiness Pope Clement XIII for obtaining permission for dispensations because of a journey to be undertaken through non-Catholic lands upon call from the king of Denmark.
>
> Since upon invitation from His Most Serene King of Denmark, communicated through His Ambassador to the Imperial Court in Vienna Count von Bachoff, and upon permissions from Her Highness the Empress Maria Theresa and from the general of the Society of Jesus His Most Reverend Father Laurentius Ricci, a long journey is to be undertaken, funded by the king of Denmark, beginning this spring and lasting for several years, passing through Saxony, Brandenburg, Denmark, and Sweden to the farthest island of Norway by the Arctic Sea, called Vardøhus, a place where I will have to stay for a rather long period of time because of astronomical observations that I have been ordered by the king of Denmark to undertake, followed by a return journey to Vienna, through the whole of Sweden and Denmark and then perhaps through Holland, Belgium, England, France, and the entire [Holy Roman] Empire, and since this journey and sojourn will befall me and my assistant in non-Catholic lands of this kind, in which neither official churches nor other places of

76 Bachoff to Bernstorff in Copenhagen, dated Vienna, October 29, 1767 (RA).
77 Bernstorff to Bachoff in Vienna, dated Copenhagen, February 20, 1768 (RA).
78 Pinzger, *Hell Miksa*, 1:80.

> Catholic worship are found and no worship of the Catholic religion is tolerated, and where our religious dress will need to be exchanged for secular clothing and we on the whole will have to behave in public in such a way that we not only avoid incurring the suspicion of being priests, but on certain occasions even must avoid being recognized as Catholics, we hereby beg, on behalf of myself, my assistant, and my servant, in order to avoid danger, to receive spiritual solace, and to sedate scruples, to be bestowed by His Most Holy Pontiff the most gracious permission for the utterly necessary dispensations that are stated below.
>
> *First*, for as long as we stay among non-Catholics, and even when traveling among Catholics, because of the strenuous labors both day and night as well as the incommodities caused by the conditions of traveling, and not least in order to avoid being recognized as priests while among non-Catholics, we beg most humbly to be freed from the obligation of reciting the breviary.
>
> *Second*, we beg most humbly to be allowed to minister at domestic altars of Catholic ambassadors, whenever we find such persons, and to be allowed to celebrate Mass upon a portable table that we will bring with us in secret, either in private rooms or at least in tents, during holidays and Sundays.
>
> *Third*, in the event of necessity, for as long as we stay in non-Catholic lands we beg most humbly to be allowed to eat meat even on days prohibited by the church when this cannot be avoided.[79]

In other words, the Jesuit priest prepared himself and his associates for a temporary existence as "crypto-Catholics." We have seen how profoundly Hell's scientific persona had been shaped around his identity as a Catholic over the previous decades. Yet, for the sake of the expedition's success, he soberly acknowledged a need for dissimulation, to the extent of abandoning the distinctive garment, habits of worship, and diet of the Jesuit order. A good decade earlier, a stock of 104 pairs of shoes as well as wigs and countless other items of clothing characteristic of a representative of the service nobility emerging from a middle-class background, together with ones obtained with the specific purpose of integration with the colonial elite, had been indispensable to boldly mark out and fix von Jacquin's identity as a scientific traveler in the

79 Hell to Pope Clement XIII, dated Vienna, March 5, 1768. Vatican See, Archivio Segreto Vaticano, "Archivio della Nunziatura Apostolica in Vienna," 136:fol. 45^{r} (secretary's copy).

Caribbean.[80] Jesuits traversing the northern wilderness under Protestant control needed to be more circumspect about revealing their true character.

It is also noteworthy how vaguely Hell described the duration and expanse of his expedition. The extraordinary invitation may have stirred up the imagination of the otherwise sober and even-tempered servant of God. He may even have been tempted to envision himself in the persona of the scientific field-worker-celebrity steadily emerging as the eighteenth-century European public was exposed to reports about men of learning who heroically defied hostile climates in order to expand the stock of knowledge and share new discoveries. Hell's letter to the pope reveals a desire to obtain license for temporarily abandoning his character as an ordinary member of the Society of Jesus, with the goal of carrying out research "for several years" and then disseminating its results throughout virtually the whole of Western Europe. The detour on the return journey "through Holland, Belgium, England, France, and the entire [Holy Roman] Empire" could have had no other envisaged purpose than further consolidating his already considerable fame and expanding the network built via the *Ephemerides*. Hell must have been dreaming of lecture halls packed with members of the learned and the curious part of the public; reports in the local press for the information of those who missed the presentations; audiences with royalty; intimate personal conversations with correspondents in the Republic of Letters. The publicity earned for Catholic knowledge by resorting to such means of advertisement—stock-in-trade for eighteenth-century savants—seemed to be well worth the compromises on externalities solicited from the supreme pontiff.[81]

Answer from the Holy See reached Father Hell when he was already in Danish-ruled Traventhal (not far from Lübeck) on May 31, 1768. The reply itself is not known to have survived. However, Hell's assistant noted the following sarcasm in the travel diary:

> [The secretary of the foreign minister] Mr. Temler delivered to us letters, which he had brought with him from Vienna to Denmark, from Denmark to Holstein, and then hither [to Traventhal]. One letter was from Father Antonius Pilgram, another from the Roman court. Our Holiness Clement XIII bestowed upon us the right to minister at a portable table, provided

80 Klemun and Hühnel, *Nikolaus Joseph Jacquin*, 83–87.

81 One would assume that a European grand tour such as this would also have required the assent of Hell's employer, the empress, but there is no surviving document in which he voiced such a request.

> that no one sleeps in the room at night. Dispensation from canonical hours and abstinence from meat was not granted, no doubt because the pontiff was not well informed. If he had perceived the circumstances of the journey, the nature of the roads, the way of life, and the sheer amount of fatigue involved, he would definitely have been affected often enough not only by compassion but even horror, and on his own initiative granted even more dispensations than those he had been asked for. However, he obviously thought this excursion of ours was undertaken as any other holiday for pleasure's sake, with the aim of reaching the idyllic Italian gardens, having been told so by those whose job it was to inform him about the application.[82]

It is easy to agree with Sajnovics: neither the destination nor the travel route promised the pleasures of "idyllic Italian gardens." If one is to believe Sajnovics's slightly anecdotal account of the audiences the two Jesuits had with the imperial couple before their departure, the empress had a clearer notion of the circumstances awaiting them: "But my dears, she interjected, shall you not be harmed by the heavy cold—do you have good fur coats?"[83]

The two Jesuits rolled out of Vienna on April 28, 1768, carrying letters of instruction by Kaunitz, addressed to Austrian envoys at the main stations of their journey, requiring these to render the travelers all necessary help. The trip overland took them through Prague, Dresden, Leipzig, Hamburg, Altona, and Lübeck. As we learn from Sajnovics's travel diary, even on this apparently comfortable stretch, accidents might occur: opening their suitcase upon arrival in Prague on May 2, they found their barometer and thermometer broken, and their clothes covered with quicksilver.[84] They also commented on the facilities and the collections of the Jesuit colleges where they stayed. Sajnovics thought that those in Prague were inferior even to what he had experienced in Trnava, but in Dresden he was quite impressed—all the more remarkable as in Protestant Saxony the Catholic Church could not hold property, so these were rented premises. General hatred of Catholics there is taken note of, as well as the widespread and seemingly limitless consumption of beer in place of wine.[85] (Indeed, the poor quality and meager quantity of the food and drink they were offered at most places in the German-speaking lands is a recurrent theme in the diary, somewhat defying von Bachoff's notions of monkish austerity.)

82 Sajnovics's diary, proofread version (WUS), entry on May 31, 1768.
83 Cited in Pinzger, *Hell Miksa*, 1:71.
84 Sajnovics, travel diary, proofread version (WUS), on May 2, 1768.
85 Sajnovics, travel diary, proofread version (WUS), on May 3, 1768.

Wherever they stayed for more than brief stops, they took the opportunity presented by the journey for socializing with local scholars. Thus, in Leipzig they met mathematician and astronomer Gottfried Heinsius (1709–69), formerly working in St. Petersburg with Euler (1734–1800), and two Hungarians: father and son Bél of Pressburg (Bratislava) origin, the elder being a professor of poetry and the younger a doctor of medicine.[86] As for the latter, "the physiognomy and gestures of the man reminds a lot of our Pray."[87]

After passing through some north German towns, including the bustling port city of Hamburg, Hell and Sajnovics entered Danish territory and had an audience with King Christian VII in Traventhal on June 1, 1768. The king, foreign minister, and a considerable entourage of crucial ministers were about to leave the country on the young monarch's Grand Tour of Germany, England, and France. According to Sajnovics, their young patron proved to be very well versed in the themes relevant to their mission. He was especially interested in fallback scenarios, in case the observation of the transit of Venus became frustrated by adverse conditions, and was very pleased to learn about other useful scientific research that they were planning to carry out in Vardø. From the port in Travemünde outside Lübeck, Hell and Sajnovics proceeded by ship to Copenhagen, where they stayed for three weeks. Of this period, there is unfortunately no record in any of the portions of the diary by Sajnovics, though from a report to Kaunitz by the secretary of the Austrian embassy in Copenhagen we learn that the Viennese Jesuits met Horrebow, and "as it seems, the presence of Father Hell is utilized here to improve the very ordinary local observatory."[88]

As Hell and Sajnovics arrived in Copenhagen, on the back of a storm that left the expedition leader sea sick,[89] they were received cordially by the lord chamberlain, Count Moltke, who spared no efforts taking care of the imperial astronomer of Vienna and his assistant over the coming weeks. In one of his letters to the superior general of the Society of Jesus, Hell describes how he was invited by Moltke to a particularly

86 These were the son and the grandson of polymath Mátyás (Matej) Bél, already mentioned in Chapter 1. After studies at various German universities, Károly András (Carl Andreas) Bél (1717–82) had his first appointment in Leipzig in 1742 and became ordinary professor in 1757. From 1764, he edited the important journal *Nova acta eruditorum*, where Hell's work was often reviewed and where the call for subscriptions of the planned *Expedition litteraria ad Polum arcticum* was later published.

87 Sajnovics, travel diary, proofread version (WUS), on May 13, 1768.

88 ÖStA, Haus-, Hof- und Staatsarchiv, Gesandtschaftsberichte, fasc. 63. Cited in Pinzger, *Hell Miksa*, 1:75.

89 Sajnovics, letter to Splenyi in Trnava, dated Copenhagen, June 21, 1768 (contemporaneous copy preserved at Magyar Tudományos Akadémia Könyvtára, Budapest, irodalmi levelezés [hereafter: MTAK IL] 2-r, 13. sz.).

> lavish and truly royal dinner, which all ministers at the royal court attended, as well as envoys and ministers from foreign courts. Before dinner, the illustrious minister introduced me to every single ambassador in the assembly hall, spelling their names out loud. During the meal itself, I was placed between the ambassadors of the majesties of Naples and England respectively; not far from me were ambassadors from such countries where our Society is abolished.[90]

It was also in Copenhagen that the itinerary for the rest of the journey was carefully designed, a process that had begun even before Hell's release from Vienna became known. Various memoranda by Copenhagen residents with personal experience of the conditions for traveling in northernmost Norway were submitted to this effect, but an opinion was also requested from the bishop of Trondheim (Nidaros), Johan Ernst Gunnerus (1718–73), given his good knowledge of the terrain. Gunnerus was a man of broad learning. Having studied and taught theology, philosophy, and natural law under Wolff and other notabilities in Halle and Jena for more than a decade, he was appointed bishop in 1758. His diocese covered virtually half the Norwegian territory, from the coastal areas of today's Møre through entire Trøndelag and all the way up to the Russian border. Famously, soon upon his arrival in Trondheim, Gunnerus established the Norwegian Society of Sciences and Letters, which earned a royal epithet—and the patronage of King Christian VII—in 1767. It was upon his advice that Borchgrevink, who had already been to the region of their destination three times, joined the team ("as a botanist, who studied with Linnaeus in Sweden for a year"—as Sajnovics introduces him).[91] While the elderly minister Moltke served as host, inviting Hell and Sajnovics for dinner every other day during their entire three-week stop in Copenhagen, responsibility for the logistics of the expedition as such was in the hands of Otto Thott. Minister of the interior and responsible for all affairs of the church and higher education, including serving as president and host of the sessions of the Royal Danish Society of Sciences, Thott was the obvious candidate to handle the affairs of this high-profile expedition. In Hell's letter to the Jesuit general, Thott is praised for his expediency and is also portrayed as an excellent host: "During a costly dinner party, at which all prominent members of the Society of Sciences" were present, Thott

90 Hell to the superior general of the Society of Jesus in Rome, dated Vardø, January 15, 1769 (draft, WUS).

91 Sajnovics, travel diary, proofread version (WUS), August 8, 1768. On Borchgrevink and his career in general, see Nils Voje Johansen, "Vitenskap som springbrett."

> illustrated all branches of the sciences with a splendid piece of Chinese art. Then, as we rose from the table in waiting for the next course, a new piece of art, equally splendid, was placed on the table. The first part of the artwork, which measured twelve palms in its total length, portrayed the astronomical tower of Copenhagen as the place where my journey began, the second and third parts showed the two main cities of Norway, Christiania [Oslo] and Trondheim, through which my itinerary was to bring me, and the fourth and last showed the fortress of Vardøhus, my place of observation surrounded by open sea and a ship approaching port, with the Danish flag flying—a beautiful thing to behold indeed![92]

This quotation is, again, taken from one of Hell's letters to the superior general of the Society of Jesus in Rome. Not surprisingly, this source abounds in reflections on the show of respect that prominent Protestants, such as Thott, bestowed upon their Catholic visitors: "There were one or two present," Hell proceeds,

> that became rather pale when witnessing this most unexpected and exceptional honor that was showed to me by such a mighty minister, and that for good reason: for this supreme minister bears responsibility for the entire clergy of Denmark and, in effect, serves as a sort of supreme prelate for its members.[93]

Despite the symbolic displays of tolerance shown by both Moltke and Thott in Copenhagen, the ministers were unable to guarantee Hell's safety from disgraceful treatment by subjects outside the capital. Thott therefore advised Hell to use the title of "professor," not *pater*, when traveling farther north.

Although Sajnovics's diary from the stay in Copenhagen is missing, other important meetings can be reconstructed from Hell's correspondence and other sources. Professor Kratzenstein, the instigator of the transit of Venus expedition to Trondheim in 1761, put Hell in touch with persons of the high nobility. These included, for instance, Andreas Peter Bernstorff (1735–97), the nephew of the foreign minister and himself an important official, who on one occasion informed his uncle that

92 Hell to the superior general of the Society of Jesus in Rome, dated Vardø, January 15, 1769 (draft, WUS).

93 Hell to the superior general of the Society of Jesus in Rome, dated Vardø, January 15, 1769 (draft, WUS).

> Father Hell dined here today, brought here in triumph by Niebuhr, who is in love with him and who has no greater regret in the world than that of not being able to travel to Vardøhus along with him. He is furious at Horrebow and the young astronomers of this city for the reason that there is not one among them who wishes to do the same, which is indeed disgraceful.[94]

Niebuhr's dining together with Hell at the residence of Andreas Bernstorff is further indication of the prestige involved. That Niebuhr, the experienced veteran of the reputed expedition to Arabia Felix, rubs shoulders with the leader of the next emblematic expedition sponsored by the Danish–Norwegian monarchy, forges a link and a continuity between past and present heroic endeavors for the promotion of knowledge. Although neither Niebuhr nor Kratzenstein joined Hell to the north, they lent him equipment such as a declinometer to observe the variations of the earth's magnetic field, constructed by Kratzenstein, and a quadrant for measuring the geographical latitude, constructed by Tobias Mayer in Göttingen and used by Niebuhr during his entire expedition. The latter even lent Hell his manuscript of astronomical observations from Yemen, which Hell promised to study while in Vardø.[95] Furthermore, the organizers of Hell's expedition offered him a generous pick of instruments to bring to Vardø from Copenhagen's Rundetårn observatory. Among these were an astronomical clock made by Julien Leroy (1686–1759) in Paris, a ten-foot telescope of John Dollond's (1709–61) patent and a three-foot quadrant made by Johan(nes) Ahl (1729–95) in Copenhagen.[96] These and further pieces of equipment came in addition to a temperature-compensated pendulum clock made in Vienna by Hell's observatory assistant Anton Pilgram as well as achromatic telescopes eight-and-a-half- and ten-and-a-half-feet long, also made in Vienna.[97] All these instruments were used for the determination of the longitude and latitude of Vardø as well as for the observation of the Venus transit itself.

---

94 Andreas Peter Bernstorff to Johann Hartvig Ernst Bernstorff, dated Copenhagen, June 18, 1768, in Aage Friis, ed., *Bernstorffske Papirer: Udvalgte Breve og Optegnelser vedrørende Familien Bernstorff i Tiden fra 1732 til 1835* (Copenhagen: Gyldendalske Boghandel, 1904), 1:509.

95 Hell to Niebuhr in Copenhagen, dated Vardø, April 6, 1769 (draft, WUS. Incomplete transcript in Pinzger *Hell Miksa*, 1:88–91).

96 Hell, *Observatio transitus Veneris* [...] *1769*, 5–6. Ahl's name is misspelled "Aal" by Hell.

97 Hell, *Observatio transitus Veneris* [...] *1769*, 6, 71; Hell's MSS "Observationes astronomicæ et Cæteræ in itinere litterario Viennâ Wardoëhusium usque factæ" (1768–69) and [no heading, starting with the words] "NB De Horologiis" (1769). See also Thykier, Gyldenkerne, and Darnell, *Dansk Astronomi*, 2:252–53.

Having received practical advice, scientific equipment, assistance with the logistics as well as dinners worthy of royal guests, the expeditionists left Copenhagen on July 2 and set forth via Helsingør and Helsingborg along the coast of southwestern Sweden to Fredrikshald (now Halden), and Christiania (Oslo). Christian Horrebow and his family were in the escort of the imperial astronomer for the first stretch of the journey, but as soon as they entered Swedish territory, Hell and his associates were handed over to a young student, who served as their interpreter and factotum all the way up to Christiania. During their five-day rest in this administrative center of the Norwegian part of the realm, Hell and Sajnovics were again celebrated as true representatives of the royal courts. Accordingly, neither the senior district stipendiary of Christiania, Caspar Herman von Storm (1718–77) nor the vice-governor of Norway Jacob Benzon (1688–1775), spared any effort—or expense—in facilitating the overland journey ahead.[98] While Sajnovics was amazed by the condition of the roads in Sweden (where it was the duty of the villagers to maintain a stretch assigned to them in good repair, and they did it so well that "the roads in this region are splendid, and perhaps even better than Austrian ones"),[99] the cart roads across the mountains of southern Norway to Trondheim were far from comfortable. Though the journey was arduous, the natural beauty and the fertility of the land did not escape Sajnovics. Arriving in Trondheim on July 30, another rest of three weeks followed, with frequent mixing with local society, whose excessive drinking habits—and the resulting drinking pressure—proved hard to cope with. There were benefits, too, at least of the meetings with the bishop, whose collections of natural history specimens and books earned the travelers' esteem, and who as president of the local society of sciences inducted Hell as its member.

With the title of professor, Hell traveled more or less incognito. His real status, however, was well known at least to members of the higher echelons of society. In Trondheim, there was a fortress (Kristiansten) with a substantial percentage of mercenary troops from Catholic parts of Europe. As they became enrolled, these had been promised pastoral care according to their own rites, a promise that had proven difficult to keep given the general scarcity of Catholic clergy in the country. Thus, when word spread of Hell's arrival, the commander of Kristiansten, General Johann Wibe von der Osten (1708–1800), immediately approached Hell and Sajnovics with a suggestion that they

98 Sajnovics, travel diary, proofread version (WUS), July 14–18, 1768; letter from Jacob Benzon to *Rentekammeret* (i.e., the ministry of finance) in Copenhagen, dated July 16, 1768 (RA, Stattholderembetet 1572–1771, C VI Kopibøker, no. 7).

99 Sajnovics, travel diary, draft version (WUS), on July 5, 1768.

administer the sacrament to Catholic soldiers. In a letter to the Jesuit superior general, Hell explains that he was indeed willing to meet the request,

> since the Catholic bishop count [Franz Joseph] von Gondola [1711–74], Vicar Apostolic for entire Denmark, Norway, and Sweden, had provided me already before my departure from Vienna with a patent giving me all episcopal rights and freedoms, as well as holy oil and other necessities for a three-year period. I added, however, the condition that this practice of our religion had to constitute no infringement of our royal assignment nor be displeasing to the magistrate or bishop of Trondheim.[100]

General von der Osten assured him that the bishop had no jurisdiction whatsoever over the soldiers at the fortress. Thus Hell and Sajnovics prepared a hall for services on military property, and already on the fifth day upon their arrival they celebrated Mass and started taking confessions. This early morning activity was—on Hell's own testimony—not frowned upon by any of the many Trondheim citizens with whom they interacted. Instead, "the entire town of Trondheim, including the non-Catholic priests, held us in great esteem and revered us as unusual persons of a stature almost on the same level as bishops."[101]

As mentioned, the government had expected Hell and Sajnovics to spend the winter in Trondheim. The expeditionists themselves, however, had other plans. They insisted on reaching their destination the same autumn, in order to have sufficient time to construct a proper observatory and conduct various scientific tasks, including meticulous measurements of the geographical latitude and longitude of the observation site. This change in schedule meant that everything needed to be prepared in great haste, since the season of the fierce autumn storms was fast approaching. Besides hiring a ship equipped with a crew of sailors that were supposed to hibernate together with Hell and his team in Vardø, the magistrates managed to assist them in securing warm furs and provisions of food and wine sufficient for a whole year, and even hire a cook that knew how to bake bread.[102]

Embarking on August 22, a seven-week coastal voyage—considerably beyond Gunnerus's optimistic prediction of twenty-eight days, or the thirty-four days they were told by the captain of a ship arriving from Vardø to Trondheim

100 Hell to the superior general of the Society of Jesus in Rome, dated Vardø, January 15, 1769 (draft, WUS).

101 Hell to the superior general of the Society of Jesus in Rome, dated Vardø, January 15, 1769 (draft, WUS).

102 Pinzger, *Hell Miksa*, 1:76–77.

while staying there—still lay ahead of them. There are two conspicuous objects of attention in this part of Sajnovics's diary. First, the indigenous Sámi, who appear in the accounts after the company leaves Tromsø—their transhumant lifestyle between the coast and the mountains; the huge herds of reindeer ("their only fortune") and the trade in fish that they cultivate with the transiting merchants; their attachment to Christianity; and "their apparel, which resembles that of Hungarian peasants."[103] The other central topic, naturally, is the weather: now the standstills, and then the roaring winds, both of which had an adverse effect on their progress toward their destination. They reached Vardø in the midst of a storm on October 11, 1768.[104] An eyewitness from Skjervøy west of the North Cape characterized the very idea of traveling to Vardø by boat at that time of year as "a desperate voyage by desperate persons."[105]

Conditions remained inimical virtually on all fronts. Sajnovics's diary reports on recurrent, frightful storms that prevented the Viennese Jesuits even from keeping the routine of socializing with the local "elite"—the commander of the fortress and the pastor (who, as they discovered to their dismay, hated each other). Morning temperatures in their sleeping quarters were barely over freezing point, and even in May Sajnovics recorded heavy snowfall on several occasions. They felt compelled to rebel against the food regime: as early as November 2, they decided to require the cook to submit for inspection the menu for the day each morning, "since the cook nearly killed us with his dry, Norwegian dishes."[106] Such daily tribulations notwithstanding, the Jesuits calmly continued to produce "immutable mobiles"[107]—drawings, maps, charts—whereby the objects and phenomena fixed in their native habitat became

103 Sajnovics, travel diary, draft version (WUS), quotation on September 28, 1768.

104 Sajnovics, travel diary, draft version (WUS); Hell to Pilgram in Vienna, dated Vardø, November 12, 1768 (draft, WUS. Transcript in Pinzger, *Hell Miksa*, 1:7–20).

105 Pastor Cornelius Duns (1724–70) in Skjervøy to Bishop Johann Ernst Gunnerus in Trondheim, dated September 13, 1768. Cited in Ove Dahl, *Biskop Gunnerus's virksomhed fornemmelig som botaniker, tilligemed en oversigt over botanikens tilstand i Danmark og Norge indtil hans død* (series of offprints from *Det Kgl. Norske Videnskabers Selskabs Skrifter*) (Trondheim: Aktietrykkeriet, 1899), 4:109: "Father Hell is in Maursund with the rest of the company, he intends to go to Vardø in this time of year: a desperate voyage by desperate persons!"

106 Sajnovics, travel diary, draft version (WUS), on November 2, 1768.

107 This term was introduced by Bruno Latour and refers not only to the actual vehicles of transmission but also to the material conditions of their production (e.g., instruments). Cf. Bruno Latour, "Drawing Things Together," in *Representations in Scientific Practice*, ed. Michael E. Lynch and Steve Woolgar (Cambridge, MA: MIT Press, 1990), 19–68. Artists were hired to accompany many eighteenth-century expeditions, but naturalists were often themselves trained in practices of visual representation. While mathematics and

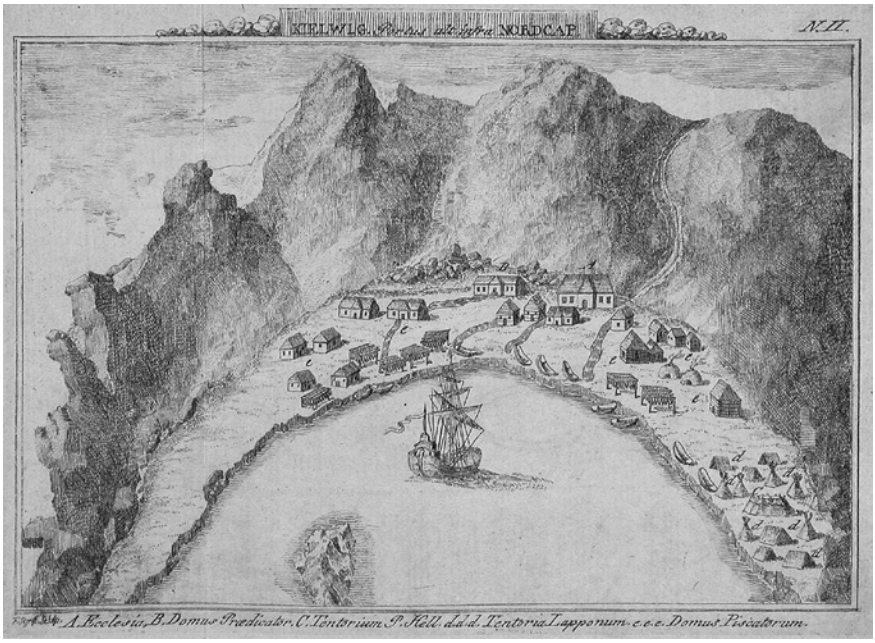

FIGURE 7 The ship of Hell and his associates approaching Kjelvik, the last harbor before reaching Vardø
Drawing by Hell, published in the *Ephemerides* for the year 1791 (printed 1790). Note the Sámi tents in the bottom right corner marked by letter "d," with Hell's expedition tent conspicuously placed in the middle of the camp ("C"). Digitized by the Department of Astrophysics, University of Vienna

transferred as knowledge items. Also almost immediately upon arrival in Vardø, they started constructing their modest observatory, as an annex to the house they were offered. The building consisted of two small rooms, *observatoriola* (or "small observatories"), with hatches in the roof and walls for observations of the sky. The two small observatories faced north and south respectively. In the middle, between the northern and southern observatory, was a small laboratory. Soldiers from the local garrison were hired to take care of the construction process. By Christmas, the building was finished, so Hell unpacked his instruments and started mounting them in early January.[108] A scientific expedition program of encyclopedic dimensions was ready to begin.

astronomy did not require as refined drawing skills as, e.g., botany, Hell was apparently a quite proficient drawer.

108 The best source-based, contextualized study of Hell's stay in Vardø is still Helge Kragemo, "Pater Hells Vardøhusekspedisjon: Belyst ved Pater Sainovič's dagbok 1768–1769," in *Vardøhus Festning 650 år. Jubileumsskrift*, ed. G.I. Willoch (Oslo: Generalinspektøren for

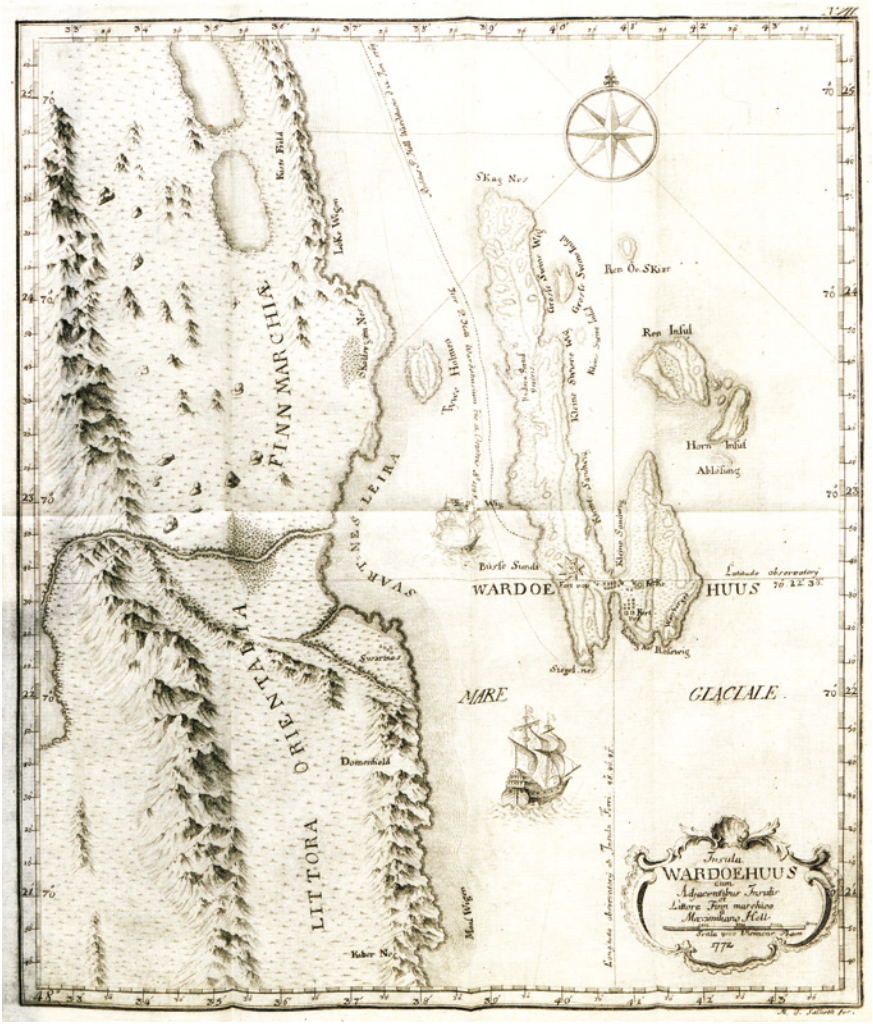

FIGURE 8 Map of the Island of Vardø with the nearby islands and the coast of Finnmark Map by Hell and the engraver M.T. Sallioth (*Insula WARDOEHUUS cum Adjacentibus Insulis et Littore Finn marchico, a Maximiliano Hell; M.T. Sallioth fec.* [Vienna, 1772]). Hungarian National Library, Map Department, TR 8 116

Kystartilleriet, 1960), 92–125 (a German translation was issued by the Tornedalica Foundation in Luleå, 1997). See also Truls Lynne Hansen and Per Pippin Aspaas, *Maximilian Hell's Geomagnetic Observations in Norway 1769*, Tromsø Geophysical Observatory Reports no. 2 (Tromsø: University of Tromsø, 2005); Aspaas and Lynne Hansen, "Geomagnetism by the North Pole, Anno 1769: The Magnetic Observations of Maximilian Hell during His Venus Transit Expedition," *Centaurus: An International Journal of the History of Science and Its Cultural Aspects* 49 (2007): 138–64; Aspaas, "Maximilian Hell og Johannes Sajnovics";

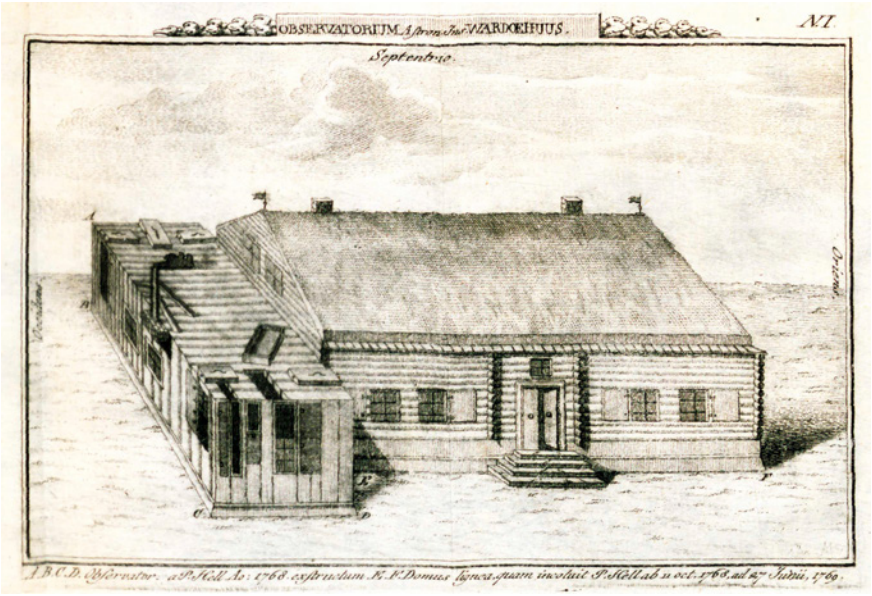

FIGURE 9 The house of Hell and Sajnovics at Vardø, with the makeshift observatory annexed on the left
Drawing by Hell, published in the *Ephemerides* for the year 1791 (printed 1790). Digitized by the Department of Astrophysics at the University of Vienna

---

Aspaas, "Maximilian Hell's Invitation to Norway," in *Konferenzbeiträge/Proceedings: Festkolloquium und Fachtagung 250 Jahre Universitätssternwarte Wien*, ed. Maria G. Firneis and Franz Kerschbaum, Communications in Asteroseismology 149 (Vienna: Austrian Academy of Science Press, 2008), 10–20; Nils Voje Johansen, "In ultimo fine Europae: Astronomen Maximilian Hell på besøk i Vardø," in *Kompassrosen: Orientering mot Nord*, ed. Benedicte Gamborg Briså and Bente Lavold (Oslo: Nasjonalbiblioteket, 2009), 40–51.

CHAPTER 5

He Came, He Saw, He Conquered?: The *Expeditio litteraria ad Polum Arcticum*

> In these northern regions, so rarely visited and so little explored, everything is of interest, and Father Hell studied everything.
>
> JÉRÔME DE LALANDE[1]

∴

To commission a high-quality, internationally respected astronomical observation and thus restore Denmark's dwindling fame as a "nation of astronomy" was no doubt the chief ambition of Hell's sponsors. In the very first letter from Foreign Minister Bernstorff to his Viennese envoy, the only explicit aim of the expedition is observation of the transit of Venus from Vardø.[2] Although the expedition's timeframe expanded significantly, with the departure from Vienna finally set more than a year ahead of the astronomical event, there is no evidence in the ensuing diplomatic correspondence between Vienna and Copenhagen to suggest that Denmark–Norway was preparing to support a wholescale encyclopedic expedition entailing years of exploration and voluminous publications.[3] Such plans, however, soon took form in Hell's mind. Besides bending to God's will, Hell must have been all too aware that to the Republic of Letters the region in question was still virtually a *terra incognita*. It was exotic and "liminal," with the aurora borealis, polar night, and midnight sun, along with extreme weather and natural dangers such as the maelstrom of Moskenes, and above all the indigenous Sámi (Saami, Sami) population—known in those days as "Lapps"—forming intriguing objects of study with a broad popular appeal.[4] The Lapland voyages of Linnaeus and Maupertuis in the 1730s had

1 Jérôme de Lalande, *Bibliographie astronomique avec l'histoire de l'astronomie depuis 1781 jusqu'à 1802* (Paris: Imprimerie de la République, 1803), 721.

2 Letter from Bernstorff to Bachoff in Vienna, dated Copenhagen, August 18, 1767 (RA).

3 Letters from Bernstorff to Bachoff in Vienna, dated Copenhagen, October 3, 1767 and February 20, 1768 (RA); letters from Bachoff to Bernstorff in Copenhagen, dated Vienna, September 7, 1767 and October 29, 1767 (RA).

4 Sven Widmalm, *Mellan kartan och verkligheten: Geodesi och kartläggning, 1695–1860*, Institutionen för idé- och lärdomshistoria, Uppsala universitet, Skrifter 10 (Uppsala: Institutionen

© PER PIPPIN ASPAAS AND LÁSZLÓ KONTLER, 2020 | DOI:10.1163/9789004416833_007
This is an open access chapter distributed under the terms of the CC-BY-NC-ND 4.0 License.

emblematic status, but they did not reach the area targeted by the Hell expedition, which thus held out the promise of a wealth of new information capable of breaking new ground in several fields of knowledge. This chapter describes how the Vardø expedition, originally conceived as confined to astronomical observation, turned into a more comprehensive scientific endeavor of virtually encyclopedic scope, with astronomy forming only a part of the research program.

1 A Journey Finished and Yet Unfinished

Hell's idea of expanding the scientific ambitions of an astronomy-motivated expedition was by no means unique. Besides curiosity, some of the motivation was purely pragmatic and utilitarian. A statement by Cassini de Thury in a paper on the Venus transits in the proceedings of the Académie Royale des Sciences is typical:

> When such long voyages are undertaken, one must have more than one object, so that in case the essential goal cannot be accomplished, it will be possible in some measure to remedy the damage. Otherwise, one may be forced to take comfort in having traveled more than a thousand leagues only to gaze at the Sun for six hours and find it eclipsed, not by the planet, but by a cloud.[5]

Closer to home, a similar view was expressed by Scherffer in a letter to Weiss as early as 1750, offering Weiss advice on the aims and scope of a planned expedition to survey the Portuguese dominions in Brazil. Scherffer emphasized that his colleague should prepare to undertake not only geodetic work but also to make delicate barometrical observations, investigate the running of pendulum

---

för idé- och lärdomshistoria, Uppsala universitet, 1990), esp. 183–85; Florian Wagner, *Die Entdeckung Lapplands: Die Forschungsreisen Carl von Linnés und Pierre Louis Moreau de Maupertuis' in den 1730er Jahren* (Norderstedt: Books on Demand, 2004), esp. 22–30; Päivi Maria Pihlaja, "The Study of the North in the 18th Century: Knowledge of Lapland in Europe, and Its Significance for Foreign Scholars," in *The North Calotte: Perspectives on the Histories and Cultures of Northernmost Europe*, ed. Maria Lähteenmäki and Päivi Maria Pihlaja, Helsingin yliopiston historian laitoksen julkaisuja 18 (Inari: Puntsi, 2005), 25–37; Sigri Skjegstad Lockert, *Havsvelget i nord: Moskstraumen gjennom årtusener* (Stamsund: Orkana akademisk, 2011); Alessandra Orlandini Carcreff, *Au pays des vendeurs de vent: Voyages et voyageurs en Laponie et Finlande du XVe au XIXe siècle* (Aix: Presses universitaires de Provence, 2017).

5 César-François Cassini de Thury, "Remarques sur la conjonction de Vénus avec le Soleil, qui doit arriver le 6 Juin de l'année prochaine 1761," *HARS* (1762; paper read November 12, 1760): 334.

clocks, undertake numerous geophysical observations, and so on—in short, "to describe the Brazilian lands" in all their diversity:

> I confess that, if merely one of these aspects are left out [of the expedition's research program], there will be no one in Europe who will explain that defect by pointing to the expedition's mandate, the hardships endured, the wants of the instrumentation, the limited staff, or the [king's] parsimony in the expenses: surely, every person will blame it on the ignorance of Jesuits abusing the treasuries of kings.[6]

In other words, as Scherffer saw it, ensuring a broad expedition program was especially important when Jesuits were concerned in order to ward off attacks by anti-Jesuits. Returning to Hell's own point of view, he assured the readers of the official Venus transit report, published in Copenhagen in February 1770, that "nor have we neglected the facts that throw light on or supplement the natural history of the animal and vegetable world, such as mussels, herbs, algae, mosses, and making other observations especially useful in regard of their economic applications" and the "origins, language, and different dialects of the Lappian nation living scattered in the north." Thus, even if "as a result of adverse weather conditions [...] I were to be disappointed in regard of the often mentioned observation, this scientific expedition were still not entirely fruitless for the sciences and the useful arts."[7] While "Sámi studies" obviously benefited hugely from the expedition, whatever specimens of the mentioned items of the flora and fauna Hell and his associates might have collected and brought back with them from the journey, the sources contain virtually no information about their fate. It is thus a question of whether this remark is a genuine account of their pursuits, or merely a gesture toward the practices and the topoi of exploration in the eighteenth century. In any case, it is important that the enlightened language of improvement was just as appropriate to frame his thoughts on the prospective yields of the northern expedition for the Viennese Jesuit as it had been for Linnaeus or Maupertuis.

After spending eight and a half months in the treeless, Arctic scenery of Vardø, Hell and Sajnovics left the island on June 27, 1769. They took their time on the return journey. After sailing past the huge Varanger Peninsula, on the east side of which Vardø is situated, they allowed themselves a detour to the settlements of Talvik and Alta in the innermost part of a fjord, some sixty kilometers away from the direct sea route to Trondheim. Here, they enjoyed the

6 Scherffer to Weiss, dated [Graz], August 2, 1750, in Vargha, *Correspondence de Weiss*, 10–11, here 11.

7 Hell, *Observatio transitus Veneris* [...] *1769*, 4.

sociability of Eiler Hagerup (1736–95), the senior district stipendiary of Finnmark, in whose agreeable company they had already spent several weeks when they traveled north from Trondheim the previous year. They also met historian and translator of the ancient laws of Norway Hans Paus (1710–70) and surveyor of western Finnmark and amateur astronomer Christian Frost Bredahl (1717–1811).[8] Years later, Hell remembered his visit to Talvik in colorful terms:

> There is hardly a place in the European part of the world surpassing it in beauty. Toward the end of July, when I visited this place surrounded by high mountains at roughly one mile's distance, I saw the most idyllic forests with various sorts of trees, luxuriant fields, and gardens with blossoming plants belonging to the zone of temperate climate, among them carpets of flowering Linneas [*Linnaea borealis*]. The summits wrapped in snow, the hillsides covered with green trees, and spring meeting summer in the valleys, were a wonderful sight. Then, there was the refreshing air, the sweetest of Zephyrs blowing, in a day that knows no night. Therefore this place, at the seventieth latitude, is rightfully called the "Paradise of Finnmark" by its inhabitants. Bewildered, I found this to be what it really was—a paradise.[9]

They also spent several days in the port of Tromsø, no doubt motivated by Borchgrevink's wish to pay a family visit to his sister and brother-in-law, who worked there as a priest. In total, the return journey to Trondheim lasted a good nine weeks, this time not primarily as a result of adverse winds (although they had their share of them as well) but because the Jesuit wanted to explore the area and cultivate friendships. There is no reason to characterize this as a pause from Hell's otherwise devoted adherence to the scientific goals of the expedition. Interaction with local informants was of utmost importance to eighteenth-century traveling explorers. Ultimately, any fruitful collection of information was based on sociability. In an addition to the diary from the stay in Tromsø, Sajnovics noted:

> The Lapps that are in the area of Tromsø stay here for no more than seven or eight weeks. Their winters are spent in Sweden. And since they are unable to speak Norwegian, they carry with them [written] testimony from

8 Sajnovics, travel diary, draft version (WUS), on July 22–27, 1769.

9 Hell, "Observationes astronomicae latitudinum, et longitudinum locorum borealium Daniae, Sueciae, et Finnmarchiae Lapponicae per iter arcticum annis 1768, 1769, et 1770 factae," *Ephemerides* 1791 (1790): 300–86, here 321. Translation in Lynne Hansen and Aspaas, *Maximilian Hell's Geomagnetic Observations*, 34.

> a Swedish priest confirming that they did attend service during wintertime. On his recommendation, during summertime they are even here [in Tromsø] allowed to Holy Communion without declaration of faith or examination.[10]

Questioning the degree of success by the Danish crown in bringing Sámi subjects under its jurisdiction and into religious conformity through mission was a standard element of descriptions of the indigenous people of the north in eighteenth-century global geographies. It was not uncommon that travel accounts, rather than providing original observations on such matters, simply repeated the stereotypes found in the relevant literature. This seems not to be the case with Sajnovics's remark: the precious piece of information was obviously revealed to the Jesuits directly during conversations with locals, whose confidence they could only gain by taking their time.

Moreover, Hell and Sajnovics wanted to measure the geographic latitude of as many places as possible. In the absence of visible stars during the Arctic summer months, this act of surveying was only feasible at the time when the Sun reached its highest point at midnight or at noon.[11] In the same process, it was also possible to determine the axis of true north and south, which in turn was a prerequisite for the measurement of the slightly varying deviation of the compass needle from true north.[12] Many a short stop was therefore prolonged for a couple of hours or more, so that the local pole height as well as the degree of magnetic declination could be measured. Similarly, the curiosity of the two Jesuits also induced them to inspect marks of old shorelines formed ages ago and to measure their distance from the present sea level (in Hamningberg, Kjelvik, and Måsøy);[13] to engage in climbing to measure the height of mountains

10 Sajnovics, a sheet of paper named "Supplementa Diarij" (WUS).

11 Hell summarized these observations in the report *Latitudines geographicae locorum Finmarchiae, Nordlandiae, Norwegiae et Sueciae observationibus astronomicis definitae à Maximiliano Hell* (manuscript, National Library of Norway, MS 4° 16), published in Danish translation as "Nogle Steders Geographiske Breder i Finmarken, Nordlandene, Norge og Sverrige bestemmede ved astronomiske Observationer […] og overgivet det Kongelige Videnskabernes Selskab i Kiøbenhavn den 18 May 1770. […] af det Latinske Sprog oversat paa Dansk af Henrich Hövinghoff," *Skrifter Kiøb.* 10 (1770): 619–52, and, twenty years later, in an expanded Latin version in Hell's own *Ephemerides*, "Observationes astronomicae latitudinum […]."

12 Aspaas and Lynne Hansen, *Maximilian Hell's Geomagnetic Observations*; Aspaas and Lynne Hansen, "Geomagnetism by the North Pole."

13 Hell's manuscript "Methodus observandi declinationes acus magneticae per iter litterarium ad Polum boreum" (WUS; facsimile in Aspaas, "Maximilian Hell og Johannes Sajnovics," 68, and in Lynne Hansen and Aspaas, *Maximilian Hell's Geomagnetic Observations*, 61–105), entries on July 8 and 19, 1769.

by means of barometers (in Kjelvik);[14] to catch and make sketches of species of jellyfish (at Havøysund);[15] to collect specimens of hermit-crabs on the shore and cook them for long-term preservation (at Selsøya);[16] and so on.

When they finally reached Trondheim on August 30, another two weeks were spent in the company of Gunnerus and other notables, including General von der Osten and his Catholic soldiers, who were again offered a string of "church" services at Kristiansten fortress. Prominent among the persons who greeted Hell was the city mayor and *littérateur* Niels Krog Bredal (1733–78), whose slightly mock-heroic poem on the occasion contains reference to the Keeper of the Winds in Greco-Roman mythology (Aeolus), the gods of the Sun and the sea (in the guise of Phoebus and Neptune, respectively), as well as an allusion to the conquests of Julius Caesar by the immortal phrase *veni, vidi, vici* (I came, I saw, I conquered):

> What truth there is in the declarations of prophets, you now know,
> My sweet friend! You return, having achieved what you prayed for.
> Narrow straits do not scare you, nor shipwrecking reefs;
> Neither the ice-covered sea, nor the polar winter nights.
> The Alps dressed in fog, the long-lasting winter with its eternal masses of snow;
> None of that is capable of preventing your voyage.
> You come [*venis*], you see [*vides*] everything that is worthy of being observed;
> You conquer [*vincis*] the Gods that are up against you from either side.
> The heroic endeavor was favored by Phoebus, Venus, and Aeolus,
> As well as by all the spirits that Neptune has under his sway.
> I congratulate you! Now safely return to visit the Penates of your own:
> May the Gods hear my prayers this time as well![17]

Many years later, the heroic explorer, who "sees everything that is worthy of being observed," included Bredal's poem in an article in the *Ephemerides*. Some

14 Hell's manuscript "Methodus observandi," as reproduced in Lynne Hansen and Aspaas, *Maximilian Hell's Geomagnetic Observations*, entry on July 7, 1769.

15 Hell's manuscript "Methodus observandi," as reproduced in Lynne Hansen and Aspaas, *Maximilian Hell's Geomagnetic Observations*, on July 19, 1769.

16 Sajnovics's travel diary, draft version (WUS), on August 17, 1769.

17 Latin poem in Bredal's own hand, dated September 1, 1769 (WUS); edited with translation in Per Pippin Aspaas, "Astronomy, Latinity, Enlightenment: Niels Krog Bredal's Poems Commemorating the Transits of Venus, 1761 and 1769," *Symbolae Osloenses* 90 (2016): 205–34, here 224.

of the sting was taken out of the poem, however, when he as editor took the liberty of altering the phrase into "everything that was visible in the sky."[18]

In the continuation of the reverse trip, Hell and Sajnovics followed exactly the same route as in the previous year—through Christiania, Fredrikshald, Gothenburg, Helsingborg, and Helsingør—to Copenhagen, which they finally reached on October 17. Here, they stayed until May 22 the next year, meanwhile engaging extensively with local men of learning as well as with members of the nobility and the royal family.

By the time Hell began writing his official paper on the Venus transit observation, the chief goal of the expedition had indeed been accomplished. Not only Hell but also Sajnovics were soon honored with memberships of the two royal scientific societies in the realm, in Trondheim and Copenhagen, respectively. Yet, the Venus transit expeditionists allowed themselves no rest on their laurels, but systematized and checked the results of their wide-ranging observations and experiments by consulting the available expertise and stock of literature in the capital. Spending their nights in the house of the Austrian embassy, they had living quarters comfortable and peaceful enough to enable them to work on the wealth of information they had gathered and to compose scientific works that—as they hoped—would bring them lasting fame.

While in Copenhagen, Hell and Sajnovics regularly visited the sessions of the Royal Society of Sciences, which were held at the residence of Minister Thott. Three long reports and a comparatively short one were produced and presented to the society in this period. Beginning with the official Venus transit report (read during three sessions in November–December 1769),[19] there followed a famous "Demonstration That the Language of the Hungarians and the Lapps Is the Same" by Sajnovics (three sessions in January–February 1770),[20] a "New Theory of the Aurora Borealis" by Hell (five sessions in March 1770),[21] and finally, "The Geographical Latitude of Several Places" (manuscript submitted in May 1770).[22] In each of these papers, all subsequently printed and distributed through respected Danish and Habsburg publication outlets, the two Jesuits made sure to emphasize that the texts in question were really just sections

18 Hell, "Observationes astronomicae latitudinum [...]," 361. For details, see Aspaas, "Astronomy, Latinity, Enlightenment."

19 Protocol of meetings, archives of Det Kongelige Danske Videnskabers Selskab (DKDVS), entries November 17, November 24, and December 1, 1769.

20 DKDVS, entries January 26, and February 2 and 9 1770.

21 DKDVS, entries March 2, 9, 16, 25, and 28, 1770.

22 *Latitudines geographicae locorum Finmarchiae, Nordlandiae, Norwegiae et Sueciae observationibus astronomicis definitae à Maximiliano Hell* (manuscript, National Library of Norway, MS 4º 16).

of a larger work that Hell was preparing, the *Expeditio litteraria ad Polum arcticum*.[23] This grand work, never accomplished in its entirety, merits some consideration as it seems to have functioned as an important vehicle in Hell's attempt at promoting himself as an explorer with first-hand knowledge of—and thereby legitimate authority also to interpret and explain—"everything" in the Far North.

Judging from the correspondence of Hell from the period 1768–70, the idea of a grand encyclopedic work on the Far North was present in his mind from the outset of his journey. The first reference to the title as such is in a letter to his substitute in Vienna, Anton Pilgram, dated Vardø, April 30, 1769: "My observations, which I have either made or am going to make here in Vardø, will be reserved for the *Expeditio litteraria ad Polum arcticum*."[24] As mentioned, Hell and Sajnovics made sure to mention this plan in all the various papers presented to the Society of Sciences in Copenhagen, although there they solely used the form *Expeditio litteraria*. A more elaborate description of the work (this time with its full title) was issued later in 1770, in the form of a call for subscriptions that was included in the Leipzig journal *Nova acta eruditorum* and also issued as a separate leaflet in both Latin and German in Vienna, from where it was distributed far and wide in the Republic of Letters.[25]

It is tempting to translate the title of the prospective *magnum opus* as "Literary Expedition to the North Pole," as has been done by several scholars.[26] However, the only word that is unproblematic in that translation is *expeditio*, expedition. The adjective *litterarius* in its early modern version has little to do with *belles-lettres*. Rather, it emerges from *litterae* as it appears in *respublica litteraria* (Republic of Letters, *république des lettres*, *Gelehrtenrepublik*, *den lærde republikk*). The nearest modern equivalent would be "scientific," allowing for a broad concept encompassing bookish erudition as well as natural philosophy and empirical natural knowledge. Hell's great astronomer

23 Hell, *Observatio* [...] *1769*, esp. 2–6, 17, 61; Sajnovics, *Demonstratio* [...] (1770), 82; Hell, "Aurorae borealis theoria nova [...] Pars I," *Ephemerides* 1777 (1776), 2; Hell, "Nogle Steders Geographiske Breder," 621.

24 Printed in Pinzger, *Hell Miksa*, 2:93–95, here 94.

25 *Nova acta eruditorum* (September 1770): 427–32. While no comprehensive search for mentions of the *Expeditio litteraria ad Polum arcticum* in contemporary journals and magazines has been undertaken, it is telling that the *Journal des Sçavans* included a detailed summary of the call for subscriptions in July 1771 (see 499–500). By then, the *Jenaische Gelehrte Zeitung* had issued a similar summary in June 1771 (no. 48), 399–400, whereas the *Staats- und Gelehrte Zeitung des Hamburgischen unpartheyischen Correspondenten* had published the entire text in the original Latin, March 9 (no. 40), March 12 (no. 41), March 13 (no. 42), and March 15 (no. 43), 1771.

26 Sarton, "Vindication," 104; Kragemo, "Pater Hells Vardøhusekspedisjon," 122.

contemporaries used vernacular equivalents of the word exactly in this sense, even referring to expeditions. As Nevil Maskelyne (1732–1811) summed up the historical significance of British participation in the 1761 Venus transit project in a letter to the president of the Royal Society of London:

> Nor can the learned world but look upon themselves as highly indebted to your Lordship, for that noble zeal, which you have manifested for the improvement of astronomy, in setting forward, and promoting, these *literary expeditions*, which tend to the benefit of mankind, and the honour of our native country [italics added].[27]

Literary, or *littéraire*, had a similar meaning in French. Lalande, in one of his letters to Weiss, asked him to address his letters to the Académie Royale des Sciences, so that the academy would cover the postage. This would be quite legitimate, he proceeded, for what they were dealing with was "above all observations and literary correspondence [*correspondance litteraire*]," that is, contents worthy of being paid for by the academy.[28] Finally, when Hell's planned work was referred to in contemporary translations into Danish, the title was regularly rendered *Det lærde Tog*.[29] The epithet *lærd* is associated with the noun *Videnskab* (*Wissenschaft*), implying both erudition and empirical science, but hardly works of fiction, which nowadays appears to be the primary connotation of "literary."[30]

---

27 Nevil Maskelyne, "An Account of the Observations Made on the Transit of *Venus*, *June 6*, *1761*, in the Island of *St. Helena*: In a Letter to […] *George* Earl of *Macclesfield*, President of the Royal Society, from the Rev. *Nevil Maskelyne* […]. Read Nov. 5, 1761" *PTRSL* (1762), 196–201, here 200.

28 Lalande to Weiss in Trnava, dated Paris, August 7, 1768, in Vargha, *Correspondance de Weiss*, 68.

29 See, e.g., Maximilian Hell, "Observation over Veneris Gang forbi Soelens Skive den 3 Junii 1769. anstillet i Wardøhuus efter den Stormægtigste og Allernaadigste Konge til Dannemark og Norge &c. &c. Kong Christian den Syvendes Befalning, og forelæst det Kongelige Videnskabernes Selskab i Kiøbenhavn den 24 November 1769. af Maximilian Hell. Oversat af det Latinske i det Danske Sprog af Henrich Hövinghoff," *Skrifter Kiøb.* 10 (1770): 537–618, here 538–39; Ioannes Sainovics, "Beviis, at Ungarernes og Lappernes Sprog er det samme: Oversat af det Latinske ved M.R. Fleischer," *Skrifter Kiøb.* 10 (1770): 653–732, here 731.

30 A likely model for Hell's work is the *De litteraria expeditione* by Boscovich and his fellow Jesuit Christopher Maire (1697–1767), published in 1755. As Boscovich explains in the preface, it consists of five parts: (1) a historical and physical account of the two Jesuits' *expeditio litteraria* through the Papal States, by Boscovich; (2) a determination of one degree of meridian on the basis of observations made by the two Jesuits, by Maire; (3) a correction of the geographical map of the Papal States, by Maire; (4) descriptions of the instruments used during the expedition, by Boscovich; and (5) a discussion of the shape of the Earth

In the next part, *ad Polum arcticum*, "to" as a translation is obviously problematic: the North Pole was neither reached by Hell and his associates, nor was it ever meant to be. (Even though this is also what the German translation as *Reisebeschreibung nach dem Nordpol* implied.[31] In this reading, "North Pole" simply designates "the region of the High North; the Arctic.")[32] In reality, at most, they moved "toward" it, which the preposition *ad*, when connected with verbs or nouns implying movement, usually means. However, another frequent meaning of *ad* is "by, near, in the vicinity of." This is the meaning one may infer from a manuscript covering magnetic observations made during the southbound part of the journey, that is, from Vardø toward Copenhagen. This manuscript bears the title "The Method Used for Observing the Magnetic Needle's Declinations during the *Iter litterarium ad Polum boreum*."[33] (*Iter*, journey, is here a synonym for *expeditio*; *boreus* for *arcticus*.) Given the southbound travel route described in this manuscript, *ad* is clearly meant on this occasion to imply "by the North Pole," not "toward." On these grounds, the sense of the expression *Expeditio litteraria ad Polum arcticum* is best conveyed as "Scientific Expedition by the North Pole."

Taken as a whole, the *Expeditio litteraria* was meant to comprise three volumes in folio, with numerous illustrations and several geographical maps of the regions visited by Hell and Sajnovics. One preserved portrait of Hell, produced in 1771, possibly with the intention of serving as additional promotional material for the *Expeditio litteraria*, shows the Viennese Jesuit flanked by the allegorical figures Religio and Scientia (see fig. 8). In the middle of the portrait, there is vivid imagery illustrating the delicate process of observing a transit of Venus. Even more conspicuous, however, are the books lying about underneath

---

on the basis of Newton's theory of gravity and the measurement of degrees, by Boscovich. Christopher Maire and Ruggiero Giuseppe Boscovich, *De litteraria expeditione per Pontificiam Ditionem ad dimetiendos duos meridiani gradus et corrigendam mappam geographicam* (Rome: Palladis, 1755), xiv. In 1770, this classic of geodesy appeared in a French edition, bearing the title *Voyage astronomique et géographique, dans l'etat de l'eglise*.

31 Maximilian Hell, *Nachricht* [...] *Wien den 2. März 1771* (call for subscriptions, in German [n.p.: n.p.]), [1].

32 Such a translation is given by the editors in Andreas Christian Hviid, *Andreas Christian Hviids Europa: Udtog af en Dagbog holden i Aarene 1777–1780 paa en Reise igennem Tyskland, Italien, Frankrige og Holland*, ed. Michael Harbsmeier, Claus Mechlenborg, and Morten Petersen (Copenhagen: Forlaget Vandkunsten, 2005), 589n368: "En litterær ekspedisjon til de nordlige polaregne." In that interpretation, "Polus arcticus" would be a synonym for "Zona frigida arctica" (used by Hell in the call for subscriptions, *Tomi II. Pars IV. Sectio I*, see Aspaas, "Maximilianus Hell," 374–75).

33 Maximilian Hell, "Methodus observandi declinationes acus magneticæ per iter litterarium ad Polum boreum" (1769–70). WUS, Manuscripte Hell.

FIGURE 10 Maximilian Hell accompanied by his principal works and allegorical imagery Copperplate by the Augsburg miniature artist Johann Esaias Nilson (1721–88), based on a drawing by Wenzel Pohl (1720–90). Two versions of the copperplate exist. The earlier version lacks the "inscriptions" *Religione* and *Scientia*. These were, however, explicitly asked for by Hell, along with other minor changes in the extant drafts of two letters, undated and without explicit mention of recipients, but clearly addressed to Pohl and Nilson. Digitized by Nils Voje Johansen

the portrayed Jesuit. Present among the titles are his report "Observat: ♀ Wardöhus […]" and the (never accomplished) "Expeditio litteraria" itself. Other titles are, besides various issues of the *Ephemerides*, the observations of Jesuit missionaries in China, edited by Hell (referred to as "Observat[iones] Pekin[enses]"), his Cluj textbooks on mathematics, his refutation of Schumacher's text on the Easter celebrations, his experiments with magnetism, his treatise on the moon of Venus as well as his tables of solar, lunar, and planetary orbits (here abbreviated "Algebra," "Von der Oster Feyer," "De Magnete," "De Satell[ite] ♀," "Tabul[ae] Astron[omicae] ☉ ☽ et Planet[arum]"). In other words, the court astronomer of Vienna is portrayed as a man who knows "everything." Above his head shines the radiant emblem of the Society of Jesus, with Religion and Science smilingly lending support to his endeavors: this sense emerges from the ablative case of the inscriptions, *RELIGIONE* and *SCIENTI*[*Ā*], "by means of Religion and Science." The meaning of the allegory could hardly be missed. The metropolitan court astronomer had returned from the wilderness to civilization as an explorer with first-hand knowledge encompassing numerous branches of knowledge, backed by the Society of Jesus as a source of Enlightenment. Scherffer's worries are dispelled by this imagery, which supplies a resounding response to any critic of "Jesuits abusing the treasuries of kings."

2 Enigmas of the Northern Sky and Earth

The *Expeditio litteraria* was supposed to consist of three volumes, the second of which bore the title *Tomus physicus*. "Physics" here—true to the general understanding of the term in the eighteenth century—encompasses areas now known as meteorology and upper atmosphere physics, as well as natural history (marine and terrestrial biology alike), and even the exploitation of natural resources. In summary, the following parts were planned:

> Part 1: On plants, animals, fish, etc. in northern Norway; Part 2: On the decrease of the sea level in the Far North; Part 3: On the luminescence of the sea in the Far North ("morild" in Norwegian); Part 4: A new theory of the Aurora Borealis; Part 5: Meteorological observations, including investigation of the ebb and flow of the tides, etc.; Part 6: Economic remarks.[34]

34 For a full edition and translation of the call for subscriptions, see Aspaas, "Maximilianus Hell," 361–81.

Neither Hell nor Sajnovics could boast of a background as natural historians, and no article by them pertaining to the very first part of this volume ever saw the light of day. In research relating to natural history, they were no doubt aided by Borchgrevink who, it will be remembered, had been educated by Linnaeus at Uppsala. In a letter from Vardø to the professor of botany in Copenhagen, Georg Christian Oeder (1728–91), Hell promises to assemble "algae, mosses, and other aquatic plants" for Oeder to make use of for his purposes.[35] Collecting plants of the Danish–Norwegian kingdom was now a priority, in conjunction with the richly illustrated *Flora Danica*, the first ten parts of which were edited by Oeder during this period. An alumnus of Albrecht von Haller (1708–77) at Göttingen University, Oeder himself had undertaken several expeditions across Denmark and Norway, but never traveled farther north than Rana in Nordland county, not too far beyond Trondheim.

What came out of Hell's promised contributions to the *Flora Danica* is, however, hard to establish, since Oeder was removed from office not long after Hell's return to Copenhagen, and the name of the collector of specimens for each plant is not mentioned in the printed *Flora*. Moreover, for this part of the *Expeditio litteraria*, Hell would probably have drawn heavily upon a pioneering work by bishop and amateur natural historian Erik Pontoppidan (1698–1764), the two-volume *Norges Naturlige Historie* (The natural history of Norway [1752–53]).[36] This richly illustrated work was also available in a German translation, to which Hell had access.[37] Likewise, the two-volume work of another bishop, Gunnerus's *Flora Norvegica* (Norwegian flora [1766–72])[38] was likely to have been used as a consistent point of reference, along with various relevant articles in the proceedings of the Royal Society of Sciences in Trondheim, edited by Gunnerus and published in both Danish and an unabridged German

35 Hell to Oeder, dated Vardø, April 6, 1769 (WUS, draft): "Algas fucosque, cæterasque Plantas aquaticas."

36 Available in a facsimile edition, Erik Pontoppidan, *Norges Naturlige Historie 1752–53* (*Det første Forsøg paa Norges Naturlige Historie, forestillende Dette Kongeriges Luft, Grund, Fielde, Vande, Vexter, Metaller, Mineralier, Steen-Arter, Dyr, Fugle, Fiske og omsider Indbyggernes Naturel, samt Sædvaner og Levemaade*), 2 vols. (Copenhagen: Rosenkilde og Bagger, facsimile 1977). An English edition was also published as *The Natural History of Norway* (London: A. Linde, 1755).

37 Erich Pontoppidan, *Versuch einer natürlichen Historie von Norwegen, worinnen die Luft, Grund und Boden, Gewässer, Gewächse, Metalle, Mineralien, Steinarten, Thiere, Vögel, Fische und endlich das Naturel, wie auch die Gewohnheiten und Lebensarten der Einwohner dieses Königreichs beschrieben werden*, trans. Johann Adolph Scheiben, 2 vols. (Copenhagen: Franz Christian Mumme, 1753–54).

38 Johan Ernst Gunnerus, *Flora Norvegica: Observationibus praesertim oeconomicis panosque norvegici locupletata*, 2 vols. (Trondheim: Typis Vindingianis, 1766–72).

edition. In letters from Vardø, Hell shared some details of his observations in this domain;[39] we may surmise that further details were communicated directly to the bishop by Borchgrevink. Hell also collected some specimens that were certainly delivered to Gunnerus, among them the littoral red algae then known as *Fucus alatus* and *Ulva caprina*, which "inhabits the sea of Finnmark, whence the highly famous astronomer, Mr. Prof. Hell, brought it to me, along with numerous other rarities from Finnmark," as Gunnerus recorded in the concluding volume of his *Flora*.[40] Collections in the domain of zoology were exposed to unexpected hazards. In a letter from Vardø, Hell relates how

> Sajnovics augments every day his collections of natural objects, but the mice of Vardø have dealt serious damage: all hermit crabs (a kind of small marine sea crayfish, living in mussels) that he so meticulously collected during our voyage and boiled red, have been completely eaten and destroyed by the mice.[41]

The second part of the *Tomus physicus*, on the decrease of the sea level in the Far North, was not published either. In an elaborate summary in the call for subscriptions, Hell promised to treat "signs and arguments in favor of the decrease of the sea level in the northern sea" and also to provide "geometric dimensions" of this development.[42] In one of his manuscripts from Vardø, Hell took notes from a conversation with a thirty-year-old soldier at the fortress:

> As a fifteen-year-old, he had seen with his own eyes how during high tide the water rose so high from the two bays that it became connected [i.e.,

39 Hell to Pilgram in Vienna, dated November 12, 1768; to Gunnerus in Trondheim, November 12, 1768; to Schöller in Trondheim, January 12, 1769; to Pilgram in Vienna, January 15, 1769; to Christian Horrebow in Copenhagen, January 15, 1769; to Gunnerus in Trondheim, January 15, 1769; to Mercier in Copenhagen, April 6, 1769; to Gunnerus in Trondheim, April 6, 1769; to Niebuhr in Copenhagen, April 6, 1769; to Öder in Copenhagen, April 6, 1769 (drafts for all letters are kept at WUS; many of them have been published by Pinzger, *Hell Miksa*, vol. 2).

40 Gunnerus, *Flora Norvegica*, 2:91, 2:127. The synonyms of the plants in modern taxonomy are *Membranoptera alata* and *Palmaria palmata*. Further evidence of sea algae and other plants that were delivered by Hell and Borchgrevink to Gunnerus can be found in Gunnerus's correspondence with von Linné. Johan Ernst Gunnerus and Carl von Linné, *Brevveksling 1761–1772*, ed. Leiv Amundsen (Oslo: Universitetsforlaget, 1976), 101–6.

41 Letter from Hell to Pilgram in Vienna, dated Vardø, January 15, 1769 (draft, WUS), parentheses are also found in the original. Printed in Pinzger, *Hell Miksa*, 2:50–55 (quotation on 53–54).

42 Hell, call for subscriptions, translation in Aspaas, "Maximilianus Hell," 373.

> cut the island into two halves]. This means that the sea level, during the fifteen years, has decreased as much as the current distance between the two bays. […] The same soldier said that the winter cold intensifies more and more each year, an observation in perfect accordance with the decrease of the sea and rise of the land. […] Perhaps the same decrease of the sea level is the cause of a general decrease in the amount of fish over the last decade, both in terms of the number of fish and their size. For when there is less water, there is obviously less fish as well.[43]

Based on this quick note, scribbled down at the spot, Hell took action. Before leaving Vardø for good in late June 1769, he made sure to erect two pillars at the highest level currently reached by the sea during high tide. The local clergy and military personnel were requested to keep an eye on the experiment by taking notes of how far the sea level receded from those pillars over the coming years.[44] During stops on the southbound journey, he found further evidence in support of his conviction of a receding sea level. Such was the apparent speed of the development that Hell believed he could provide the world of learning with a discussion of "unavoidable politico-economical consequences resulting from the decrease of the sea level in the northern reigns."[45] Again, an enlightened perspective is adopted by Hell, in which natural knowledge has crucial implications for developments in the public domain, and the temporary servant of the Nordic kingdom does not hesitate to bring such implications to the attention of his masters and the wider world.

In the third part of the *Tomus physicus*, Hell promised to unveil one of the natural wonders of the north, namely the nightly luminescence of the sea, or "milky seas," known in the local Norwegian language as *morild*. The question of the cause of *morild* was a matter of dispute. In Pontoppidan's *Norges Naturlige Historie*, Hell seems to have read what the bishop had to say on the matter: according to an Italian study published in Venice, small "larvae" had been found to emit light when the water of the Mediterranean was stirred. These were, however, only visible when the sea water was sieved through a piece of cloth and the minuscule creatures thus trapped subsequently studied in a microscope.[46] A contradictory opinion was found in the first volume of the

43 Hell, manuscript beginning with the words "NB de horologijs" (WUS).

44 Kragemo, "Pater Hells Vardøhusekspedisjon," 118.

45 Hell, call for subscriptions, translation in Aspaas, "Maximilianus Hell," 373. An early stage discussion of this topic is found in Hell's letter to Niebuhr in Copenhagen, dated Vardø, April 6, 1769 (draft, WUS), incomplete transcript in Pinzger, *Hell Miksa*, 2:88–91 (on 90–91).

46 Pontoppidan, *Norges Naturlige Historie*, 1:117–20.

proceedings of the Society of Sciences in Trondheim, where priest Erik Gerhard Schytte (1728–1808) reported from Lyngen, not far from Tromsø, that since in his experience "frozen sea water shines exactly like that which is not frozen," no "insects" could possibly be the cause of the light. Instead, he surmised that *morild* was caused by fragments of bitumen, which the soil in that area was teeming with.[47] The question was subject to a great deal of attention by the Arabia Felix expedition as well. Although the natural history diaries of Niebuhr's associate, Pehr Forsskål (1732–63), had not yet been published, Hell may well have discussed the topic in his meetings with Niebuhr in Copenhagen during the northbound part of his journey. In any case, Forsskål was trying to find the cause of *morild* during the sea voyage soon after the expedition ship had left Copenhagen. Unable to find any trace of animals in the water samples, even when sieved through cloth as in the example from Venice, Forsskål concluded that the luminescence was probably caused by "the slimy residue of jellyfish."[48]

During the dark winter nights of 1768, Hell and his associates noticed that the Arctic Ocean sometimes proved to be luminescent. Accordingly, they took samples and performed tests similar to those described in Pontoppidan's book. They found—correctly—that the light in the sea around Vardø was caused by "quite small sea insects, no greater than an average flea, indeed far smaller than that" and visible only in the microscope.[49] Hell describes his experiments in various letters from January 1769.[50] In a particularly elaborate letter to Gunnerus, he confesses that earlier he had been convinced that *morild* was caused either by electricity or by pieces of minerals floating in the water, as argued by Schytte. However, when experimenting with the sea water in Vardø equipped with cloth, a microscope, and distillation apparatus, he managed to come to the conclusion that the tiny "sea insects" were the real cause of the phenomenon.

47 "Verschiedene Anmerkungen an den Bischoff in Drontheim," *Der Drontheimischen Gesellschaft Schriften Erster Theil* (1765), 242–49 (quotations on 249).

48 Lawrence J. Baack, *Undying Curiosity: Carsten Niebuhr and the Royal Danish Expedition to Arabia (1761–1767)* (Stuttgart: Franz Steiner, 2014), 96. See further, E. Newton Harvey, *A History of Luminescence from the Earliest Times until 1900* (Philadelphia: American Philosophical Society, 1957), 522.

49 Draft of letter from Hell to Gunnerus in Trondheim, dated Vardø, January 15, 1769 (WUS; most of the letter is published in Pinzger, *Hell Miksa*, 1:59–62). In Norwegian waters, the cause of *morild* is usually species of the genera *Noctiluca*, *Gonyaulax*, or *Ceratium*, all animal planktons never exceeding two millimeters in size.

50 Hell to Schøller in Trondheim, dated January 12, 1769; to Pilgram in Vienna, dated January 15, 1769; to Horrebow in Copenhagen, January 15, 1769; to Peter Tønder Nordal in Trondheim, January 16, 1769 (all drafts, WUS). The investigations of the cause of *morild* are also mentioned in Sajnovics's travel diary, draft version (WUS), on December 9 and 10, 1768.

In his letter to the bishop, he promised to submit an article on his findings to the proceedings of the Trondheim Society,[51] but this came to nothing. Gunnerus, however, who cultivated frequent correspondence with von Linné in Uppsala, told the Swedish natural historian about Hell's findings and even made sure to have Hell send some specimens to Uppsala for inspection.[52] The same happened to several botanical specimens: Hell brought dried plants with him to Denmark, from where they were carried farther to Uppsala.[53] Thus, although his planned publications in the domain of natural history never saw the light of day, Hell's expedition program produced yields that contributed to the research of some of the most respected scholars in this domain.

Nothing of the sixth part, on the exploitation of natural resources, ever materialized. According to the call for subscriptions, it would present remarks on the migrations of the Sámi, including "observations concerning how to bring the migratory Lapps to lead a civilized life with stable dwellings." Temporary settlements and migrations across borders of the kind described in Sajnovics's notes from Tromsø, quoted above, were clearly recognized by the Viennese Jesuits as a central issue that exercised the minds of European "scientific travelers" across the world as well as the scholars who molded their accounts into comprehensive ethnographic works (whether under the label of global geography, global history, or otherwise). It is unfortunate that the findings of the Hell expedition did not find their way into this literature. Another problem that Hell promised to discuss was "the cause of the declining fishery in eastern parts of Finnmark," where the supply of *salpa* (cod, *Gadus morhua*) during the 1760s had been so limited that it caused widespread poverty and even periodic starvation among the local population.[54] With the benefit of hindsight, we can characterize this as fluctuations, whereas Hell and his informant appear to have interpreted the development as steady decline.

The fourth and fifth parts of the *Tomus physicus*, on the aurora borealis and on meteorological observations from Vardø, were in fact published, in the 1777

51 Draft of letter from Hell to Gunnerus in Trondheim, dated Vardø, January 15, 1769 (WUS). The promise is repeated in the Venus transit report: Hell, *Observatio transitus* [...] *1769*, 2–3.

52 Gunnerus to von Linné in Uppsala, dated Trondheim, September 2, 12, and [date not specified], 1769; von Linné to Gunnerus in Trondheim, dated Uppsala, October 5, 1769. Printed in Gunnerus and von Linné, *Brevveksling 1761–1772*, 101–6.

53 Gunnerus and von Linné, *Brevveksling 1761–1772*, 101–6.

54 Hell, call for subscriptions, in Aspaas, "Maximilianus Hell," 376–77. That there were meager quantities of cod caught in Vardø throughout the 1760s is confirmed by the priest Henning Junghans Kaurin (1736–97), in his *Jord Beskrivelse over Wardøe Præstegield, og dets Tilstand fra 1764 til 1770*. Manuscript kept at NTNU Trondheim, University Library, Gunnerus XA Qv. 281.

and the 1793 volumes of the *Ephemerides*, respectively. For centuries, the aurora had been one of the most intriguing riddles of the atmosphere, capable of spellbinding the general populace and scientific circles alike. Major theories of the eighteenth century included sulfurous emissions from volcanoes of the farthest north; reflections of the rays of the sun illuminating frozen particles in the upper atmosphere from underneath the horizon; discharges in the sky, either of a magnetic or electric nature (no theory of electromagnetism existed as yet); and a host of others.[55] In his treatise, Hell refers to all the major theories in existence, refuting them one after the other. Notably, Hell dismisses a possible correlation between the northern lights and magnetism as well as electricity. Instead, the aurora borealis is described by him as a "purely optical phenomenon."

Hell had brought a kind of electric machine with him to Vardø to see whether there might be some way to measure the electricity involved in auroral outbreaks. Details regarding the instrument are not known, except that it was of English origin and had been borrowed from the senior district stipendiary of Christiania, the above-mentioned von Storm, an avid book collector who also took an interest in scientific experimentation. While in Vardø, Hell tested von Storm's electric machine in the period from October to January.[56] He found nothing, which is not surprising considering the extreme distance of the phenomena (it is now known that the average auroral outbreak takes place more than eighty kilometers above the surface of the Earth). As mentioned, Hell also had magnetic needles at his disposal, and in late April he set up a magnetic observatory to measure the fluctuations of the compass needle several times a day. He did experience some disturbances similar to those that had been reported by Anders Celsius (1701–44) and others. But when he looked up into the sky, there was no northern light in sight. What he did see, in the foggy conditions of the Vardø climate, was a variety of other optical phenomena, like rainbows, halos around the moon, and so-called *parhelia*, or "mock suns," all of which are purely optical illusions, which can sometimes resemble the aurora borealis. Accordingly, Hell vigorously rejected any connection between the

55 See, e.g., J. Morton Briggs, "Aurora and Enlightenment: Eighteenth-Century Explanations of the Aurora Borealis," *Isis* 58, no. 4 (1967): 491–503; Wilfried Schröder, *Das Phänomen des Polarlichts* (Darmstadt: Wissenschaftliche Buchgesellschaft, 1984); Per Pippin Aspaas, "The Auroral Zone versus the Zone of Learning: A Brief History of Early Modern Theories on the Aurora Borealis," in *Travels in the North*, ed. Silje Gaupseth, Marie-Theres Federhofer, and Per Pippin Aspaas (Hannover: Wehrhahn Verlag, 2013), 113–36.

56 Hell, "Aurorae borealis theoria nova," 8–9. Sajnovics, travel diary, proofread version (WUS), on July 16, 1768.

northern light and magnetism or electricity, and concluded that it was a phenomenon of light being reflected in the atmosphere.

With the benefit of hindsight, we can conclude that Hell had set up his magnetic observatory far too late. In late April, May, and June, it is impossible to observe real aurorae because the sky is much too bright for that, even at midnight. Thus, the Midnight Sun blinded Hell's inquisitive eye. His conclusion was as follows:

> The northern light is, therefore, a purely optical phenomenon in our atmosphere. It consists of frozen particles of moisture, of various shapes, most often flat, extremely smooth, and light, capable of densification as well as rarefaction. These particles float into the atmosphere at different distances from the Earth. They may be moved by any kind of movement in the air, for example, be tossed back and forth by winds. Furthermore, they can condense or disintegrate completely; in the manner of the lightest of clouds, they can be transported to various locations; heaped together into a thousand forms they exhibit different optic patterns, etc., etc. This light of the north is usually caused by the rays of the Sun, at other times, by the rays of the moon, or even by a combination of rays from the two celestial bodies simultaneously. The rays in question are reflected in the surface of the variously formed, frozen particles. Sometimes, the rays are both reflected and refracted simultaneously, depending on the conditions such as light, color, or the shape of the patterns.[57]

As mentioned, the conclusions of Hell's interesting, albeit mistaken *Aurorae borealis theoria nova* were presented as a lecture to the Royal Society of Copenhagen as early as March 1770. It was printed in Vienna in 1776, and a German translation, with rather extensive interpretative commentary in the preface by the editor, Hell's former student and professor in Breslau, Longinus Anton Jungnitz (1764–1831), appeared in 1792.[58] Despite Hell's explicit comparison of his findings with the discoveries of Copernicus,[59] his theory, even when published in full, hardly acquired any acclaim. Wargentin's associate, physicist Johan Carl Wilcke, immediately dismissed it, and nobody in Denmark–Norway appears to have embraced it; the academicians of Paris simply remained

57 Hell, "Aurorae borealis theoria nova," 79–80. Translation in Per Pippin Aspaas, "Biographical Introduction, Summary of Contents (manuscript version), Summary of Contents (Latin edition) and Summary of Contents (German edition)," *Aurorae borealis studia classica* 4 (2016): 1–17, here 12–13.

58 See Per Pippin Aspaas, "Biographical Introduction," 4, 14–17.

59 Hell, "Aurorae borealis theoria nova," 21–22.

silent.[60] The only part that was printed was the first and fundamental one, enunciating the theory in general with special emphasis on Hell's own observation data assembled north of the sixty-sixth latitude. In the further parts of the treatise, Hell promised to discuss auroral observations from more southerly latitudes. If finished, this would have brought him into an even more explicit confrontation with the leading theory in existence, that of Mairan. According to his *Traité physique et historique de l'aurore boréale* (Physical and historical treatise on the aurora borealis [1733, 2nd ed. 1754]), the phenomenon takes place when particles from the "atmosphere" of the Sun meet the atmosphere of the Earth. The reasons for Wilcke's dismissal may have been partly connected to the fact that two Swedes, Olof Hiorter (1696–1750) and Anders Celsius, had found the correlation between (genuine) auroral outbreaks and disturbances of the magnetic needle, which Hell rejected.[61]

Finally, as late as 1792, the year in which he died, Hell published his meteorological report from Vardøhus, *Observationes meteorologicae in insula Maris Glacialis Wardoehus dicta* (Meteorological observations made on the island of the Arctic Sea with the name of Vardøhus), originally intended as yet another part of volume 2.[62] The weather report contains readings of barometers and thermometers (according to the scale of René Antoine Ferchault de Réaumur [1683–1757]) three times a day—at 7 a.m., 12 a.m., and 10 p.m. These readings were accompanied by a column designating "the appearance of the sky, weather, and directions of winds." This column contains brief notes on precipitation (not measured in quantity), wind directions, storms, and auroral outbreaks, from the mounting of the instruments on October 15, 1768 until their travel

60 Johan Carl Wilcke, *Tal, om De nyaste Förklaringar öfver Norr-Skenet, hållet, i Kongl. Maj:ts höga nårvaro, för dess Vetenskaps-Academie* (Stockholm: Johan Georg Lange, 1788), esp. 71–98.

61 For a comprehensive discussion of this discovery and they way in which it was mediated in contemporary Sweden, see Sven Widmalm, "Auroral Research and the Character of Astronomy in Enlightenment Sweden," *Acta borealia* 29, no. 2 (2012): 137–56.

62 Maximilian Hell and János Sajnovics, "Observationes Meteorologicae in Insula Maris Glacialis Wardoehus dicta […] factae 1768, et 1769," *Ephemerides* 1793 (1792), 352–93. This early series of meteorological observations seem to have escaped the notice of historians of meteorology in Norway. A brief series of data from 1829 to 1831 are mentioned as the earliest from Finnmark in B.J. Birkeland, "Ältere meteorologische Beobachtungen in Vardö," *Geofysiske publikasjoner* 10, no. 9 (1935): 1–52. Nor is Hell's meteorological report mentioned in Helge Kragemo, "Pater Hell's observasjoner i Vardøhus 1769," in *Norvegica: Minneskrift til femti-årsdagen for opprettelsen av Universitetsbibliotekets norske avdeling 1883; 1. januar 1933* (Oslo: Grøndahl & Søn, 1933), 220–26; Kragemo, "Pater Hells Vardøhus-ekspedisjon"; Kragemo, "Pater Hells ufullendte," in *Med boken som bakgrunn: Festskrift til Harald L. Tveterås* (Oslo: Tanum, 1968), 121–33. But see Lajos Bartha, "Hell Miksa légkörtani munkássága," *Légkör* 49, no. 4 (2004): 20–25.

gear was packed down on June 23, 1769. Observations of aurorae are noted in a seemingly consistent manner in this column. As already described, according to Hell's theory, observation of northern lights during the Arctic night in May or June was perfectly logical. His theory comprised not only the aurora borealis as it is defined today but also other phenomena resembling it. Thus, on June 17 Hell noted: "Silent weather, but dark clouds, the sky growing more and more clear. Mediocre eastern wind, very clear sky with southern and southeastern wind continually alternating, until around 3 a.m., when *northern lights disturbed the observations* [emphasis added]."[63] After the day-by-day, tabular overview with brief descriptions such as the one quoted here, there follows a seven-page commentary, *Animadversiones*, with descriptions of the instruments and methodology used, and—importantly—Hell's own deliberations on the weather conditions of Vardø. The very coldest recording, –18 Réaumur (corresponding to –22.5 Celsius), lasted for a very short time during the night between January 28 and 29. However, the everyday winter temperatures fluctuated between 0 and –10 Réaumur (0 to –13 Celsius) (i.e., perfectly comparable with the winter in Vienna). The existence of the Gulf Stream, constantly steering temperate sea water from the Bay of Mexico toward far-northern Scandinavia, was beyond the grasp of the Viennese visitor. Instead, he argued that the iceless waters around Vardø had resulted from a combination of three different factors, namely the nearly incessant waves of the sea, the general direction of the winds, and the currents pouring sweet water from the huge rivers of Russia. In Hell's view, the same three reasons contributed to the congelation of the vast expanse of sea from Novaya Zemlya to Spitsbergen and extending farther in an arch north of Iceland toward the shores of Greenland. All the while, the sea around Vardø remained open and free of ice:

> Ice is never encountered by sailors on this Mare Glaciale [i.e., the Eismeer, nowadays officially the Barents Sea] when they are out in the open sea, several miles from the shore. However, as soon as they encounter great ice floes floating in the sea, the sailors know for sure that they are not far removed from the mainland.[64]

In sum, Hell's meteorological deliberations cast him in a typical Enlightenment role. On the one hand, we find Hell meticulously recording his endeavors, including inventing several creative solutions to gather data despite harsh winds threatening to tear their thermometers and other apparel to pieces. On the

63 Hell, "Observationes meteorologicae," 384.
64 Hell, "Observationes meteorologicae," 389.

other, we find him assuming the role of interpreter of the Far North, synthesizing geophysical processes of global or at least circumpolar dimensions. Third, there is his application of knowledge to the benefit of sailors and decision-makers.

3 On Hungarians and Laplanders[65]

Having considered Hell's and Sajnovics's engagement with "nature in the north," the first volume of the *Expeditio litteraria* envisioned in the call for subscriptions needs attention. Apart from an introductory chapter by Hell, explaining how the expedition came about and the international context in which it was inscribed, this volume would certainly have relied heavily on contributions from Hell's assistant, Sajnovics. Its contents may be summarized thus: "Part 1: The history of the expedition, including a diary of the entire journey; Part 2: An ethnographic description of the 'Lapps'; Part 3: On the 'Lappish Language,' on its unity with the Hungarian language, and on the 'Asian Language' in general." Unlike Sajnovics's work on the Sámi language, epitomized in the *Demonstratio* and amounting to the third part of the first volume of the *Expeditio litteraria* as outlined in the call for subscriptions, the second part (which was to contain ethnographical descriptions of the Sámi) was never published. The preserved manuscripts are few, fragmentary, and insignificant compared with Hell's texts on Hungarian history and language. However, there is reason to suspect that this part would have consisted mainly in a summary of an original work by the Norwegian priest and Lappish-language professor, the author of the vocabulary used by Sajnovics and Hell during the expedition, Knud Leem (1697–1774): the chapter headings in Leem's bilingual, richly illustrated *Beskrivelse over Finmarkens Lapper/De Lapponibus Finnmarchiae* […] *commentatio* (Description of the Lapps of Finnmark [1767]) match the chapters planned by Hell quite well.[66] A few comments would probably have been

65 We have addressed aspects of the topic of this section in Per Pippin Aspaas and László Kontler, "Before and After 1773: Central European Jesuits, the Politics of Language, and Discourses of Identity in the Late Eighteenth-Century Habsburg Monarchy," in *Latin at the Crossroads of Identity: The Evolution of Linguistic Nationalism in the Kingdom of Hungary*, ed. Gábor Almási and Lav Subarić (Leiden: Brill, 2015), 95–118.

66 Available in a facsimile edition, Knud (Canutus) Leem, *Beskrivelse over Finmarkens Lapper 1767*, Efterord af Asbjørn Nesheim (*Knud Leems, Professor i det Lappiske Sprog, Beskrivelse over Finmarkens Lapper, deres Tungemaal, Levemaade og forrige Afgudsdyrkelse, oplyst ved mange Kaaberstykker: Med J.E. Gunneri* […] *Anmærkninger; Og E.J. Jessen-S.* […] *Afhandling om de Norske Finners og Lappers Hedenske Religion/Canuti Leemii, professoris lingvæ*

added by Hell, based on his Lapland experiences, but one may assume that this part of the *Expeditio litteraria* would have relied mostly on Leem's work.

Sajnovics, who was the author of the "diary of the entire journey," had spent the last couple of years as an assistant of Weiss at the Trnava observatory by the time Hell received an invitation from Copenhagen, so he may not have been the likeliest candidate for the role of Hell's companion on the journey. In the unfinished draft introduction to the *Expeditio litteraria*, Hell states the obvious, namely that Sajnovics was chosen because of his likable personality, his good health, and his astronomical skills. An alternative or supplementary explanation also lends itself: on his own testimony, Sajnovics was "born and raised in Hungary by Hungarian parents."[67] As one of the principal sub-projects associated with the Vardø expedition (to be elaborated in part 3 of volume 1) was the investigation of the linguistic kinship between Sámi and Hungarian, having a member of the crew with Hungarian as his mother tongue was certainly of some significance. It is, however, hard to corroborate the claim that Hell judged Sajnovics's linguistic skills to be of importance already in 1767. There is counter-evidence to suggest that the idea of such an investigation may have been formed at a later stage, almost by hazard. Before we investigate this possibility, a brief sketch of the "pre-history" of Finno-Ugrian comparative linguistics seems warranted.

Although neither the notion of "language families" nor the term "Finno-Ugrian" (or Finno-Ugric) existed before the nineteenth century, by itself, the positing of the kinship of Hungarian and Sámi was nothing new at the time of the expedition.[68] One of the earliest academic texts arguing for a linguistic link between several of the languages now considered Finno-Ugrian was written by Martin Fogel(ius) (1634–75) of Hamburg, *De Finnicae linguae indole*

Lapponicæ, de Lapponibus Finmarchiæ, Eorumqve lingva, vita et religione pristina commentatio, multis tabulis æneis illustrata: Una cum J.E. Gunneri [...] *Notis; & E.J. Jessen-S.* [...] *Tractatu singulari de Finnorum Lapponumqve Norvegic. religione pagana*) (Copenhagen: Rosenkilde og Bagger International Boghandel, 1975). Cf. the chapter headings with Hell's call for subscriptions.

67 János Sajnovics, *Demonstratio: Idioma Ungarorum et Lapponum idem esse* (Copenhagen: Salicath, 1770) and (Trnava: Collegium Academicum Societatis Jesu, 1771), [x]. For modern editions, see the facsimile, ed. Thomas A. Sebeők (The Hague: Mouton, 1968); German translation by Monika Ehlers, *Beweis, das die Sprache der Ungarn und Lappen dieselbe ist*, ed. Gyula Decsy and Wolfgang Veenker (Wiesbaden: Harrassowitz, 1972); Hungarian translation by Zsuzsa C. Vladár, *Demonstratio: Bizonyítás; A magyar és a lapp nyelv azonos*, ed. Enikő Szíj (Budapest: ELTE, 1994).

68 For a standard narrative of the early modern roots of Finno-Ugrian linguistics, see Günter Johannes Stipa, *Finnisch-ugrische Sprachforschung: Von der Renaissance bis zum Neupositivismus* (Helsinki: Suomalais-ugrilainen Seura, 1990).

observationes (Notes on the character of the Finnic language), whose manuscript from 1669 was later unearthed among the papers of Gottfried Wilhelm Leibniz (1646–1716).[69] The works that Leibniz and his collaborator, Johann Georg von Eckhart (1664–1730), put forward in the early eighteenth century became seminal. Leibniz argued for the large-scale collection of samples from various vernaculars, not least in Russia. In this context, he pointed to a supposed connection between Sámi, Finnish, Hungarian, and several indigenous languages found in the Russian realm.[70] Collection of linguistic data from Russia, however, did not begin in earnest until the 1720s. Several expeditions were then dispatched to chart the Russian Empire, with linguistic studies forming part of the research programs. A German-speaking Swedish officer who had been taken captive and sent to Siberia, Philipp Johann von Strahlenberg (1676–1747), took part in one of the earliest expeditions. After being released, he published a sensational book on the northern and eastern parts of Russia (1730).[71] In his book, von Strahlenberg included a table with words from what he defined as "the Tatarian and Hunno-Scythian ancestral peoples." All the languages he included in the table are now considered parts of the Uralic language family, in which the Finno-Ugrian group (or, as he called it, the "Hun nation") constitutes the largest branch. *Mutatis mutandis*, von Strahlenberg perceived the linguistic links between the entire group of Finno-Ugrian peoples, with members from Siberia (Mansi, Khanty) via northwest Russia (Komi, Mari, Mordvin, etc.) and the Baltics (Estonian, Livonian) to Central Europe (Magyar) and Fennoscandinavia (Sámi, Finnish, Karelian).[72]

Further contributions in the same vein as von Strahlenberg added more empirical material besides presenting theories on the ethnic kinship of the Magyars. They include several works by Johann Eberhard Fischer (1697–1771), who was the secretary of the second Kamchatka (or "Bering") expedition between 1733 and 1743 (himself involved in the fieldwork from 1740): *De origine*

69 On Fogel, see Maria Marten and Carola Piepenbring-Thomas, *Fogels Ordnungen: Aus der Werkstatt des Hamburger Mediziners Martin Fogel (1634–1675)* (Frankfurt am Main: Vittorio Klostermann, 2015).

70 Gottfried Wilhelm Leibniz, "Brevis designatio meditationum de Originibus Gentium, ductis potissimum ex indicio linguarum," *Miscellanea Berolinensia ad incrementum scientiarum, ex scriptis Societati Regiae Scientiarum exhibitis edita* 1 (1710): 1–16; cf. Stipa, *Finnisch-ugrische Sprachforschung*, 155–64; Hans Arens, *Sprachwissenschaft: Der Gang ihrer Entwicklung von der Antike bis zur Gegenwart* (Freiburg: K. Alber, 1969), 94–104.

71 P.J. [Philipp Johann] von Strahlenberg, *Das Nord- und Ostliche Theil von Europa und Asia, Jn so weit solches Das gantze Rußische Reich mit Siberien und der grossen Tatarey in sich begreiffet* [...] (Stockholm: In Verlegung des Autoris, 1730).

72 Modern archival studies have revealed that his book relied heavily on materials collected by another participant of the same expedition, Daniel Gottlieb Messerschmidt (1685–1735). See Stipa, *Finnisch-ugrische Sprachforschung*, 173–79.

Ungarorum (The origin of Hungarians, written in 1756, and published as part of a more comprehensive work in 1770), and the two-volume *Sibirische Geschichte von der Entdeckung Sibiriens bis auf die Eroberung dieses Landes durch die Russische Waffen* (Siberian history from the discovery of Siberia to the conquest of this land by Russian arms [St. Petersburg, 1768]). Fischer's books reiterated the claim that the Hungarians are a Finno-Ugrian people, and soon became reference works in German academic circles, particularly in Göttingen, where the theory became enshrined in August Ludwig von Schlözer's (1735–1809) widely influential *Allgemeine nordische Geschichte* (General Nordic history [1771]).[73] In Hungary itself, the first to embrace the Finno-Ugrian theory was the remarkable Lutheran antiquarian scholar Dávid Czvittinger (1675/79–1743) in his *Specimen Hungariae litteratae* (Sample of Hungarian learning [1711]). There were several others to prepare the ground for Sajnovics, including individuals who did so despite their uneasiness with the theory, such as Bél, who presumed to identify the remnants of the "Hungarian-Scythian" language in Finnish.[74] One also finds brief mentions of hypotheses of linguistic kinship of the same kind in several ethnographic and geographic works, such as Johannes Schefferus's (1621–79) classic monograph *Lapponia* (1673)[75] or the influential *Erdbeschreibung* (Description of the world [1764–92]) by Anton Friedrich Büsching (1724–93).[76]

73 Fischer's role is usually understood as subsidiary to the better-known German scholars recruited for the expedition, naturalist Johann Georg Gmelin (1709–55) and especially historian Gerhard Friedrich Müller. He is also recognized as having written at the request of von Schlözer the *Vocabularium Sibiricum* (1747), deposited in manuscript as a gift in the Historical Institute in Göttingen, to be used extensively by later scholars there. The literature on Fischer is meager, but see passing references in Yuri Slezkine, "Naturalists versus Nations: 18th-Century Russian Scholars Confront Ethnic Diversity," *Representations*, special issue, "National Cultures before Nationalism," 47 (Summer 1994): 170–95, here 186–87; in more detail, Vermeulen, "Anthropology in Colonial Contexts," 22–25; and Vermeulen, *Before Boas*, 167–71, 186–94, 281, 294. For the Kamchatka expeditions in the context of eighteenth-century Russian voyages of discovery, see Erich Donnert, *Russia in the Age of Enlightenment* (Leipzig: Edition Leipzig, 1986, German original 1983), 95–114.

74 Péter Domokos, *Szkítiától Lappóniáig: A nyelvrokonság és az őstörténet kérdéskörének visszhangja* (Budapest: Universitas, 1998).

75 Johannes Schefferus, *Lapponia, id est regionis Lapponum et gentis nova et verissima descriptio* (Frankfurt: Ex officina Christiani Wolffii, 1673), esp. 177–83 (a chapter consisting primarily of a comparison between Sámi and Finnish, which are indeed related languages). The book was also made available in German, English, French, and Dutch editions between 1674 and 1682.

76 Anton Friedrich Büsching, *Neue Erdbeschreibung* (Hamburg: Bohn, 1764), e.g., 1:428: "Their [the Finnish] language is slightly different from the Estonian, in dialect only; furthermore, it is related to Lapponian and in some respects to Hungarian as well."

FIGURE 11 Sámi community
Drawing clearly commissioned by Hell, with annotations in his hand. The annotations translate as "bad," "all this will not do," and "this entire drawing is worthless." Digitized by the Department of Astrophysics, University of Vienna

As Sajnovics's travel diary testifies, already at the stations of the northward journey he was paying attention to the lifestyle and the customs of the locals of the region, and the topic was also discussed (together with the observations of the flora and fauna and collecting of natural specimens) in the reports published in the Viennese press during the team's sojourn in Vardø.[77] Using local priests and missionaries as intermediaries, during these nine months Sajnovics had ample opportunities to pursue linguistic fieldwork among the Sámi. He summarized the results in three lectures to the Copenhagen academy at the beginning of 1770, and published them in the same year while still in the Danish capital as the *Demonstratio Idioma Ungarorum et Lapponum idem esse* (Demonstration that the language of the Hungarians and the Lapps is the same). A revised edition, leaving the original text virtually unchanged but supplementing it with important elements, appeared in Trnava in the following year. Already in the 1770s and 1780s, the *Demonstratio* attracted considerable

77 See, e.g., *WD*, May 6, 1769, 10–12.

attention[78] and received further reinforcement from the publication of the *Affinitas linguae Hungaricae cum linguis Fennicae originis grammatice demonstrata* (Grammatical proof of the affinity of the Hungarian language with languages of Fennic origin [1799]), written in Göttingen with von Schlözer's patronage by the Transylvanian physician and linguist Sámuel Gyarmathi (1751–1830). Today, the value of these two works is recognized to consist in going beyond the predecessors mentioned above in their systematic application of the principles of linguistic comparison to their data—in the case of Sajnovics, gained from first-hand empirical work—and their emphasis on evidence not just from vocabulary, phonetics, and phonology but also grammatical structures.

Rather than venturing a detailed analysis of the linguistic contribution of the *Demonstratio* here,[79] the question of authorship in strict and broader terms merits attention. This is not because of antiquarian issues of attribution, but because it is closely related to the larger problem of Hell's development of new academic agendas, including the origin and early history of the Hungarians, which in turn became highly relevant to his position in the public–political landscape of the Habsburg monarchy in the wake of the suppression of the Society of Jesus in 1773.

In the first, Copenhagen edition of the *Demonstratio*, Hell is acknowledged for having asked Sajnovics to undertake this research, for pointing out certain methodological guidelines for his assistant's interviews with native Sámi speakers, and for never allowing him to give up, even though the task proved difficult. The second, Trnava edition, goes much further. As to the reason for electing Sajnovics as travel companion, the following statement is found in the slightly rephrased introduction to the second edition:

> For he [Hell], with the same benevolence that he had bestowed upon me already some time ago, during that two-year period when he wanted me to assist him in his astronomical tasks in Vienna, had chosen me also for this expedition to the Far North, and brought me along to Finnmark as a travel companion and an assistant in his activities, *in particular in his endeavors to investigate the Lappish language*. This was an occasion *for Hungarians* to visit the Lapps, this was an occasion to test *the conjecture of a*

78 The Copenhagen edition had already been extensively reviewed (a mere two months after its publication) in the *GAgS* [18]:1, no. 78 (June 30, 1770): 674–79. The *Journal des Sçavans* also reported on it, see *JS* (February 1772): 121.

79 For an excellent assessment in English along the lines indicated above, see Zsuzsa C. Vladár, "Sajnovics's *Demonstratio* and Gyarmathi's *Affinitas*: Terminology and Methodology," *Acta linguistica Hungarica* 55, nos. 1–2 (2008): 145–81.

> *correlation between the Hungarian and Lappish language, which Honorable Father Hell had formed in his mind already beforehand*, from reading the "Lapponia" of Schefferus and the "Geographia" of Büsching, a conjecture he had mentioned to me every so often during the journey [emphasis added].[80]

Hell now appears explicitly as not merely a constant source of support but as the *fons et origo* of the linguistic endeavor of the Vardø expedition. His direct involvement in the project is also stressed by changing "an occasion for a Hungarian [Ungaro] to visit the Lapps" in the first edition to the plural (Ungaris) in the second. An extant draft in Hell's own hand, intended to be sent to Sajnovics in the winter of 1770–71, demonstrates that these changes were introduced in the Trnava edition upon Hell's own explicit instruction:

> In the preface to the Royal Society [of Copenhagen] // After the words: "Imperial and Royal Astronomer from the University of Vienna" [add the following], "*also a Hungarian by nation*, invited to Vardøhus by the redoubtable Majesty King Christian VII of Denmark and Norway in order to observe the transit of Venus in front of the disc of the Sun. Since the same Hell, formerly my teacher in astronomical subjects, had chosen me as his travel companion in order to assist him in his astronomical tasks and in particular the examination of the Lappish language, I set off for Finnmark, where I spent about a year. // For on this occasion, it was possible for *Hungarians* to spend time among the Lapps; on this occasion, it was possible to put to the test Father Hell's conjecture, which he based upon the *Geographia* of Büsching and the *Lapponia* of Schefferus and which he had frequently mentioned to me during the journey [...]."[81]

As a result of the additions and the small amendments in the second edition, Hell emerges as not only the initiator but the permanent guiding spirit of and an equal, even principal contributor to the research. He now appears also to have been the one who introduced Sajnovics to the method of comparison: "In his leisure hours, he joined me, studied the *Nomenclator* [the 1756 Danish–Lappish dictionary of Leem] with me, searched for words and interpreted them."[82] He is credited with having directed the work of data collection by putting

80 Sajnovics, *Demonstratio* (1771), [xi–xii], cf. 22.

81 "Jn adlocutione ad Societatem Regiam," Manuscripte Hell, WUS. Digitized in Aspaas, "Maximilianus Hell," 126–7.

82 Sajnovics, *Demonstratio* (1771), 23.

together the list of questions to be asked during the interviews with the natives,[83] and he even took the initiative personally: while engaged in a long conversation about the Sámi with a missionary named Daas, a "Karelian" fisherman entered the house, and it was upon Hell's explicit instruction that he was requested to recite the *Pater noster* in his mother tongue.[84]

The idea of listening to spoken "Karelian" (related as it is to both Finnish and Sámi) and thus recognizing similarities in phonological structures may well have been Hell's. However, the story of Hell's planning the investigation and framing the methodology is hard to reconcile with other pieces of evidence. The above-mentioned *Nomenclator* as well as a *Grammatica*, or Lappish grammar, by professor of the Sámi language Knud Leem was given to the company by von Storm in Christiania during their northbound trip, "as a token of great friendship, without us asking for this at all," Sajnovics explains.[85] A couple of weeks later, Hell and Sajnovics landed in Trondheim, where they spent three weeks preparing the continuation of their expedition. Trondheim was the place where Leem lived and worked, as professor of the Seminarium Lapponicum, or special seminary giving language instruction to Norwegians preparing for a career as missionaries in the northernmost parts of the kingdom.[86] It is here that the narrative of a "planned discovery" of the linguistic link between Sámi and Hungarian, and thereby also between "Lapps" and "Magyars," falters.[87] Assuming that this kind of research was at the top of Hell's priorities, it

83 Sajnovics, *Demonstratio* (1771), 24.

84 Sajnovics, *Demonstratio* (1771), 22–23; an account of this incident is found in the first edition as well, but without mention of any role played by Hell, *Demonstratio* (1770), 14–15. "Karelian" is one of several ethnonyms formerly used for the group now commonly known as Kven, i.e., people that migrated from Finnish-speaking parts of modern Finland and northern Sweden to settle along the coast of northernmost Norway during the early modern period. The form of Finnish spoken by Kvens deviates slightly from the official language in Finland, and since 2005 Kven has been formally recognized a minority language in Norway.

85 Sajnovics, *Demonstratio* (1770), 15; *Demonstratio* (1771), 23; travel diary, proofread version (WUS), on July 16, 1768.

86 Dedicated missionary work in Dano-Norwegian Lapland began early in the eighteenth century, motivated not only by pietistic ideals associated with the saving of souls but also by a perceived need of transforming the migratory Sámi into loyal subjects of the Dano-Norwegian state. Cf. Jan Ragnar Hagland and Steinar Supphellen, eds., *Knud Leem og det samiske*, Det kongelige norske videnskabers selskabs Skrifter (Trondheim: Tapir akademisk, 2003).

87 It has already been suggested that the investigation of the Sámi language and its affinity with Hungarian, with all the implications to Hungarian prehistory, was an improvisation of the expeditionists while already en route to Vardø in Lajos Bartha, "Sajnovics János, Hell Miksa és a 'magyar őstörténet,'" *Nyelvtudományi Közlemények* 85 (1983): 297–304.

seems strange that there is no mention at all of an attempt to contact the main authority on Sámi language and ethnography in the country during their three-week stay in Trondheim. Other factors that may point to the improvised character of the linguistic research of the expedition include Sajnovics's enthusiastic mention of having been supplied with a copy of the famous *Nova grammatica Ungarica* (New Hungarian grammar [1610]) of Albert Szenczi Molnár (1574–1634) during the southbound stay in Copenhagen: had there been a preconceived intention to inquire into the subject, this book ought to have been an almost mandatory item in the Jesuits' luggage. It might be added that, besides this work, the only Hungarian grammar referenced in the *Demonstratio* is the standard Jesuit grammar by Pereszlényi, mentioned above.[88] One would also have expected Hell to have already asked for the most recent literature on the Sámi language and ethnography while in Copenhagen, with the Royal Library and the avid collector of learned literature and mighty interior minister Thott close at hand.[89]

Throughout their stay in Denmark–Norway, Hell and Sajnovics enjoyed Thott's support. It is in this connection that the idea of introducing Hungarian orthography into the Sámi language, as a fully new topic in the 1771 edition of the *Demonstratio* also ascribed there to Hell, merits separate mention.[90] This had important, though short-lived resonances in Copenhagen: by Thott's decision, the recommendations of the Viennese visitors were to be followed in the revision and reissuing of the official Danish dictionary of the Sámi language. In doing so, Thott overruled protests from Norwegian priests and missionaries who had a different understanding of the Sámi language and its origins.[91] The

88 Sajnovics, *Demonstratio* (1770), 82: "Alone Molnár's words, full of perspicuity and honesty that they are, are found worthy of being quoted. He […] wrote a grammar of Hungarian, published in Hanover and not seen by me until it was communicated to me by the Illustrious Gentleman Langebeck […]"; repeated in 2nd ed. (1771), 130. We are grateful to Zsuzsa C. Vladár for having called our attention to the scarce reliance on Hungarian grammars in the *Demonstratio*.

89 There is no record of an (attempted) meeting with Leem in 1768. However, the diary for the southbound journey contains the brief statement that "Mr. Leem, professor of the Lapponic language was visited." Sajnovics, travel diary, draft version (WUS), on September 7, 1769.

90 Sajnovics, *Demonstratio* (1771), 33.

91 This story is recounted in detail by Bente Martinussen, "Anders Porsanger: Teolog og språkforsker fra 1700-tallets Finnmark," *Nordlyd* 18 (1992): 15–59; for a brief English summary of her conclusions, see Even Hovdhaugen et al., *The History of Linguistics in the Nordic Countries* (Helsinki: Societas Scientiarum Fennica, 2000), 54–55. See also Pekka Sammalahti, "History of Finno-Ugric Linguistics in the Nordic Countries," in *Studies in the Development of Linguistics in Denmark, Finland, Iceland, Norway, and Sweden*, ed. Carol Henriksen et al. (Oslo: Novus Forlag), 297–323; Per Pippin Aspaas, "Maximilian Hellin ja

"Royal stamp" that protected Hell and Sajnovics while in Denmark–Norway also secured them collaboration from virtually every core member of the Royal Society of Copenhagen. This is evident from the concluding chapter of Sajnovics's *Demonstratio*, where numerous savants who had contributed to his studies by lending him books and offering other sorts of assistance are singled out and thanked. Not surprisingly, Thott was the dedicatee of both editions of the *Demonstratio*. In December 1770, however, in the aftermath of a coup staged by Christian VII's personal physician Johann Friedrich Struensee (1737–72), Thott was forced to resign from all his offices.[92] By the time the orthographic reform was propagated in the second edition of the *Demonstratio*, the initiative had lost its chief patron in Copenhagen, and was dropped.

Finally, frequent anticipations of the *Expeditio litteraria* also serve to associate the *Demonstratio* more closely with Hell. A newly introduced sentence by Sajnovics in the 1771 edition is either an innocently polite gesture toward the strong man of the expedition, or an all too unconcealed acknowledgment of the ongoing process of appropriation: "Reverend Father Hell is treating the present little work with benevolence, *as if it were his own* [italics added] and will publish it for the third time inserted in his *Expeditio litteraria*."[93] The 1771 edition also contains specific information about some of the planned content of the larger work, and a part of this, again, can be traced back to direct instruction by Hell, this time in another draft, also to be sent to Sajnovics in Trnava during the winter of 1770–71:

> Moreover, in the same work (as I learned from the same letter of Father Hell's, recently sent to me from Vienna), he will not only demonstrate the common origin of each of the two peoples, that is, the Hungarians and the Lapps; he will also, by means of weighty evidence, show that the Fenni, or Finns, are the ancestors of all the various tribes that use the Hungarian language, and especially that the ancient fatherland of that most noble Hungarian tribe, which inhabits Hungary, was Carjelia, and that

---

Johannes Sajnovicsin 'Expeditio litteraria ad Polum arcticum' ja suomalais-ugrilaisen kielentutkimuksen synty," in *Lapin tuhat tarinaa*, ed. Osmo Pekonen and Johan Stén (Ranua: Mäntykustannus, 2012), 65–86.

92 The same happened to another supporter of the two Jesuits, the foreign minister Bernstorff. It seems Struensee's coup even brought an end to Danish participation in projects of international science; cf. Allan Sortkær, "Hvilken fortræffelig gave fra den danske nation til videnskaben! Fremkomsten af internationale videnskabelige ekspeditioner i 1700-tallet," *Den Jyske Historiker*, special issue, "Danske Videnskabelige Ekspeditioner," 119 (2008): 5–25, esp. 21–23.

93 Sajnovics, *Demonstratio* (1771), 55.

> the Carjelians are the genuine ancestors of the Magyars and Hungarians [...].[94]

Like this one, each of the other anticipations of the contents of the *Expeditio litteraria* in the 1771 edition of the *Demonstratio* concerned issues broadly related to the larger problem of the origins, including the original home, of the Hungarians. Hell's interaction with the eminent Jesuit historian Pray, who dedicated a great deal of attention to the same issues in the same period, sheds interesting light both on the development of his own ideas on the subject, and his understanding of his role in the linguistic achievement of the *Demonstratio*.[95]

One of the relevant passages of the 1771 edition discusses the origin of Hungarians, Sámi, Finns, and so on from "the neighborhood of China."[96] This resonated in complex ways with the argument put forward in Pray's *Annales veteres Hunnorum, Avarum et Hungarorum* (Ancient annals of the Huns, Avars, and Hungarians [Vienna, 1761]), where the recent proposition by the French orientalist Joseph de Guignes (1721–1800) in his *Histoire générale des Huns, des Turcs, des Mongols, et des autres peuples Tartares occidentaux* (General history of the Huns, Turks, Mongols and other western Tartar peoples [1756–58]) that the Hsiung-nu mentioned in ancient Chinese sources were identical with the Huns, was combined with the older theory of Hun–Hungarian kinship.[97] The idea of a prestigious steppe kinship of the Hungarians with the mighty Huns had been the standard narrative of the subject matter ever since the early Middle Ages. It was incorporated in the *Gesta Hungarorum* (Deeds of the Hungarians) of the obscure twelfth-century royal notary Anonymus, whose account of the ninth-century "reconquest" of the territory of the future Kingdom of Hungary by the Magyar descendants of the people of Attila became the basis of a full-fledged social and political ideology of the Hungarian nobility in a work written in 1282–85 by Simon Kézai (Simon of Kéza), bearing the same title. Kézai proposed that the nobility's social pre-eminence, privileges, and political

94 Sajnovics, *Demonstratio* (1771), 119. Cf. "Jn eo autem opere [...]," Manuscripte Hell, WUS.

95 For an analysis of these connections from the perspective of linguistics, see Zsuzsa C. Vladár, "Valójában ki a szerzője a Demonstrációnak?," *Magyar Nyelv* 112, no. 3 (2016): 316–24; Vladár, "Hell mint nyelvész: A Kar-jelia etimológia és a kínai hasonlítás példája," in *A nyelvtörténeti kutatások újabb eredményei* , ed. Tamás Forgács, Miklós Németh, and Balázs Sinkovics (Szeged: SZTE, 2017), 9:337–50.

96 Sajnovics, *Demonstratio* (1771), 50–51.

97 On the "discovery of Eurasia" by de Guignes, see J.G.A. Pocock, *Barbarism and Religion*, vol. 4, *Barbarians, Savages, and Empires* (Cambridge: Cambridge University Press, 2005), 99–155.

rights derived from the military prowess demonstrated by their ancestors in the taking of the land, and that a sort of *politia commixta*, the proper form of government already among Attila and the Huns, was also preserved among their Hungarian offspring. The two works were first printed in 1746 and 1781, respectively,[98] a period in which this theory (perpetuated by several later medieval and humanist chronicles and the most frequently printed Hungarian book of all time: the 1517 *Tripartitum*, a collection of customary law by jurist and statesman István Werbőczy [1458–1541][99]) still held considerable authority.[100] While Anonymus was edited by the Protestant Bél and his disciple Johann Georg Schwandtner (1716–91), and Kézai by the Piarist erudite Elek Horányi (1736–1809), it is noteworthy that—as Pray's work signals—historical interest among Hungary's Jesuits was turning from questions of chronology and dynastic issues to problems central to discourses of identity shortly before the time Hell and Sajnovics formulated their ideas on Hungarian–Sámi (language) kinship.

We shall consider the predominantly hostile reaction of the adherents of the "Scythian" theory to their proposition in Chapter 8, in connection with the chances of Hell finding new social allies after the suppression of the Society of Jesus by reconfiguring himself as a Hungarus patriot. What is important to note here is that the efforts in the "domestic" (Trnava) edition of the *Demonstratio* to tacitly forge a link for the Sámi and the Hungarians with the Huns by tracing their languages back to Chinese (supposedly the source of all Asian languages)[101] may point to an awareness on the part of Hell that the theory put forward in the *Demonstratio* is likely to evoke resentment and needs

98 György Szabados, *A magyar történelem kezdeteiről: Az előidő-szemlélet hangsúlyváltásai a XV–XVIII. században* (Budapest: Balassi Kiadó, 2006) 14, 19. Hell also planned to include Anonymus's *Gesta* in the *Expeditio litteraria*. Sajnovics, *Demonstratio* (1771), 130.

99 See several studies in Martyn Rady, ed., *Custom and Law in Central Europe* (Cambridge: Centre for European Legal Studies, 2003).

100 For a brief introduction to this tradition and its ideological significance, see László Kontler and Balázs Trencsényi, "Hungary," in *European Political Thought 1450–1700: Religion, Law, and Philosophy*, ed. Howell Lloyd, Glenn Burgess, and Simon Hodson (New Haven: Yale University Press, 2007), 176–207, here 180–81, 185–86; for more details, see Jenő Szűcs, "Theoretische Elemente in Meister Simon de Kézas *Gesta Hungarorum* (1282–1285): Beiträge zur Herausgestaltung der 'europäischen Synchronismus' der Ideenstrukturen," in Szűcs, *Nation und Geschichte* (Cologne: Böhlau, 1981), 263–328.

101 For the ascription of this proposition to Hell, and its divergent linguistic grounds—the emphasis on monosyllabic roots in Chinese as well as Sámi and Hungarian; the application of metathesis and reading words backward, etc.—from the overall thrust of Sajnovics's approach, see Vladár, "Hell mint nyelvész," 338–40.

attenuation.[102] Although in private correspondence Hell repeatedly expressed to Pray his reservations about de Guignes's original thesis,[103] to his mind the only consequence of his and Sajnovics's findings for Pray's analysis was the need to add Sámi to the Hun–Hungarian combination. He expressed his hope that Pray would do this in his forthcoming work, and offered to "share my arguments and the authors on the question with Your Reverend, so that you may turn them to your own use."[104] The same kind of "attenuation" was obviously the purpose of the additions extolling the beauty and the richness of the Sámi language, as a repository for the improvement of Hungarian,[105] and even more of the references to the courage and valiance of the Lapps.[106]

There was indeed a great deal of anti-Sámi prejudice in contemporary literature to dispel if Sámi–Hungarian kinship was to be made appealing. The representation of Sámi in the standard international works—like the abovementioned *Lapponia* (1673) by Schefferus or the *Géographie historique, ecclésiastique et civile* (Historical, ecclesiastical and civil geography [1755]) by Maurist scholar Dom Jean-Joseph Vaissète (1685–1756)—was patently unflattering. In these accounts, the Sámi are described physically as of a small stature, and thin; their skin inclines to black because of the perpetual smoke in their tents; they have a large head and a protruding thorax, and small, cavernous, rheumy eyes; their nose is short and flat, their chin elongated, their mouth large and always open. They walk humped. With respect to customs and manners, "for most of the year they have little society among themselves, as they live in the forest among the wild beasts; and each family is separated from the others by a vast stretch of land." They are "cowardly and timid, and abhor war, which they never wage"; they are "cunning, and they sometimes cheat in trade."[107]

These stereotypes were faithfully reproduced in works of the same genre published in Hungary in the decades around the publication of the

102 Readers of the 1771 edition of the *Demonstratio* also familiar with Pray's *Annales* could easily make the inference that Sámi were herewith to be included in the Hun–Hungarian community (originally forged in China).

103 Hell to Pray, April 14, 1770. ELTE EK, G 119. no. 169; Hell to Pray, January 4, 1771. ELTE EK, G 119. no. 168.

104 Hell to Pray, April 14, 1770. ELTE EK, G 119. no. 169.

105 Sajnovics, *Demonstratio* (1771), 82–83, 107–10.

106 Sajnovics, *Demonstratio* (1771), 119–29.

107 Dom [Jean-]Joseph Vaissète, *Geographie historique, ecclesiastique et civile, ou description de toutes les parties du globe Terrestre, enrichie de cartes géographiques* (Paris: Desaint & Saillant, Jean-Thomas Herissant, Jacques Barois, 1755), 101, following Scheffer. It was little compensation that their bodies are still acknowledged to be "well proportioned, without being deformed," and they are said to be "charitable and hospitable, and not without talent, because they produce all their utensils with much adroitness."

Demonstratio.[108] The Sámi are characterized in these in a vocabulary used in contemporary stadial history[109] to describe "savage" societies as yet resisting the influences of their more civilized neighbors. They invariably emphasize the bodily feebleness of the Sámi,[110] and the consequent lack of military prowess among them,[111] though one source claims that "once upon a time, six hundred Lapps put twenty thousand Muscovites to flight."[112] Occasionally, the characterization of their physical features is conceived as a part of the general presentation of polar peoples. Thus, Sámi are linked with Fuegians, described as "the most inferior variety of our human kind" whom "it is impossible to behold without compassion and repugnance"; "according to some writers, they form the link between humanity and the Troglodytes [i.e., apes]," though the

108 We thank Ildikó Kristóf for bringing these works to our attention.

109 The literature on Enlightenment stadial history, classifying human societies according to progress in their mode of subsistence from hunting-gathering through pasturing to agriculture and commerce, and more generally the "sciences of man," would fill a small library. Selectively, see Gladys Bryson, *Man and Society: The Scottish Inquiry of the Eighteenth Century* (Princeton: Princeton University Press, 1945); Michèle Duchet, *Anthropologie et histoire au siècle des lumières* (Paris: Albin Michel, 1971); Antonello Gerbi, *The Dispute of the New World: The History of a Polemic 1750–1900* (Pittsburgh: University of Pittsburgh Press, 1973); Ronald L. Meek, *Social Science and the Ignoble Savage* (Cambridge: Cambridge University Press, 1976); Peter J. Marshall and Glyndwr Williams, *The Great Map of Mankind: Perceptions of New Worlds in the Age of Enlightenment* (Cambridge, MA: Harvard University Press, 1982); Anthony Pagden, *The Fall of Natural Man: The American Indian and the Origins of Comparative Ethnology* (Cambridge: Cambridge University Press, 1986); Pagden, *European Encounters with the New World* (New Haven: Yale University Press, 1993); Roxann Wheeler, *The Complexion of Race: Categories of Difference in Eighteenth-Century British Culture* (Philadelphia: University of Pennsylvania Press, 2000); Hans Erich Bödeker, Philippe Büttgen, and Michel Espagne, eds., *Die Wissenschaft vom Menschen in Göttingen um 1800* (Göttingen: Vandenhoeck & Ruprecht, 2008); Silvia Sebastiani, *I limiti del progresso: Razza e genere nell'Illuminismo scozzese* (Bologna: Il Mulino, 2008), and the revised English edition, *The Scottish Enlightenment: Race, Gender, and the Limits of Progress* (Houndmills: Palgrave Macmillan, 2013). For Hungarian resonances, see Olga Penke, *Filozofikus világtörténetek és történetfilozófiák: A francia és a magyar felvilágosodás* (Budapest: Balassi Kiadó, 2000); Péter Balázs, *Biblia, história és bölcselet a felvilágosodás korában* (Budapest: L'Harmattan, 2013).

110 [Johann Hübner], *Geographica globi terraquei synopsis: A multis praesertim quod Hungariam attinet, erroribus, qui in Celeberrimo alias Geographo Hübnero, aliisque circumferuntur, expurgata; In qua omnium mundi Regionum, & locorum situs pro Mapparum Geographicarum usu exactissime describuntur* (Trnava: Acad. Societ. Jesu, 1755), 160; [Pál Bertalanffi], *Világnak Két-rendbéli ismerete: Először A' mint Istentől teremtetett; Másodszor A' mint az Istennek, és a' természetnek Vezérléséből az emberektől különbb-különbbféle részekre, Országokra, Tartományokra, és kösségekre osztatott* [...] (Trnava: Academia, 1757), 648; [László Baranyi], *Rövid magyar geographia* (Pest: Trattner, 1796), 129.

111 [Hübner], *Geographica globi*, 214.

112 Bertalanffi, *Világnak Két-rendbéli ismerete*, 648.

author hastens to add in a Buffonian fashion that "all the different nations most probably descend from the same stock, as all nations mingle with one another, they procreate, and some of their offspring resembles the one, and others, the other nation."[113] The continued adherence of the Sámi to "pagan darkness"[114] and their primitive mode of subsistence and "beastly existence"[115] is another persistent feature of their representation in these works. Some authors elaborate on this by emphasizing the complete lack of agriculture and any other domestic animals than reindeer (which they utilize to full extent, including the drinking of their blood),[116] their simple domiciles, and the dominant role of fishing and hunting.[117] There are some important qualifications, too. One author asserts that while the Sámi are very ignorant and live among primitive conditions, "they are not as miserable as some people think," because they are "nevertheless satisfied with their lot, and live peacefully with one another."[118] Elsewhere we learn that "they are regarded as ignorant, but an English traveler says: human love and affection is taught to polished nations; but in Lapponia, it is also exercised"[119]—resembling, though on somewhat different grounds, Linnaeus's judgment of the Sámi as noble savages who may have something to teach civilized nations.[120]

113 [György Fejér], *Anthropologia vagy is az embe'r esmértetése* (Buda: Királyi Magyar Universitás, 1807), 152–53. For a similar analysis, see [Mihály Katona], *Közönséges természeti Föld-leirás* (Pest: Trattner, 1824), 452.

114 István Vetsei P[ataki], *Magyar Geografiája: Az Az; Ez egész világ négy részeinek, ugymint Európának, Asiának, Afrikának és Amerikának;'s bennek levő sokféle országok nemzetségek; azok eredetek, természetek, 's nevezetesebb szokásainak, vallásainak, imperátorinak, királyinak, s több egyéb elmét vidámito hasznos dolgainak méltó és rövid le-irása* […] (Carei: Károlyi Ferentz Typographiája, 1757), 225.

115 Bertalanffi, *Világnak Két-rendbéli ismerete*, 649.

116 [Georg Christian Raff], *Természethistoria a' gyermekeknek* (Veszprém: Számmer Mihály, 1799), 537–38. On the reception of Raff's work in Hungary, see Ildikó Sz. Kristóf, "The Uses of Natural History: Georg C. Raff's *Naturgeschichte für Kinder* (1778) in Its Multiple Translations and Multiple Receptions," in Le livre demeure: *Studies in Book History in Honour of Alison Saunders*, ed. Alison Adams, Philip Ford, and Stephen Rawles (Geneva: Droz, 2011), 309–33.

117 György Raff, *Geografiája a' gyengébbek elméjekhez alkalmaztatott, és magyarúl kiadattatott* (Vác: Ambro Ferenc, 1791), 144.

118 Raff, *Geografiája a' gyengébbek elméjekhez alkalmaztatott*, 144. It is noteworthy that Raff's work usually refrains from presenting lifestyles (the other two exceptions being the Muscovites and the Poles).

119 [János Ferenczy], *Közönséges geographia, mellyben a' Földnek mathematikai, természeti, és leg inkább politikai állapotja a' leg ujabb változások után elő adatik* (Pest: Eggenberger József, 1809), 153.

120 Koerner, *Linnaeus*, 56–81.

As a matter of fact, the same works also include—sometimes very lengthy—accounts of the peoples of the steppe, or Scythia, "an immensely large country occupying one-third of Asia," from where the Magyars had also once departed in search of a better land and where "even today, entire nations move around by the thousands because of the barrenness of the soil."[121] They live mostly as nomadic shepherds—thus in a stage more advanced than the Sámi—and are also acknowledged to be bloodthirsty warriors. However, though the Greeks and Romans may have regarded them as barbarians,

> it is very true of the Scythians that they achieved more good by relying on nature than the Greeks by all the learned instruction of their philosophers [...]. In addition, this people never bowed to a foreign nation, they even founded the Parthian and Bactrian empire, they defeated Cyrus and Darius, they put Alexander the Great to nothing, and the Romans never dared to attack them.

Contradicting some earlier claims, it is stated that

> though they are pagans, like some other nations in this world, they never had any idol either cast or carved, they respected marital life, they cultivated the art of war, and many of them did not eschew the sciences either; they even had philosophers, studied the rules of justice, and many other laudable things were found among them, for which reason the Apostle Paul distinguishes them from the barbarians, Col. 3:11.[122]

In these descriptions, in which the standard international knowledge on the subject was recycled for Hungarian audiences, we thus meet savages and barbarians, both of whom have some potential to be recognized as "noble." With regard to the reception and uses of this knowledge, because of the ideological aspects mentioned earlier, there was a strong presumption in favor of accentuating this potential in the case of "Scythians," and against the same in the case of the Sámi—even without the provocation of the *Demonstratio*. To pre-empt and counter this, Hell resorted, among other things, to a bizarre etymology of Carjelia (or Karjelia), supposedly derived from *karjel*: the Hungarian compound *jel*(*es*) *kar* (i.e., "illustrious arm"); and to lend further support to the representation of the "Lapps" of "Karjelia" as heroic warriors, he included the

121 Vetsei, *Magyar Geografiája*, 355, 357.

122 Vetsei, *Magyar Geografiája*, 360 (wrong pagination: properly 356).

insignia of the region, representing two arms holding a sword and a spear (or an arrow?), found in the Blaeu atlas.[123]

Each of these topics, besides several others related to the origin and ancient history of the Hungarians, are discussed in notes and letters by Hell preserved among the papers of Pray, deriving from the period of the preparation and the aftermath of the publication of the second edition of the *Demonstratio*.[124] As regards *karjel*, Hell claims that this is the form in which all of their local interlocutors referred to themselves, and in a letter to Pray he also underpins this from the Swedish description of Lapland by Pehr Högström (1714–84), published in Stockholm in 1747.[125] Elsewhere, he claims to have heard the "Karjelian dialect" spoken among the Szekels of Transylvania, who supposedly migrated there from Karjelia itself with "King Attila."[126] Hell's above-mentioned note was conceived as a response to Pray, who was apparently skeptical about Hell's explications. Another effort by the astronomer at etymological analysis, deriving Dentumoger—the name of the homeland of the Hungarians before the conquest of the Carpathian Basin in Anonymus's *Gesta*—from *Dán-vad-magyar*, "Danish-fierce-Hungarian," was dismissed by Pray in notes on Hell's manuscript as "violent distortion" and "gross ignorance."[127]

While these ventures of Hell into linguistics were clumsy, the zeal with which he pursued them and investigated a wide range of issues and sources of early Hungarian history are proof of his determination to be recognized as an expert in the field. Besides the exchanges with Pray, the evidence for Hell's infatuation with the history of Hungarians during the later stages of the steppe migrations, the conquest and settlement in the Carpathian basin, and the early period of the Christian monarchy includes items of correspondence with the two other leading Jesuit historians of the time, István (Stephanus) Kaprinai (1714–85) and István (Stephanus) Katona (1732–1811), as well as notes, drafts, and fragments undoubtedly intended to feed the pages of *Expeditio litteraria*. Hell delved into and discussed puzzles found in primary sources like Anonymus's *Gesta* and the Byzantine emperor Constantine VII Porphyrogenitus's (909–59, r.913–59) *De administrando imperio* (Of the governance of the empire

123 Sajnovics, *Demonstratio* (1771), 119–24 (the insignia, 122). It is noteworthy that wherever the region's name appeared in the 1770 edition, it was Careila (Karelia), i.e., without the "j" that supported Hell's etymology.

124 These documents are included in the Collectio Prayana, vol. 18, Miscellanea, at the ELTE EK, now digitized; https://edit.elte.hu/xmlui/gallerymanager?reckey=HeadCollPray018#drop (accessed April 16, 2019).

125 Coll. Prayana 18:25; Hell to Pray, February 5, 1772. ELTE EK, G 119. no. 162.

126 Hell to Pray, March 29, 1771. ELTE EK, G 119. no. 165.

127 Coll. Prayana 18:23.

[c. 948–52]), written to his successor as a governance manual, and containing a great deal of material, including histories and legends, about neighboring peoples.[128] He even took inspiration from these to prepare historical maps, and brooded over questions like the "original homes" of the Magyar tribes as well as the peoples they encountered and mingled with during their migration—the Khazars and Khazaria figuring especially prominently among them—the date of the birth of the founder of the state, King Saint Stephen I (c.970/75–1038, r.1000–38), or the later immigration of further nomadic groups like the Jazigs and Cumans into the medieval Kingdom of Hungary.[129]

Given this deep and systematic immersion, by the time of the Trnava edition of the *Demonstratio* Hell's swelling self-confidence in the field led him to strike an increasingly polemical, even resentful tone. Writing to Pray on February 5, 1772, he still regarded the historian as an ally, requesting his support in countering some disparaging comments on the *Demonstratio* in von Schlözer's *Allgemeine nordische Geschichte*. In his work, von Schlözer charged Sajnovics with ignorance of the migration of his own Hungarian people. Hell

128 Two chapters of the *Expeditio litteraria* were supposed to be devoted to Anonymus and to Constantine, respectively. For modern editions, see Anonymus and Master Roger, *Anonymi Bele Regis Notarii Gesta Hungarorum/Anonymus, Notary of King Béla, the Deeds of the Hungarians*, trans. and ed. Martyn Rady and László Veszprémy; *Magistri Rogerii Epistola in Miserabile Carmen super Destructione Regni Hungarie per Tartaros Facta/Master Roger's Epistle to the Sorrowful Lament upon the Destruction of the Kingdom of Hungary by the Tatars*, trans. and ed. János M. Bak and Martyn Rady (Budapest: Central European University Press, 2010); Constantine VII Porphyrogenitus, *De administrando imperio*, Greek text ed. Gyula Moravcsik, English trans. R.J.H. [Romilly James Heald] Jenkins, commentary by F. [Francis] Dvornik (Washington, DC: Dumbarton Oaks, 1962–67).

129 Besides the letters to Pray already mentioned, Constantine Porphyrogenitus and Anonymus are also discussed in Hell to Pray, January 10, 1771 and January 28, 1772, ELTE EK G 119. nos. 167, 161; Khazaria in Hell to Pray, January 18, 1772, ELTE EK G 119. no. 161. Anonymus is the central subject in Hell to Kaprinai, January 28 and February 18, 1772, and Kaprinai to Hell, February 16, 1772. ELTE EK, Coll. Kaprinayana, 66:nos. 2–4 (the original of the latter one, dated February 15, 1772, with a slightly different wording, is held at the WUS MS Hell, 4:no. 47) As late as November 2, 1776, Katona sent Hell long reflections on Porphyrogenitus, WUS MS Hell, 4:no. 53. The relevant drafts and fragments by Hell (all of them undated) are also held at the WUS, MS Hell, vol. 4, and include: "Notitia regni Ungariae anno 886. ante adventum Ungarorum" (no. 26); "Criteria ad indagadandam, et definiandam statem Scriptae Historia Anonymi Regis Belae Notarii de VII Ducibus Ungariae. ex ipso Auctore deducta" (no. 36); "Synopsis Chronologico-Geographico-Historica Adventus Ungarorum in Pannoniam Seculo IX. Ex Anonymo Regis Belae Notario, et Constantino Porphyrogenetae De Administrando Imperio" (no. 40); "Disquisitio Critica de Cumanis" (no. 41); "De Primis Ungarorum sedibus seu Natali solo Ungarorum" (no. 58); "De Anno Nativitati S. Stephani" (no. 85); "Dissertatio de Ultimo Ungarii adventa in Pannoniam seu Hodiernam Ungariam" (no. 97).

FIGURE 12 Prince Árpád acknowledged as principal leader by raising him on the shield ("in a Khazaraian style") by the Magyar chieftains and their allies
From a map of ancient Hungary drawn by Hell on the basis of Anonymus's *Gesta Hungarorum* (*Tabula geographica Ungariae Veteris Ex Historia Anonymi Belæ Regis Notarii, a P. Maximiliano Hell S.I. Gabriel Ruderstorffer* [Vienna, 1772]).
Hungarian National Library, Map Department, TR 378.

retorted that this was just because von Schlözer only had access to the Copenhagen edition (to amend which Hell arranged for a copy of the Trnava edition to be sent to Göttingen); besides, the German professor was misled in his own notion of the original home of the Hungarians by his fallacious spelling of "Magyar" as "Madschar," and by using the wrong sources and methodology (Fischer, geographer Johann Gustav Gärber [1690–1734], and renowned Swedish polymath Olof [Olaus] Rudbeck [1630–1702]). Soon after Hell sent this letter to Pray, he also received one from von Schlözer, thanking Hell for sending the Trnava edition of the *Demonstratio*, but reiterating some of the German

scholar's objections.[130] Hell asked Pray to include a critique of von Schlözer in his forthcoming *Dissertationes historico-criticae in annales veteres Hunnorum, Avarum et Hungarorum* (Historical–critical investigations of the old annals of the Huns, Avars, and Hungarians, eventually published in 1774 in Vienna and again in 1775 in Bratislava).[131]

The hope that in this work Pray would highlight the contribution of the *Demonstratio* had already been expressed in one of the additions to the text of the Trnava edition of Sajnovics's treatise: "Whether our eminent historian, Father Georgius Pray, adopted any of the claims put forward by these authors [i.e., various authors supporting the Finno-Ugrian theory], he will show himself to the erudite world in his finely conceived *Dissertationes*, to be published soon."[132] Hell's response to Pray on the interpretation of *karjel*, already mentioned above, also records the disappointment of this expectation. While in the *Dissertationes* Pray revised his overall theory to include the Finns, besides the Huns, Avars, and Hungarians in the common narrative of origin from China, and acknowledged his debt on this point to Hell and Sajnovics, already at the beginning of the work he signaled disagreement with certain aspects of the *Demonstratio*, which in the elaboration turned out to be particularly the coat-of-arms and the etymology of Karjelia.[133] Hell, probably familiar with the manuscript of the *Dissertationes*, was fuming in his note to Pray. His strategy of dismissing the latter's counterarguments—based on the lack of empirical evidence for the word-formations asserted by Hell on syllogistic grounds—is strongly anchored in stressing the superiority of his method of deduction based on "stringent formal logics and proof" characteristic of his own discipline.[134] Hell almost addresses a threat to Pray on this account: "Therefore I must request the respected author to keep quiet [...] unless he wishes to make an enemy out of me, the mathematician and thus the severest of critics."[135]

130 Von Schlözer to Hell, February 29, 1772, published by Ferdinánd Mencsik, *Magyar Történelmi Tár*, 4th series, 6 (1905): 143–47.

131 Hell to Pray, February 5, 1772, ELTE EK, G 119. no. 162.

132 Sajnovics, *Demonstratio* (1771), 129. Cf. the tentative formulation in the 1770 edition, 82: "Whether Father Georgius Pray, the eminent author of the *Annales Ungariae*, has adopted any of their claims, I am as yet unable to tell."

133 György Pray, *Dissertationes historico-criticae in annales veteres Hunnorum, Avarum et Hungarorum* (Vienna: Bernard, 1774), 1, 18, 28, 43, 66–68. Cf. the discussion in Vladár, "Hell mint nyelvész," 343–47.

134 In the letter mentioned above in n. 130, von Schlözer was also highly critical of the inflexibility of Hell's method, e.g., his insistence that the "identity" means the sameness of all roots except borrowals and extinct words.

135 Coll. Prayana 18:25.

This aspect of Hell's response also points to the difficulty of conceiving an all too obvious and sharp wedge between the deductive and inductive method in the sciences: as a competent practitioner in astronomical observations, his credentials as a sound empiricist were good enough, but he had no qualms representing himself as the impeccable deductionist when this suited his polemical purposes. In his defense against Pray, the haughty confidence of the representative of the exact sciences over the mere student of the humanities also spills into *ad hominem* argument: Pray's objections are dismissed as "lacking any rationality," "ridiculous," even "stupid."

But Hell was upset not only because of the challenge to "his system" but also because he felt it was not properly recognized as "his." This is the aspect in which the debate on substantive issues tackled in the *Demonstratio* becomes intertwined with the problem of attribution. At the very outset of the response, Hell writes: "I do not know what came to the mind of the illustrious author to persecute my things (*for all that Father Sajnovics writes in his treatise about the origin of the Hungarians is mine* [italics added]) with such venom [...]."[136] In another undated note to Pray, this time called "Animadversiones" (Remarks), Hell gives full vent to his consternation upon the perceived neglect of his role.[137] He opens the document with a complaint at Pray's allegation, in a 1768 epistle refuting the Piarist Benedetto (Benedictus) Cetto's (1731–99) account of the "Chinese rites controversy,"[138] that Sajnovics was invited to participate in the Vardø expedition along with Hell by the Danish king. As Hell stresses, the invitation was delivered "most privately to me alone [...] by the Danish ambassador," and after the necessary negotiations with Kaunitz and the government had been conducted, he himself chose Sajnovics as his assistant and travel companion. To make things fully unequivocal, he added:

136 Coll. Prayana 18:25.

137 Coll. Prayana 18:24.

138 This was a debate among different groups of Catholic missionaries concerning the interpretation and status of rites in Confucianism and Chinese imperial practices. The Jesuits claimed that these were essentially secular and thus, within certain limits, to be tolerated, while Dominicans and Franciscans argued that they were incompatible with Catholicism and therefore were to be combated. The Vatican adopted the latter position and banned the rites for Chinese Catholics. For a comprehensive discussion, see George Minimaki, *The Chinese Rites Controversy: From the Beginnings to Modern Times* (Chicago: Loyola University Press, 1985). Pray's commentary on Cetto was eventually published as the *Imposturae CCXVII in dissertatione R.P. Benedicti Cetto Clerici Regularis e Scholii Piis, de Sinensium impostoris detectae, & convulsae* (Buda, 1781) and then incorporated in the *Epistola ad Benedictum Cetto e piis scholis in qua novae huius in rebus sinicis imposturae deteguntur: Accedit historia controversiarum de ritibus sinicis* [...] (Buda: Strohmayer, 1789). In these publications, however, there is no reference to Hell, Sajnovics, and the *Demonstratio*.

> Nothing, therefore, of all this has to do with Father Sajnovics, nor does any of the other research made during the expedition pertain to him; except that [he] assisted me in some tasks according to my instructions and my ideas; thus, whatever has been revealed, elaborated, discovered, and so on, has to do with me only, and the demonstration of the identity of the Lappish and Hungarian language, as regards the structure of the work, the arguments, its elaboration, and so on has itself been accomplished according to my ideas and instructions, so that if I had not personally assisted, Hungary today would not be aware of this linguistic identity; out of his own initiative, Sajnovics certainly would not have accomplished this work, he always opposed my opinion, I had to take this labor in my hand, and he saw how gravely I was affected by his repugnance toward me and the job.[139]

Hell explained that the exact particulars of the division of labor between him and Sajnovics were left obscure in the first edition of the *Demonstratio* because while in Copenhagen he wanted benevolently to promote Sajnovics, to be treated there "not as an assistant or a disciple, but as a good companion of mine, and therefore I arranged his election, after my own, to the academies of Trondheim and Copenhagen, and even he has to acknowledge that he owes this solely to me." But this was to be over: Hell revealed to Pray that in the forthcoming *Expeditio litteraria* he had no intention of identifying Sajnovics as an author of the relevant part (to be based on the *Demonstratio*), and in the meantime demanded that "everything concerning my *Expeditio* that is in the plural on the first and second page [of Pray's epistle], ought to be separated, and either to be tied exclusively to my person, or deleted."[140]

---

139 Coll. Prayana 18:24. This document was first highlighted by András Vértes at the conference of the Hungarian Society for Linguistics on October 26, 1971, and analyzed in Anna Jászó, "Deux études sur János Sajnovics," *Études Finno-Ougriennes* 16 (1983): 255–61. Cf. Vladár, "Valójában ki a szerzője," 322.

140 Coll. Prayana 18:24. This reminds one of the changes inserted in the advertisement of the *Expeditio litteraria*. In an early manuscript draft to the call for subscriptions, Hell points to Sajnovics as the author of a chapter of the first volume: "The treatise of Father Sajnovics on the identity of the Hungarian and Lappish language." In all printed versions, however, the name of Sajnovics was erased, and Hell promises only a chapter on "the origin and occasion of this investigation of the Lappish language." Pray complied with Hell's requests to the extent that in the first pages of the *Dissertationes* Hell is mentioned as the sole recipient of the invitation, who then took along Sajnovics. As far as the authorship of the Sámi–Hungarian theory is concerned, Pray consistently ascribed it to Sajnovics—quite naturally, as no edition of the *Demonstratio* was ever published under any other name than his, and Hell's publication plans on the subject came to nothing.

It is quite noteworthy that just as Hell's debate with European astronomers concerning the solar parallax (to be described in the next chapter) was unfolding, he threw himself, with increasing determination, into another controversy on the other substantial finding of the expedition on the home front. The explanation is probably that he realized with ever greater clarity the importance of the subject matter generally on the map of learning and specifically for the educated public of his fatherland, and wanted to capitalize on exaggerating his own role in attaining the results. Judging from the fervor with which he engaged in the debate, the stake of which was ultimately the unsettling issue of identity, Hell the man of the "exact sciences" was ready for a conversion into a cultural theorist—importantly, as we have seen, also attempting an act of methodological colonization. In regard of this conversion, it is worth observing that while in the first edition of the *Demonstratio* only Sajnovics is referred to as a "Hungarus," in the second one, issued about ten to twelve months later,[141] Hell is also mentioned as such on several occasions. These were the beginnings of a process, to be amplified during the 1770s, of Hell's (re)discovery

141 It is often overlooked that the year of printing is missing on the title page of both the first and the second editions of the *Demonstratio*. The Copenhagen edition states: *Regiae Scientiarum Societati Danicae praelecta Hafniae mense Januario anno* MDCCLXX (Read before the Royal Danish Society of Sciences in Copenhagen, in the month of January of the year 1770). The Trnava edition reads: *Regiae Scientiarum Societati Danicae praelecta, et Typis excusa Hafniae anno* MDCCLXX*: Recusa Tyrnaviae* (Read before the Royal Danish Society of Sciences, and printed in Copenhagen in the year 1770: Reprinted in Trnava). The date of publication is well documented in the case of the first edition: on March 4, the proofs were still being read, but on April 10, 1770, Sajnovics received a copy fresh from the press (Sajnovics, travel diary, entries for March 4 and April 10, 1770 [WUS]). The second edition is not that easy. Correspondence confirms, however, that it was published later than January 1771, for in a letter to Pray in Bratislava Hell writes: "Father Sajnovics will hardly be able to go to Vienna in the month of January, and I doubt that his work will be ready from the press in this month either: if he can manage to come around the end of February, I shall be happy" (Hell to Pray, dated Vienna, January 4, 1771 [ELTE EK G 119. no. 168]). In a letter dated January 10, 1771, Hell asks Pray to pass on some papers to Trnava "for the new edition of Father Sajnovics's work." It is crucial that Pray takes care of this task as soon as possible, he adds, "for without this, Father Sajnovics has so far been unable to begin his work" (Hell to Pray, dated Vienna, January 10, 1771 [ELTE EK G 119. no. 167]). From a letter dated March 29, 1771, it emerges that Sajnovics had by then arrived in Vienna, probably to promote the new edition of the *Demonstratio* (Hell to Pray, dated March 29, 1771 [ELTE EK G 119. no. 165]). By May of the same year, Sajnovics had returned to Trnava and could boast about the favorable reception that his work had received in Vienna (Sajnovics to Joannes Nagy, dated Trnava, May 12, 1771. See transcript in Flórián Holovics, "Sajnovics János a Demonstratióról," *Magyar Nyelv* 68 [1972]: 432–501). For a good discussion of the internal evidence in the printed text of the Tyrnavian edition, see also Danilo Gheno, "Sajnovics e la *Demonstratio*: Problemi e caratteri dell'edizione di Trnava," *Atti e memorie, Accademia patavina di scienze, lettere ed arti* 87 (1975): 45–59.

of his identity as a Hungarus patriot and public fashioning of himself in that role. Further manifestations of these efforts, as well as responses to them, will be discussed in Chapter 8. Here it should suffice to draw the balance as to the probable real division of labor between Hell and Sajnovics on the Sámi–Hungarian kinship and origins with reference to an earlier statement by Hell himself, which may also throw further light on the genealogy of this aspect of the expedition. This is how Hell wrote on the subject, while still in Vardø, to Pilgram, his substitute at the Imperial and Royal Observatory in Vienna:

> [You] must have had a prophetic spirit, when You in Your letter to Sajnovics wrote: 'I salute the dark pastorella a thousand times,' and 'I expect Lappish eclogues from him'; in fact, You, and the entire European world of learning may expect concerning the Lappish race a new discovery, which will be received with bewilderment by entire Europe. I, who formed this conjecture about the Lapps from the very beginning, gave him some rules and criteria, according to which he was to do this research, and now we have reached such clarity, that no human being will doubt this. Indeed, indeed, Sajnovics is in fact able to make "Lappish eclogues"; I am quite satisfied to have chosen him as my travel companion, he who so readily and in such a brief span of time was able to learn the Lappish language. I have asked him to extract some memorable stories from our diary and send them to [You], so that You may share them with our friends in Vienna. […] I beg you, however, to please make sure this discovery arrives to the ears of *Mr. van Swieten*; he will find pleasure therein, *since he was the one who bade me do this investigation* [italics added]; but please give him only the general information that they [the Sámi] are no Americans, but real Orientals, as we will have the honor to inform him in detail upon our return.[142]

Writing privately to a colleague vis-à-vis whom there was certainly no need to promote Sajnovics in the ways Hell alleged doing it toward their Copenhagen audience, Sajnovics is effectively acknowledged to have mastered—to Hell's own great satisfaction—the skills necessary for the research, and also to have pursued it, albeit building on a "conjecture" and following "rules and criteria" that Hell claims originated from himself. Or maybe not: interestingly, he effectively contradicts himself just a few sentences below, where the initiative is ultimately attributed to the man who stood behind virtually all the innovative

142 Hell to Pilgram, Vardø, April 5, 1769 (WUS), printed in Pinzger, *Hell Miksa*, 2:67–68.

transformations of the academic scene in Vienna during the previous two decades: Gerhard van Swieten.[143]

Van Swieten may well have been the implacable opponent of the Society of Jesus that he is usually described as being, but as we have seen, in his campaign against "vampirism" he resorted to an argumentative strategy familiar from Jesuit polemics against superstition, and competent and qualified Jesuit savants still retained important positions under his regime. On this occasion as well, he apparently found it possible to cooperate with them. However, one may also conjecture that one further step was included, and that Van Swieten, who is not known to have ever studied linguistics and the problems of language kinship, relied on expert advice in instructing Hell to do so. There is at best circumstantial evidence for identifying Van Swieten's potential source. Hell's apparently strange prompt that the Sámi "are no Americans, but real Orientals" may provide a clue. Notions about the peopling of America from Asia, and thus an ethnic and linguistic link between the indigenous peoples of both continents, were already in circulation at the time.[144] The man in Vienna known for both his prodigious command of Oriental languages and his inquiries into native American cultures (including the curating of a carefully assembled collection of artefacts) was the first custodian of the Imperial and Royal Library, hired there by Van Swieten and the direct subordinate of the latter as the director of the institution: Adam František (Franz) Kollár, already introduced in Chapter 1 as a fellow novice of Hell in Trenčín in the 1740s. Kollár must also have been eagerly awaiting the publication of the linguistic results of the Vardø expedition. He was aware of the Copenhagen edition of the *Demonstratio* as well as at least the main elements of the theory it contained as early as May 1770.[145] Shortly after, he thanked Pray for sending excerpts of the early

143 Naturally, the explicit ascription of the inspiration behind the investigation of linguistic kinship to Van Swieten relativizes the doubt expressed earlier about the purposiveness of the enterprise. The puzzle may be resolved by surmising that clues about the topic were supplied to Hell and Sajnovics from Vienna not prior to their departure but in correspondence while already en route, but no surviving letters known to us support this.

144 Several passages in Buffon's *Histoire naturelle*, based on accounts of Jesuit missionary and traveler Pierre-François-Xavier de Charlevoix (1682–1761), played a prominent role in giving the idea currency. See, e.g., Georges-Louis Leclerc Buffon, *Histoire naturelle, générale et particulière* (Paris: Imprimerie Royale, 1749), 1:224–25.

145 In a letter of May 29, 1770, his friend, teacher and jurist József Benczur (1728–84), thanked Kollár for reporting (in two letters that are not extant) about Sajnovics's discovery of peoples in the Arctic "who ought to be reckoned as the brothers of Hungarians," expressed his hope that the book would be reprinted once the author was back in Vienna, and asked Kollár to help him obtain a copy of the book. However, Benczur, who "easily allowed that our Hungarians are not the descendants of Attila's Huns," also warned that "our

thirteenth-century "Funeral Oration," the earliest surviving document written in the Hungarian language, and—believing "Lappish" to be an archaic "dialect" or variety of Hungarian—expressed his hope that "your Columbus, your Vespucci" (i.e., Sajnovics, who had apparently mastered Sámi) would be able to read, pronounce, and understand it impeccably.[146] In December 1770—only eight months after the book appeared, and four months after Hell and Sajnovics arrived back in Vienna—Kollár published a review of it in the second issue of a brand new Viennese journal dedicated to "sciences, arts, and commerce."[147]

The review is essentially positive. The only criticism concerns the origin of a few words, Hungarian according to Sajnovics but Slavic according to the reviewer (who was correct on this point).[148] Apart from this, Kollár commended the whole enterprise—mentioning the invitation to Hell, characterized remarkably as another "born Hungarian" (*gebohrnen Ungar*)—as well as the sound methodology and the convincing findings. Especially noteworthy are a few sarcastic remarks, aimed at theories "destroyed" according to Kollár by Sajnovics's successful "demonstration," and pre-empting the likely opposition against it. "Our learned author should not be looked for among the ranks of those who, even a short time ago, presumed to find the Hungarian nation and language through a laughable effort in the Sinai peninsula,"[149] Kollár writes, referring to the old tradition of deriving Hungarian from Hebrew (also explicitly rejected in the *Demonstratio*). Before concluding the review by "publicly thanking the learned father Sajnovics for the excellent present brought along from the distant north," Kollár describes the "undoubtedly very great" benefits of the book as follows:

> Only from now on can the Hungarians, the Lapps, the Finns, and others become more exactly familiar with themselves and their Scythian origin: only from now on can learned men acknowledge the difference between the Scythian and the Turkish language.

Hungarians may have the intention to prevent in every way" the republication of the *Demonstratio*, because they "do not want to believe that they have relatives in Lapland." The letter was published; see István Salánki, "Levél Sajnovicsról," *Magyar Nyelv* 60 (1964): 250–52.

146 Kollár to Pray on June 12, 1770, in Soós, *Kollár levelezése*, 207.

147 [Adam František Kollár], "Joannis Sajnovics S.J. Ungari Tordasiensis & c. *Demonstratio idioma Ungarorum et Laponum idem esse*," *Realzeitung* (December 1770): 18–23. Kollár is identified as the anonymous author of the review, and the whole of the text is included with commentaries in Zoltán Éder, "Sajnovics Demonstratiójának első recenziója: 'Viennensis Recensitor opusculi mei Hafniae editi,'" *Magyar Nyelv* 110 (2014): 85–94.

148 The critique is rejected in the Trnava edition of the *Demonstratio* (1771), 72–73.

149 [Kollár], "Joannis Sajnovics S.J. Ungari Tordasiensis & c. *Demonstratio*," 19.

> Therefore it would be desirable that after this fortunate discovery about the Scythian peoples and languages no one dares to write of the Huns, whom many have considered the forefathers of the Hungarians; at first, they should learn more about the Scythian and the Turkish language, following the example of our Sajnovics, who leaving behind his homeland took long journeys in northern Europe and in Asia [*sic*]; despite this, some do not cease building imaginary systems before assembling sufficient material from experience [...].[150]

The tenor of these remarks appears to belong to someone imbued with a sense of triumph over having received what he had expected and hoped for. As we shall see in more detail, by this time Kollár had been engaged for several years in polemical activities directed at the political and fiscal privileges of the Hungarian nobility. He thus had a distinct stake in emphasizing that the *Demonstratio* dealt a blow to the Hun–Hungarian discourse of origin and identity, which was one of the cornerstones of the noble ideology—although as a scholar he also pretended to suspend judgment, and addressed to the opponents a rhetorical invitation to counter Sajnovics on the ground of as abundant and sound empirical evidence as he had collected in support of his own argument. Whether or not Kollár played a role, via Van Swieten, in instigating the linguistic inquiry of the expeditionists, the results satisfied him greatly, and his contributions had an important part in the development of an atmosphere in which the credibility of Hell's efforts to present himself as a Hungarus patriot in the 1770s was questionable in the eyes of a broad segment of the country's elite.

4 Authority Crumbling

The items discussed in this chapter all point to a Maximilian Hell prepared to vindicate his place as the hero who "came, saw, and conquered" all obstacles, emerging as the celebrated and unquestionable authority on everything from natural history and geophysics to linguistics and astronomy. Nothing went according to plan. On some of these subjects, he either failed to publish anything at all (as in the case of *morild* and other zoological and botanical matters) or published much too late (posthumous weather reports with climatic deliberations); on others, he encountered problems of attribution (the linguistic

150 [Kollár], "Joannis Sajnovics S.J. Ungari Tordasiensis & c. *Demonstratio*," 22.

studies of Sajnovics) and even fierce opposition (the historical theories building upon them), or, worse still: disinterested silence from the theoreticians that he most of all would have wanted to reach (the theory on the aurora borealis). In short, instead of relishing the comforts of fame both home and abroad, Hell saw his authority under attack from virtually all sides. His fierce and often puerile reactions indicate a man with his back against the wall, jealously protecting what is left of his standing in the Republic of Letters. Nowhere was his public response more verbose than when he felt his credibility as an astronomer questioned. The next chapter deals with what would have become the third and fundamental part of the *Expeditio litteraria*: the "mathematical and astronomical volume," or *Tomus mathematicus & astronomicus*.

CHAPTER 6

"Tahiti and Vardø will be the two columns […]": Observing Venus and Debating the Parallax

> A precise definition of the Sun's parallax, that is, a definition beyond any doubt, associated with all certitude or at least the highest degree of probability, would not have been possible if it were not for the Supreme King CHRISTIAN the SEVENTH, who followed the advice of Denmark's wisest ministers and entered among the participants in this extremely important enterprise. To the surprise of all other academies, His Highness donated the greatest possible sums for the attainment of this goal and thereby ended up placing what we might call the crown on the head of all the glorious, ruler-sponsored expeditions treated so far.
>
> MAXIMILIAN HELL, introduction to "Expeditio litteraria ad Polum arcticum" (unfinished manuscript, *c.*1773, WUS, Manuscripte Hell)

With the third volume of the *Expeditio litteraria ad Polum arcticum*, both Hell and Sajnovics should be on solid ground. Their professional formation as astronomers and "mathematicians" in the eighteenth-century sense of the word could hardly be contested. Nor is it surprising that, despite the book as such never materializing, the "mathematical-astronomical" part resulted in more pages in print than even the *Demonstratio* and the polemics entailed. In brief, the third volume was to consist of the following works:

> *Volume 3. Mathematicus, & astronomicus*
>
> Part 1: The latitude and longitude of Vardø, description of the observatory and instruments used in Vardø during 1768–69, the refraction of the atmosphere in the Far North, the observation of the transit of Venus itself, and an accurate determination of the solar parallax; Part 2: Geographical latitudes determined en route between Copenhagen and Vardø; Part 3: Observations pertaining to the declination of the magnetic needle; Part 4: A new method to determine the figure of the earth, by means of barometric observations.

© PER PIPPIN ASPAAS AND LÁSZLÓ KONTLER, 2020 | DOI:10.1163/9789004416833_008
This is an open access chapter distributed under the terms of the CC-BY-NC-ND 4.0 License.

Although not in the framework of the *Expeditio litteraria*, the first part was effectively published as the *Observatio transitus Veneris* [...] *1769* (after the first edition in Copenhagen in February 1770, three further Latin editions as well as a Danish translation were issued later in the same year). One particular part of this work, on how to determine the latitude by means of stars culminating in the same zenith distance, was the subject of a more elaborate account in the *Ephemerides* (1774).[1] As for the "accurate determination of the solar parallax" meant to be included in the *Expeditio litteraria*, this instead took the form of two intricate and polemical pamphlets, issued as appendices to the *Ephemerides* (1772 and 1773).

The second part of the third volume would consist of contributions to the geography of western Scandinavia. Hell presented a report on his latitude determinations made en route between Copenhagen and Vardø to the Royal Society of Sciences just before leaving Copenhagen in May 1770. It was translated into Danish and printed in the proceedings of the Copenhagen society in the same year.[2] Not until 1790 was an (enlarged) edition of the Latin original issued in Vienna, as a supplement to the *Ephemerides* for the year 1791. Maps were also made, among them a frequently reprinted map of the Island of Vardø, and maps of "Norway, Nordland, and Finnmark." The latter three should in modern terms represent southern Norway, the present-day counties of Nordland and Troms and Finnmark. According to Hell, he sent test-prints of these maps to the Copenhagen Society of Sciences around 1778, but these have not been found.[3]

---

1 Maximilian Hell, "Methodus astronomica Sine usu Quadrantis, vel Sectoris, aut alterius cujusvis instrumenti, in gradus Circuli divisi, item sine notitia refractionis, ope solius tubi instructi micrometro filari, singula secunda indicante, et in apto ad hunc usum fulcro mobili applicati, elevationem Poli cujusvis loci, in continente siti, accuratissimam definire," *Ephemerides* 1775 (1774), 3–41. This has been described as the Horrebow–Talcott method, named after Peder Horrebow the Elder and Andrew Talcott (1797–1883), see, e.g., Peter Brosche, "Küstner's Observations of 1884–85: the Turning Point in the Empirical Establishment of Polar Motion," *International Astronomical Union Colloquium* 208 (2000): 101–8.

2 Maximilian Hell, "Nogle Steders Geographiske Breder." The Latin original is today preserved at the National Library in Oslo, MS 4° 16.

3 Maximilian Hell, "Observationes astronomicae latitudinum, & longitudinum locorum borealium Daniae, Sueciae, Norvegiae, & Finnmarchiae Lapponicae per iter arcticum annis 1768, 1769, & 1770 factae," *Ephemerides* 1791 (1790): 300–86, here 310: "These maps, engraved on copper, were sent to the highly illustrious Society of Sciences in Copenhagen already twelve years ago." These maps were for a time in the hands of prominent Norwegian historian Gerhard Schøning (1722–80), who has left a brief report on the names of places they included. It is not known whether these maps exist today (cf. Kristian Nissen's manuscript "Pater Hells Norgeskarter fra tiden omkring 1770," intended as a chapter in the unpublished *Bidrag til Norges karthistorie, III* [National Library of Norway, Oslo. MS 4° 3051:c7]).

The third part of the third volume, on measurements of the declination of the magnetic needle, has survived in manuscript but was not published until 2005.[4] The fourth part is not extant, either in manuscript or in any printed version. By means of barometrical observations, Hell argued, it should be possible to determine the curvature of the Earth's surface far more accurately than Maupertuis had done some decades earlier.[5] Hell never published this part—perhaps fortunately for him, as this marvelous idea was surely a dead end.

Highest among Hell's priorities, obviously, was publication of his Venus transit report from Vardø, followed shortly afterward by calculations of the solar parallax. However, whereas his plans involved a straightforward process of summarizing, calculating, and publishing a definite result, he was soon provoked into an all-out attack on real and perceived enemies. These included colleagues across Europe that he had earlier considered as friends and collaborators.

1 Mission Accomplished

To begin with, the determination of the exact coordinates of all observational sites was of crucial importance to the Venus transit project. Hell planned to determine the longitude of Vardø by various means. In addition to a solar eclipse that was expected around midday on June 4, 1769, he intended to make use of occultations of satellites of Jupiter; a lunar eclipse that was to take place on December 23, 1768; occultations of fixed stars by the moon; and transits of the moon through the meridian compared to the positions of stars. Accordingly, he contacted Wargentin beforehand, asking him to provide corresponding datasets from Sweden.[6] In Vardø, however, all these attempts failed, partly

4 Lynne Hansen and Aspaas, *Maximilian Hell's Geomagnetic Observations*; Aspaas and Lynne Hansen, "Geomagnetism by the North Pole." Cf. Lajos Bartha, "Magyar tudósok mágneses megfigyelései a sarkkörön túl 1769-ben," *Földrajzi Múzeumi Tanulmányok* 13 (2004): 49–55.

5 A particularly valuable source not appreciated on this account is Christian Mayer's lengthy treatise on the 1769 transit of Venus. Mayer elaborates on the potentials of using barometric observations from various places as a means to settle several questions, among them the figure of the Earth: "For this reason, Honorable Father Hell, that famous astronomer of Vienna, has distributed more than twenty diligently calibrated barometers, which he had brought with him from Vienna, to curious and able observers at various places along his journey, so that he thereafter, upon his return from Vardøhus may receive their observations." Mayer, *Ad Augustissimam Russiarum omnium Catharinam II Alexiewnam Imperatricem expositio de transitu Veneris*, 314–23, here 317.

6 Hell to Wargentin, dated Copenhagen, June 30, 1768 (CVH): "I would like to ask You to make known to your colleagues and correspondents this proposal of mine: that they care to obtain astronomical observations, especially such that pertain to the determination of the

because of the high southern declination of Jupiter, partly because of overcast weather. The only feasible data Hell obtained were those of the solar eclipse that took place the day after the transit, as well as the observation of the transit itself.[7] However, the use of the Venus transit data for the purpose of determining the longitude would only be of indirect value, as a crosscheck after the solar parallax had been calculated. At the time Hell wrote his Venus transit report from Vardø, this was way too early, since only European observations had reached him by then.[8] As for the solar eclipse, this was obviously followed closely not only by Hell and other astronomers on Venus transit expeditions across the world but also by staff at all the high-standard observatories of Europe. For observing the eclipse, Hell used the eight-and-a-half-feet long telescope, and Sajnovics the ten-and-a-half-feet. According to Hell's report, the two astronomers determined the end of the eclipse as identically as could be, only a single second differing between them.[9]

Having returned to Copenhagen in the autumn of 1769, Hell was able to calculate the longitude of Vardø by means of corresponding observations of the solar eclipse of June 1769 provided by Maskelyne in Greenwich, Messier in Paris, Christian Horrebow and assistants in Copenhagen, Wargentin and Bengt Ferrner in Stockholm, Christian Mayer in St. Petersburg, Pilgram and the amateur Sambach in Vienna, and Cäsar Aman (Amman, 1727–92) in Ingolstadt.[10] In this way, he found a longitude of $3^{h}\ 14^{m}\ 41.8^{s}$ east of the island Ferro, or $1^{h}\ 55^{m}\ 6^{s}$ east of Paris, corresponding to $2^{h}\ 4^{m}\ 27^{s}$ east of Greenwich.[11] As Hell saw it, however, this was only a preliminary result, for he was still waiting to check his figure on the basis of Venus transit reports from "America" (which in Hell's parlance included the Pacific).

The site of Hell's observatory is nowadays determined as 31° 6′ 27″, or $2^{h}\ 4^{m}\ 25.9^{s}$ east of Greenwich. This means Hell's initial determination was only

longitude—that is, the moons of Jupiter, eclipses of the Sun and Moon, occultations of fixed stars by the moon, or transits of the moon through the meridian compared with positions of fixed stars—and that they show me the kindness of sharing these observations with me." It is likely that Hell asked colleagues at other sites for similar observations, but no other letters have been available for the present study.

7 Hell, *Observatio transitus Veneris* [...] *1769*, 30–31.

8 Hell, *Observatio transitus Veneris* [...] *1769*, 31.

9 That is, within a margin of error of ±½ second (cf. Hell, *Observatio transitus Veneris* [...] *1769*, 31). Other observations of the same moment made at identical sites by multiple observers varied up to ±5 seconds (cf. Hell, *Observatio transitus Veneris* [...] *1769*, 33–42, esp. 38).

10 Hell, *Observatio transitus Veneris* [...] *1769*, 33–45.

11 Hell, *Observatio transitus Veneris* [...] *1769*, 50 (mentioning only Ferro and Paris). We are indebted to astronomer Truls Lynne Hansen, former head of Tromsø Geophysical Observatory, for calculating the Greenwich value.

incorrect by 1.1 seconds, or 170 meters.[12] It is important to note, however, that this remarkable accuracy resulted from a bit of luck as well as excellent observational and calculating skills. With the data at hand, Hell might as well have opted for, say, $2^h\ 4^m\ 24^s$ or $2^h\ 4^m\ 29^s$. It would still have been a very good determination by eighteenth-century standards.[13]

For the determination of the latitude, Hell used a more unusual method, which merits some consideration. There was a widespread notion in contemporary astronomy that the atmosphere in the north was thicker and the refraction greater than in, for example, Paris, where the best tables of refraction had been made.[14] Consequently, Hell was puzzled how to test the accuracy of his quadrants as well as the geographical position of his observatory. His choice was to use a selection of pairs of stars culminating in the same zenith distance, one in the north and the other in the south. In this way, any influence of a thicker atmosphere was eliminated:

> In the ordinary method, stars of no particular position are chosen—that is, some stars culminating at various zenith distances in the south, others in the north. That procedure requires that the refraction of the atmosphere is accurately determined and known to the observer [...]. But this is not so in my method, [where] the effect of the refraction, however great or small that may be, [is ruled out].[15]

After a long series of observations, of which only an extract is given in the Venus transit report, Hell concludes that the latitude of his observatory in Vardø was 70° 22′ 36″ north.[16]

---

12 We are indebted to Bjørn Geirr Harsson of the Norwegian Mapping and Cadastre Authority (Statens Kartverk) and Truls Lynne Hansen for this determination.

13 We rely on Truls Lynne Hansen for this assessment.

14 See, e.g., Gottfried Heinsius, "De refractionibus in oris septentrionalibus," *NcASIP* (1758/59; published 1761): 412–44, where the author begins his discussion by stating that he finds it logical that the refraction be greater in the north than close to the equator, but concludes by affirming that this is not the case. Also, Hell admits that he was convinced that the refraction would be greater in Vardø than in Paris, and explains that his wish to examine the as-yet unexplored degree of refraction at the seventieth latitude was the main reason for him to spend the winter in Vardø (Hell, *Observatio transitus Veneris* [...] *1769*, 17): "This doubt, of the utmost importance, was certainly the most important among the motives leading me to spend the winter in Vardøhus."

15 Hell, *Observatio transitus Veneris* [...] *1769*, 7–29; here 10–11. See also Hell's article "Methodus astronomica Sine usu Quadrantis," esp. 5.

16 Hell, *Observatio transitus Veneris* [...] *1769*, 17–29, esp. 27.

A more straightforward method of calculating the latitude was to observe the apparent distance of the Sun's upper limb from the horizon when it reached its highest point at noon. This method yielded data of sufficient accuracy for the needs of ordinary navigation, but not for the delicate calculations of the solar parallax, where each observatory had to be determined as exactly as possible. The method presupposed, for example, that the refraction of the site was exactly known. On his trip back and forth, Hell used this less exact method to determine the latitude of thirty-seven sites between Copenhagen in the south and Vardø in the north. He estimated the degree of uncertainty involved in these measurements to be around ±15″, or for some around ±30″.[17] Fifteen arc seconds in the latitude would equal only 0.05 mm on the circle of the quadrant during observation,[18] making it hard to believe that Hell's claim to an uncertainty of only ±15″ is a reliable figure. It may be added that for surveys in central parts of Sweden around the mid-eighteenth century, an uncertainty of ±30″ was deemed acceptable, whereas Hellant in his surveys of Lapland argued that ±1′ must suffice.[19]

It would have been interesting to learn whether Hell tested the two methods comprehensively against each other in Vardø. However, neither his Venus transit report nor his subsequent treatises on the solar parallax give any evidence of this.[20] In order to answer this question, we need to look into the letters of

17 Maximilian Hell, "Nogle Steders Geographiske Breder," 622; repeated in Hell, "Observationes astronomicae latitudinum," 309–10.

18 Personal communication from Truls Lynne Hansen, based on the study of Hell's descriptions of Niebuhr's quadrant. The radius of the quadrant is stated to be two feet in Hell, "Nogle Steders Geographiske Breder," 621–22; Hell "Latitudines geographicae," fol. 4, and in Hell, "Observationes meteorologicae," 308–9. The same size is given in a letter from Niebuhr to Franz Xaver von Zach in Gotha, dated Meldorf, July 9, 1801 (originally published in von Zach's *Monatliche Correspondenz zur Beförderung der Erd- und Himmelskunde* 4 [September 1801]: 240–53, here 244: "Mayer had made for me a quadrant of two-foot radius for observations on land." In a more detailed description in Hell's MS "Observationes astronomicæ et Cæteræ Jn Jtinere litterario Viennâ Wardoëhusium usque factæ" [1768–69], [1], the radius of the quadrant is said to be *one* foot and two Viennese inches, whereas its tube was two feet and two inches. Probably, "1 ped. 11 dig." is a slip of the pen for "11 ped. 11 dig." In that case, the exact radius of Niebuhr's quadrant was two feet and two inches, or twenty-six inches).

19 Cf. Sven Widmalm, *Mellan kartan och verkligheten: Geodesi och kartläggning, 1695–1860*, Institutionen för idé- och lärdomshistoria, Uppsala universitet, Skrifter 10 (Uppsala: Institutionen för idé- och lärdomshistoria, Uppsala universitet, 1990), 79.

20 Admittedly, Hell mentions an initial result of 70° 20′ for the pole height in a more elaborate treatise on his method of calculating the latitude, but gives no details as to whether he cross-checked this result with other solar observations later in his stay in Vardø. Hell, "Methodus astronomica Sine usu Quadrantis," 31.

Hell and Sajnovics, the travel diary of Sajnovics, and other surviving manuscripts from the Vardø expedition. (The term "pole height" used below means geographical latitude.)

Writing from Vardø to his replacement at the Vienna University Observatory, Father Pilgram, Hell states that upon his arrival in the island on October 11,

> my first wish was to acquire a preliminary knowledge of the latitude, but I had as yet no suitable place at hand from which to conduct this work; I measured from the entrance hall some altitudes of the Sun at noon, and have [...] found the pole height to be between 70° 19′ 30″ and 70° 20′. This result is only preliminary, however, until I determine it accurately by means of observations of the vertical stars.[21]

In a letter to Horrebow on the same day, November 12, 1768, he mentions the same result, adding that it was the travelers' quadrant of Niebuhr that had been used for this measurement.[22] In various other letters from Vardø between November 1768 and January 1769, Hell speaks of a latitude of 70° 20′, but without explaining the methods used for this determination.[23]

---

21 Hell to Pilgram, dated Vardø, November 12, 1768, in Pinzger, *Hell Miksa*, 2:10.

22 Hell to Horrebow, dated Vardø, November 12, 1768, in Pinzger, *Hell Miksa*, 2:32: "I have here [in Vardø] also measured [the pole height] preliminary and with the same instrument [i.e., Niebuhr's quadrant]. However, partly because of the lack of a proper place to observe from—for I observed in the forecourt [*sic*], where the quadrant rested on the not entirely fixed wooden floor—partly because the midday sun was already quite low, only four or five degrees high [...], I have found it, by means of four Sun heights at midday and one culmination of the star Altair in the Eagle, to be approximately between 70° 19′ 30″ and 70° 20′."

23 Hell to Gunnerus in Trondheim, dated Vardø, November 12, 1768, in Pinzger, *Hell Miksa*, 2:26; Hell to Mercier in Copenhagen, dated Vardø, January 15, 1769, WUS, relevant part of letter not included in Pinzger; Hell to Horrebow in Copenhagen, dated Vardø, January 15, 1769, WUS. Cf. Sajnovics to Splenyi in Trnava, dated Vardø, November 14, 1768 (MTAK IL): "The Vardø Island is situated at a pole height of approximately 70° 20′." Sajnovics's diary gives additional information on the first attempts to determine the latitude of Vardø. In the entry on October 14, it is said that: "The quadrant of Niebuhr was mounted, since clouds full of snow came in intervals and gave us reason to hope for a view to the Sun. The complement of the altitude of the [upper] limb of the Sun was 78° 28′ 30″, giving a pole height of 70° 26′, [which is only] an approximation, because clouds disturbed the observation." The entry on October 16, 1768 states that "a wind from SSW melted the snow completely and brought back the serenity in the sky. The complement of the altitude of the Sun's upper limb was 79° 9′ 0″." Finally, on October 18, Sajnovics says: "I have observed the altitude of the Sun, which gives a pole height of 70° 20′." Other entries in the travel diary demonstrate that further attempts to measure the latitude were made as late as October

Hell's manuscript "Astronomical and Other Observations Made during the Scientific Journey from Vienna to Vardø" (hereafter referred to as his "astronomical notebook") gives additional information.[24] Here, Hell records even more observations of the Sun than those that are found in Sajnovics's diary, and what is more, the observations are accompanied with calculations and sometimes even theoretical deliberations. The conspicuous difference between the preliminary results of November 1768 and the final conclusions in the printed report—from around 70° 20′ or even 70° 19′ 30″, to 70° 22′ 36″—is explained by the error of the quadrant, which had not yet been determined in the autumn.[25] Thus, when Hell in his notebook on October 16–18, 1768 records observations giving pole heights ranging from 70° 20′ 26″ to 70° 21′ 12″, ending with a mean value of 70° 20′ 25″ (*sic*), he has added in a slightly different ink, *+1 30 error Quadr.*, and concluded that the pole height should be 70° 22′ 55″. Of course, 70° 20′ 25″ plus 1′ 30″ does not give 70° 22′ 55″, but 70° 21′ 55″. Neither figure, however, is too far from that of 70° 22′ 36″, which ultimately appeared in the Venus transit report. The difference between the 70° 20′ 25″ in the astronomical notebook of October 1768 and the approximate value of 70° 19′ 30″ or 70° 20′ in the letters of November and January suggests that Hell initially believed his quadrant's error to be about −30″, instead of +1′ 30″ (or even +2′ 30″). To judge from the astronomical notebook, no further efforts to measure the pole height by means of the Sun were made, not even in late May or June, when the Sun was available day and night and the stars were in any case invisible.[26]

In conclusion, there is nothing in the sources to indicate that Hell bothered about the latitude any more after he had determined it by means of observations of stars during the winter and early spring of 1769. It is a puzzle why Hell

25 and November 5, but then the subject is dropped and never mentioned again in this text. Sajnovics, travel diary, draft version (WUS), October 14–November 5, 1768.

24 Hell's MS "Observationes astronomicæ et Cæteræ in itinere litterario Viennâ Wardoëhusium usque factæ" (1768–69). WUS.

25 Hell's MS "Observationes astronomicæ […]" (1768–69): "[These observations] were also made with Mr. Niebuhr's quadrant, which needs to be examined later."

26 Further observations of solar heights recorded in the astronomical notebook are not concerned with the pole height. Thus, solar observations recorded on November 19–21, 1768 and January 19–21, 1769 contain deliberations concerning effects of the refraction upon the length of the polar night; various observations from January 24 to March 18, 1769 are either implicitly or explicitly undertaken in order to determine refraction; observations are conducted from April 10 to 26, 1769 in order to establish a correct meridian line for observations of magnetic declination; observations from April 29 to June 9, 1769 are evidently made in order to test the running of the clocks; and finally, observations in the night between June 17 and 18, 1769 have the additional aim of checking the refraction (the midnight Sun being very low above the sea level, this was a convenient crosscheck against the results obtained from observations of stars made earlier in the year).

apparently never undertook a comprehensive, comparative study of the pole height yielded by observations of the Sun versus that yielded by the stars. Incidentally, Hell's final conclusion concerning the latitude of his observatory—70° 22′ 36″—is today found to be somewhat more inaccurate than his determination of the longitude: it should be 70° 22′ 15.5″ north, that is, 20.5 seconds, or 632 meters farther south than Hell's figure.[27] It is important to note, however, that this modern value depends on more accurate knowledge of the curvature of the Earth's surface than that which existed in the eighteenth century. An overall examination of Hell's activities as a surveyor during his expedition, with assessments of his results in the light of the history of Nordic geodesy, is a desideratum.[28]

In any case, as the third day of June 1769 was approaching, Hell felt that he had safely determined the latitude of his observatory. The running of the clocks had already been tested for weeks, and the frequency of these tests was intensified in the last days before the transit. Ideally, such tests involved observations of the Sun as it passed the meridian in the south at noon and the meridian in the north at midnight. The transit was going to take place when the Sun was in the north, meaning that the northern room of his observatory (the *observatoriolum septentrionale*) would be used for this crucial observation. Having checked the time-keeping at twelve o'clock in the day, Hell had to move his instruments over to the northern chamber in the afternoon of June 3 in order to be prepared for the transit of Venus. By the next morning—June 4—at least two of his telescopes must have been moved back again, as these were used to

27 Personal communication from Bjørn Geirr Harsson. The astronomical latitude, observed by Hell, is related to the plumb line at the station, whereas the latitude obtained from a GPS receiver is related to the normal at the ellipsoid. "The angle between the plumb line and the vertical of the ellipsoid is called the deflection of the vertical," Harsson explains. "In Vardø the geoid is tilting to east northeast, which means that the deflection of the vertical has a component in direction north, even if the main component is in direction east. The north component of the deflection of the vertical is computed to be 2.5 second of an arc at today's post office in Vardø. So if 2.5″ is added to the GPS-latitude, the two latitudes can be compared. Hell's latitude was 70° 22′ 36″ and the GPS-latitude is 70° 22′ 13″. If we add the 2.5″ to the GPS-latitude we get 70° 22′ 15.5″. The difference of 20.5 seconds corresponds to a latitude for Hell to be 632 meters north of today's GPS position of the same place."

28 An investigation of the latitude for a single location (in Christiania, now Oslo) by Harsson in 2003 gave a discrepancy of only nine arc seconds, or 270 meters between Hell's determination and the modern value. Cf. Per Pippin Aspaas and Nils Voje Johansen, "Astronomen Maximilian Hell: Fra Wien til Vardø for å se Venus," *Ottar: Populærvitenskapelig tidsskrift fra Tromsø Museum* 249, no. 1 (2004): 3–11, here 5–6. It would be futile, however, to conclude much from the examples of Oslo and Vardø alone.

observe the eclipse of the Sun, which took place between 9:22 and 11:22 a.m., and would only be visible from the *observatoriolum australe*.[29]

As the moment of the transit around midnight, June 3–4, 1769 was approaching, other kinds of preparations were made, too. Of the four contacts of Venus with the limb of the Sun, Hell deemed the first exterior contact impossible to observe with anything near the accuracy required. Accordingly, he ordered his assistants Sajnovics and Borchgrevink to be on the look-out for this event "so as to avoid, by this useless staring at the Sun, to weary and weaken my eye, which I wanted to spare for the precise determination of that utterly important, first interior contact."[30] As soon as the two assistants had exclaimed that they saw "a sort of black thing" (*rem quampiam nigram*) about to enter the limb of the Sun, Hell placed his eye on the lens of his telescope and estimated, on the basis of the proportion of the disc of Venus that had entered so far, that the real exterior contact had probably taken place some thirty seconds earlier, or 9:14:47 p.m. according to the Viennese clock. Borchgrevink used the ten-foot Dollond, Sajnovics the ten-and-a-half-foot, and Hell the eight-and-a-half-foot telescope for this first observation.[31]

Before the interior contact at ingress (which took place some seventeen minutes later), Hell and Borchgrevink switched places. Hell now took charge of the Dollond and left the eight-and-a-half-foot telescope for Borchgrevink, whereas Sajnovics continued to use the ten-and-a-half-foot. The statement on the interior contact is divided in two: first, Hell records the moment when the Sun and Venus appeared to the three observers to be perfectly round, then, a moment taking place a few seconds later, when "the shining thread of the Sun's limb appears" (*Apparet filum lucidum limbi Solis*). It is the latter of these moments that Hell considers to be the moment of *ingressus totalis Veneris* (total ingress of Venus), although he concedes that some observers define the former moment as that of "real," interior contact. The latter moment was seen by Hell at 9:32:48 p.m. according to the Viennese clock, and by Sajnovics three seconds earlier. The amateur observer Borchgrevink in his turn saw it thirty-five seconds earlier than Sajnovics.[32] Only some seven minutes after total ingress had been observed, clouds started blocking their view to the Sun, and the sky remained overcast nearly continuously until less than half an hour before egress

29 Cf. Hell, *Observatio transitus Veneris* [...] *1769*, 81.

30 Hell, *Observatio transitus Veneris* [...] *1769*, 71–72, here 71.

31 Hell, *Observatio transitus Veneris* [...] *1769*, 71.

32 Hell, *Observatio transitus Veneris* [...] *1769*, 73.

began. By the time the moments of egress were observed, the sky had again become perfectly clear.[33]

The interior contact of egress is described by Hell somewhat differently from that of interior contact of ingress. Here, Hell speaks of the *gutta nigra* (black drop), which starts forming some eleven seconds before it "in an instant disappears, and so-to-speak bursts, and the limbs of the Sun and Venus flow together as one."[34] Hell and Sajnovics had, according to Hell's account, determined this moment only a single second apart—at 3:26:17 and 3:26:18 a.m., respectively, according to the Viennese clock—whereas Borchgrevink noted what he simply called "the interior contact" (*contactus interior*) at 3:26:10 a.m.[35] The moment of total egress was, according to the same account, encumbered with some uncertainty. However, it was observed by Hell, Sajnovics, and Borchgrevink within a range of seven seconds, the moment expressly stated as *egressus certus* (certain egress) being recorded by Sajnovics and Hell only a second apart—at 3:44:26 and 3:44:27 a.m., by the Viennese clock.[36]

The above extract is based upon the printed report alone. Moreover, it does not render justice to the intricate theoretical deliberations accompanying the data. The account of the observation itself is found very near the end of the eighty-two-page report, after an elaborate account of instruments used, procedures followed in the testing of the clocks, definitions of "true" and "optical" contacts, the black drop effect, and so forth. This feature of Hell's report is—to the best of our knowledge—unparalleled in all other Venus transit reports of the year 1769: no other observer produced a first edition of his observation that included such long and intricate theoretical discussions. But where theory and detail might be an advantage in a report of such momentum, the time consumed in writing and publishing it was not. As explained previously, Hell took his time when traveling back to Copenhagen, which they did not reach until October 17 (covering nearly the same period of the year, and following roughly the same route, as on their outward journey in 1768). Here, during three sessions at the Royal Society—November 24, and December 1 and 8, 1769—Hell presented his report on the Venus transit observation from Vardø.[37] He also had an audience with King Christian VII on November 29, during which he obtained permission to dedicate the printed version of the report to His

33 Hell, *Observatio transitus Veneris* [...] *1769*, 74–75.

34 Hell, *Observatio transitus Veneris* [...] *1769*, 75–76, here 76.

35 Hell, *Observatio transitus Veneris* [...] *1769*, 76.

36 Hell, *Observatio transitus Veneris* [...] *1769*, 76.

37 Sajnovics's travel diary 1768–70 (WUS), entries on November 24 and December 1 and 8, 1769; the protocol of the Royal Danish Society of Sciences (DKDVS), entries November 24 and December 1 and 8, 1769.

Majesty.[38] The printing process took its time, however, and not until February 8, 1770 could Hell present a copy of the work to its dedicatee.[39] Immediately afterward, copies were distributed to learned societies and individual savants abroad.[40]

2 Accomplishment Contested

During the eight months of secrecy between observation and publication, no foreign astronomer was given access to datasets from Vardø. This caused suspicion and even anger among some of Hell's colleagues abroad. Most astronomical datasets are useless unless they are compared with corresponding observations from other sites, and this was true to an extreme degree as far as the eighteenth-century Venus transits were concerned. This was the last chance for more than a century to obtain data for the determination of that coveted measure, the solar parallax; and in 1769, those from the High North of Europe were, along with corresponding ones from the Southern Pacific, more precious than observations from anywhere else in the Old World.

Because of such features, perhaps like no other scientific project of the age, the Venus transit enterprise embodied notions and practices of interpersonal dynamics associated both with the Republic of Letters and the ways in which it was understood to mirror the realities of complex, modern European societies at large. With regard to its patronage and its composition, the expedition led by Hell was a counterpart of several dozen similar ones taking place simultaneously all around the northern hemisphere, and a microcosmic version of

38 Sajnovics's travel diary 1768–70 (WUS), entry November 29, 1769: "When Reverend Father Hell asked him if he would allow the *Observatio transitus Veneris* that is going to be printed, to be dedicated to His Royal Name, the king answered: 'That will be a pleasure to me.'"

39 Sajnovics's travel diary 1768–70 (WUS), entry February 8, 1770: "Around 4 o'clock, we went to the palace. At about 5 o'clock, His Highness the King opened the door. Honorable Father Hell offered him a copy of the *Observatio*. He accepted it very generously and inspected it for a while. Then he kept talking for about half an hour, mentioning the northern light, the decrease of the sea level, the language of the Hungarians and the Lapps, etc., and finally, the quadrature of the circle. It emerged from all this that the king had been quite well informed concerning the works of Father Hell. He also demonstrated quite clearly that his own as well as the others' expectations had been amply fulfilled."

40 Hielmstierne to Johann Albrecht Euler in St. Petersburg, dated February 9, 1770 (archives of the Rossiiskaia Akademiia Nauk, hereafter: RAN); Hielmstierne to Wargentin in Stockholm, dated Copenhagen, February 10, 1770 (CVH). These examples corroborate a claim made by Hell in the "De parallaxi Solis […]," 110, that his Venus transit report was published in Copenhagen on February 8 and distributed by the post "to all academies" the next day.

what they, taken together, constituted: a gigantic international enterprise of eighteenth-century field science. This project of national-stately self-assertion through royal–governmental patronage to an expedition likely to earn prestige was inevitably embedded in a thoroughly cosmopolitan context, and from the perspective of the participating individual scholars and teams, the emulative drive had to be tempered by a sense of collegiality, while the lofty ideal of harmonious collaboration for the shared purpose of the advancement of knowledge was qualified by several sobering realities.[41] In many ways, the complexities of knowledge production were not unlike those involved in any other set of contemporary communicative practices that could be modeled after the then relatively newly discovered experience of the market, which depended on the maximization of one's profit by satisfying the needs of one's partners: it was exactly in the 1760s and 1770s that Adam Smith (1723–90) worked out his highly influential anthropology of commercial *and* sociable man.[42] Whether at the marketplace, the stock exchange, the coffee-house, the assembly room, or the academy, men and women were in the first place seeking their own good. But what they coveted—a fair price, a good conversation, the applause and admiration of fine society, or recognition of scientific achievement—was understood as a matter of giving as well as taking. For, in the course of such exchanges, each of the parties felt that their own interests were best served if they placed themselves—to speak with Smith, as "impartial spectators"—in the position of the others, applying the faculty of empathy to perceive *their* interest in the transaction.[43]

Immanuel Kant (1724–1804) was to call *ungesellige Geselligkeit*, unsocial sociability, the paradoxical disposition of fellow feeling arising from reasonable and enlightened self-regard.[44] Science was no exception. On the contrary, it could be understood as a social realm in which personal vanity and ambition

41 We have been reminded of the tension between such ideals and realities in the Republic of Letters (and of science), among others, by Lorraine Daston, "The Ideal and Reality of the Republic of Letters in the Enlightenment," *Science in Context* 4 (1991): 367–86; Adrian Johns, "The Ideal of Scientific Collaboration: The 'Man of Science' and the Diffusion of Knowledge," in *Commercium litterarium, 1600–1750: La communication dans la république des lettres/Forms of Communication in the Republic of Letters*, ed. Hans Bots and Françoise Waquet (Amsterdam: Apa-Holland University Press, 1994), 3–22.

42 Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations*, ed. R.H. [Roy Hutcheson] Campbell and A.S. [Andrew Stewart] Skinner (Indianapolis: Liberty Classics, 1981), book 1, Chapter 2, 1:26.

43 Adam Smith, *The Theory of Moral Sentiments*, ed. D.D. [David Daiches] Raphael and A.L. [Alec Lawrence] Macfie (Indianapolis: Liberty Classics, 1982), book 3, chapter 1.5, 112.

44 For important reconstructions of this tradition of thought, see Richard Tuck, *Philosophy and Government, 1572–1651* (Cambridge: Cambridge University Press, 1993); Knud

almost imperceptibly collapsed into and drew mutual reinforcement from one another with an ethics of service to mankind through the production of useful knowledge. Even among the numerous instances in which this could be demonstrated, the Venus transit represents a liminal case, where success depended on international cooperation and the sharing of research results on an unparalleled scale. As already noted, the results of 1761 being unsatisfactory, the number of observational posts increased by 1769.[45] The most famous expedition assigned, among many other tasks, to observe the 1769 transit of Venus, was undoubtedly that of Cook, the location in this case being the island of Tahiti. Cook's 1768–71 circumnavigation, of which the transit observation was to be a principal episode, was also paradigmatic in the sense that it perhaps most colorfully represented the unprecedented dimensions of cross-disciplinary effort manifest in the ventures: astronomical–geographical–cartographic measurement was to be accompanied with the collection of botanical, zoological, and mineralogical specimens as well as cultural, historical, and anthropological inquiry into the customs and manners, institutional and religious practices, languages, and so on of the indigenous inhabitants of the lands hitherto unexplored by Europeans.[46] But Cook's venture was only one, albeit the most complex and for obvious reasons the best known, among many, the others differing from it in scale rather than kind, whether they took place in the Pacific, in California, at the Hudson Bay in Canada, in Scandinavia, or in the Kola Peninsula in northwest Russia.[47] The many dozens of Britons, Frenchmen, Russians, and

---

Haakonssen, *Natural Law and Moral Philosophy: From Grotius to the Scottish Enlightenment* (Cambridge: Cambridge University Press, 1996).

45 See above, 136.

46 The complex cross-disciplinary effort of the voyage is well documented in the vast literature on Cook and the Pacific since the 1980s. On the strictly astronomical aspects, see Richard van der Riet Woolley, "The Significance of the Transit of Venus," in *Captain Cook: Navigator and Scientist*, ed. G.M. [Geoffrey Malcolm] Badger (Canberra: Australian National University Press, 1970), 118–35; Wayne Orchiston, "From the South Seas to the Sun: The Astronomy of Cook's Voyages," in *Science and Exploration in the Pacific: European Voyages to the Southern Ocean in the Eighteenth Century*, ed. Margarette Lincoln (Woodbridge: Boydell Press/National Maritime Museum, 1998), 55–72.

47 On the fortunes and achievements of some of these teams, see Woolf, *Transits of Venus*, passim; Helen Sawyer Hogg, "Out of Old Books: The 1769 Transit of Venus, as Seen from Canada," *Journal of the Royal Astronomical Society of Canada* 41 (1947): 319–26; Hogg, "Out of Old Books: Le Gentil and the Transits of Venus, 1761 and 1769," *Journal of the Royal Astronomical Society of Canada* 45 (1951): 37–44, 89–92, 127–34, 173–78; Angus Armitage, "Chappe d'Auteroche: A Pathfinder for Astronomy," *Annals of Science* 10 (1954): 277–93; Nunis, *1769 Transit of Venus*; Don Metz, "William Wales and the 1769 Transit of Venus: Puzzle Solving and the Determination of the Astronomical Unit," *Science and Education* 18, no. 5 (2009): 581–92; Jean-Loius Pictet and Jacques-André Mallet, *Deux astronomes*

others were supposed to send the data they collected to the Académie Royale des Sciences in Paris, where the French astronomers led by Lalande were to synthesize the results.

Let us first see what Sajnovics and Hell reveal on the observation of the transit prior to the publication of February 1770. Sajnovics's travel diary (which was in any case not a public document) gives an idea of the suspense felt when the important day arrived:

> *June 3, Saturday. This day was the cause and origin of our expedition.*
>
> Although the sky had been totally overcast yesterday evening, around three o'clock the clouds spread sufficiently to make the Sun distinctly visible, before the sky again was covered by clouds. Around four o'clock, after the Mass, these clouds disappeared and the clearest of skies appeared, allowing the altitudes [of the Sun] to be recorded. Bands of clouds, purely white and very similar to northern lights, were drifting in various directions, by a gentle breeze arriving from the north at first, then from the west and south, until it around eleven o'clock [a.m.] turned to the east before returning to the south soon after, only to arrive from the west at one o'clock [p.m.]. The culmination of the Sun in the meridian line was recorded, and after lunch corresponding heights were observed. Around three o'clock, as these operations came to a close, the sky was totally covered by small, white clouds, which were not connected with each other. The horizon in the north and south, however, was still rather clear. A gentle breeze blew from the southwest. Shortly afterward, there arrived such a multitude of clouds from the southwest that the student Borchgrevink could not be set to work to observe the Sun until six o'clock, when the Sun again broke through the clouds from time to time and he received his instructions for observing. The same clouds continued until eight o'clock. After nine o'clock [p.m.], we directed the three telescopes to the Sun, which broke through the clouds every now and then. And finally, when the Sun stayed in such a place, the exterior and interior contacts [of ingress] were observed, thanks to the singular grace of God. The merchant exploded his gun nine times, and raised the flag as a sign of joy. The commander followed his example, and made sure the flag at the fortress

---

genevois dans la Russie de Catherine II: Journaux de voyage en Laponie russe [...] *pour observer le passage de Vénus devant le disque solaire 1768–1769*, ed. Jean-Daniel Candaux et al. (Ferney-Voltaire: Centre international d'étude du XVIIIe siècle, 2005); Nils Voje Johansen, "The Expeditions of William Bayly and Jeremiah Dixon to Honningsvåg and Hammerfest, 1769," in Sterken and Aspaas, *Meeting Venus*, 59–69.

> was raised as well. Guests were allowed into the chambers of the observatory, and Venus in the Sun shown to them. But for no more than five minutes was she visible, until the Sun again was covered in black clouds, and no position of Venus—how incredible! but nonetheless true!—could be recorded over the course of six hours. We were all anxious to observe the egress, but no one hoped for this because of black clouds that were glued to the sky, so to speak, in that region where [the planet] was supposed to leave the Sun. Around three o'clock in the morning, a strong wind from the southeast began, and the cloud that covered the Sun was driven away from its position. Thus, the interior and exterior contacts of Venus were well recorded. Again the merchant fired his gun, this time three times six. A great sense of satisfaction spread among all the inhabitants of Vardø. We burst into a *Te Deum laudamus* with the sincerest of sentiments, and allowed ourselves some rest in the meantime; there was neither time nor the mood to think of the barometer or the magnetic needle.
>
> [*June*] *4, Sunday, the 3rd after Pentecost.*
>
> After Mass for the Holy Trinity, the corresponding altitudes were recorded in the clearest of skies, with some wind from the north. During these operations, at 10:09 [a.m.] according to the Copenhagen clock, the eclipse of the Sun was noted to begin. Honorable Father Hell observed this moment; and I too observed the end. Then the meridian was recorded, and after lunch the corresponding altitudes of the Sun. As I take down the last of these altitudes, suddenly the entire sky is completely filled by the thickest of fog, falling down to the ground like dew or drizzle, covering everything in a darkness that is likely to last for a very long time. How bad if it had been like this yesterday![48]

As is regularly the case with Sajnovics's diary, his account makes no attempt to give the details of the observations themselves. Thus, neither the moments of contact of Venus with the limb of the Sun, nor the moments of beginning and end of the eclipse, are stated with anything near the degree of exactitude required. Among the surviving manuscripts, these details can only be found in Hell's astronomical notebook. This crucial set of data was, however, apparently never shared with anyone until the formal report was presented to the Royal Society of Copenhagen.

As Hell wrote to one of his Jesuit brethren, on April 6, 1769 (before the observation of the transit, and concerning the linguistic and ethnographic aspects of the expedition—but establishing a general principle), they were going to

48 Sajnovics's diary, entry on June 3, 1769 (WUS).

report "astonishing things" to their superiors, but for the time being they should "quietly keep these to themselves, for propriety requires that they are first brought to the knowledge of the Danish king."[49] Hell's sincerity about the first right of access as stipulated by the sponsor of the expedition was called into question, as we shall see, by some contemporaries and by astronomers of subsequent generations, and even in some of the more recent literature.[50] There is indeed no documentary evidence that such a commitment was ever requested or made. However, this is a kind of instruction that might well have been given orally. The man who was in charge of the Arabia Felix enterprise (in the case of which there was such an explicit obligation), Minister Moltke, was also the host of Hell in Copenhagen in June 1768. The "ban" against private communication of the datasets from Vardø may have been in breach with the ideals and practices of the Republic of Letters, but it was in accordance with Danish procedure under very similar circumstances only a few years earlier. Besides, Hell as a man who must have developed a certain flair for courtly etiquette over his years of service in Vienna may have perceived restraint in regard of publicity as part of his duty even without a "ban," expressed orally or in writing. Finally, this would have also been in the spirit of the familiar Jesuit strategy of seeking intimate contact with potentates and inner circles at court by means of scientific work when visiting non-Catholic countries.[51]

Even the sporadic and rudimentary news reports that appeared in the Viennese press about Hell's team during their nearly year-long stay at Vardø were resented in the Danish capital.[52] Regarding the transit observation itself, the caution on the part of Hell even included his employer. Thus, when on June 5, 1769 an express letter was sent from Vardø to Baron Thott in Copenhagen, the leader of the expedition revealed nothing except that his observations of both the Venus transit and the solar eclipse had been successful.[53] Sajnovics, for his

49 Hell to Höller in Vienna, dated April 6, 1769 (WUS), printed in Pinzger, *Hell Miksa*, 2:93.

50 "Everyone who had results [i.e., successful observations] to share did so as quickly as possible, everyone except the Jesuit father. Hell knew that he had the trump card in his hand, for observations in the south were of little value if they could not be compared with observations in the north." Helge Kragemo, "Pater Hells Vardøhusekspedisjon: Belyst ved Pater Sainovič's dagbok 1768–1769," in Willoch, *Vardøhus Festning 650 år*, 92–125, here 120.

51 See, e.g., Florence Hsia, "Jesuits, Jupiter's Satellites, and the Académie Royale des Sciences" and Nicolas Standaert, "Jesuit Corporate Culture as Shaped by the Chinese," in O'Malley et al., *Jesuits*, 241–57 and 352–63; and Catherine Pagani, "Clockwork and the Jesuit Mission in China," in O'Malley et al., *Jesuits II*, 658–77.

52 *WD*, June 25, 1768, 6; May 6, 1769, 9–12; June 7, 1769, 5–7. The resentment evoked by these accounts in Copenhagen was reported by Mercier on June 28, 1769. See Pinzger, *Hell Miksa*, 1:78.

53 Hell to Thott in Copenhagen, dated Vardø, June 5, 1769, in Pinzger, *Hell Miksa*, 2:102–3.

part, wrote a similar letter to his Jesuit friends in Hungary, exercising all his powers of eloquence to express his joy over the supreme benevolence of God in securing the most perfect conditions, but silent about any properly scientific aspects:

> From May 27 to June 3, we could not see the Sun because of perpetual clouds, and on the last-mentioned day, after we had recorded its corresponding heights, it disappeared in clouds again. Around nine o'clock in the evening, we—myself, Honorable Father Hell, and the student from Trondheim [i.e., Borchgrevink]—stood at our telescopes, our moods fluctuating between hope and fear as we waited in suspense to see whether it would be possible to observe Venus entering the Sun, if it should happen to dive out from the clouds for a little while. Soon afterward an opening in the clouds emerged, and we could see the Sun as if through a window, and both contacts of Venus in ingress were elegantly observed. But not more than five minutes passed by, before the Sun again was enveloped in thick clouds and no longer came forth in its entirety. Dark clouds stubbornly accompanied the Sun for altogether five hours; and we had lost all hope of observing the egress. Our hosts stood there with us, sad, their faces in mourning, and expressing their sorrow and sympathy by means of utter silence. How we ourselves felt, is easier to guess than to describe. Our only hope was that God, if he should wish to do so, would come to our aid with some miracle. Meanwhile, as the time when Venus was supposed to leave the Sun drew closer, the rays of the Sun suddenly began dissolving the extremely thick cloud that stood in their way, finally dispelling it altogether. And behold! The Sun came forth in full splendor, and both contacts of Venus during egress were recorded exactly; with how much joy, with how many thanksgivings to Divine Clemency, I am incapable of expressing. Our hosts, to whom the word 'miracle' is an uncommon, perhaps even ridiculous concept, nonetheless agreed fully that the way in which the appearance of the sky had changed—so neatly and congruously—could not be due to any human or natural causes, but must be ascribed to the utterly exceptional and incredible favor of the Supreme Being. I for my part will cherish the magnitude of this miracle for as long as I live. The Sun then wandered through a very clear part of the sky, and its eclipse was observed most accurately and its passage through the meridian recorded. After lunch, its corresponding heights were again recorded in the clearest of skies, but just as I was busy taking down the very last of these observations, in the same moment a strong wind rose from the north, enveloping the sky, earth, and sea in the darkest

> of clouds. From that moment onward, the Sun has not been possible to observe, although it is by now the sixth day of June.[54]

As time passed by, the secretive descriptions became more and more sophisticated. Father Hell's letter to Wargentin, dated Copenhagen, November 7, 1769, is a good example:

> I have received Your highly friendly letter, eminent fellow, in which You congratulate me on my successful return from Lapland. I thank You sincerely both for Your friendly affections and especially for the astronomical news and that set of accurate observations of Yours. I am very sorry to learn that Venus has been so unfair when [only partially] exposing herself to all the other observers by the Arctic; it is like a miracle, how she uncovered herself graciously to me, who very nearly had given up all hope, but in doing so, she offered herself to be seen in such a parsimonious, and almost feminine manner, that apart from all the contacts—that is, her four kisses with the Sun, which she displayed with an uncovered face—she hid herself away with her Apollo behind a thick cloud for almost the entire duration of their rendezvous, as if being shy. I did not mind the clouds much, however, for after the observation of the first interior contact, which took place while the upper limb of the Sun was six degrees and thirty-three arc minutes high, the Sun dropped down closer and closer to the horizon, so that, during its passage through the northern meridian it was barely three degrees above the horizon. Because of the vapors of the horizon, which in this place [Vardø] are extremely dense and fluctuating so close to the horizon, it would in any case have been impossible to determine the position of Venus accurately. The interior contact of egress took place when the Sun was 10° 4′, and the exterior contact when it was 11° 13′ high, and they were observed by me so precisely, and in such clear and quiet atmospheric conditions, that I barely dare to doubt for more than a single second. After egress, the sky remained totally clear, without a single cloud until 3:30 p.m. on June 4, allowing me to accurately observe both the corresponding heights and the solar eclipse, and the Sun on my six-feet high meridian line.[55]

If Sajnovics engaged in rhetorical flourish to describe his experience of the transit, in Hell's parallel text this assumes near-poetic dimensions, even

54 Sajnovics to Splenyi in Trnava, dated Vardø, June 6, 1769 (MTAK IL).

55 Hell to Wargentin in Stockholm, dated Copenhagen, November 7, 1769 (CVH).

employing—strikingly, in the case of a Jesuit, but very much in the voyeuristic style of a great deal of eighteenth-century literature on natural knowledge—erotic allusions to the "feminine" shyness of Venus and her "rendezvous" with the Sun as Apollo, mostly taking place under the decent veil of clouds but reaching a climax in "four kisses" that were visible to the eager spectators. But besides the artfully covert wording used by Hell and Sajnovics when they described their observations prior to February 1770, the apparent holding back of meaningful data by them needs to be further contextualized. It is helpful both to look at Hell's status and manner of procedure in 1761 and 1769 comparatively, and at the conduct of the Royal Society of Copenhagen vis-à-vis various national scientific bodies.

As of 1761, Hell was a newcomer on the international arena. He had only recently begun expanding his network of correspondents outside the Jesuit circles of the Habsburg lands. As a corresponding member of the Académie Royale des Sciences of Paris (appointed December 1758), he shared theories and observations with several colleagues in that stronghold of theoretical astronomy. Not surprisingly, he sent the details of his Venus transit observation to Paris by letter less than a week after the event in 1761.[56] This way of sharing ideas and datasets was not only in harmony with the ideals of the Republic of Letters but was also a good fit with the self-esteem of the astronomers of Paris, who considered themselves the natural coordinators of international programs such as the transits of Venus.

In the run-up to 1769, Lalande emerged as the leading figure in the Venus transit enterprise.[57] As the elderly Delisle retreated, Lalande was issuing memoirs, offering personal advice, and placing orders at the instrument-makers on behalf of academies and individuals in various countries. It is illustrative how he advised the Imperial Academy in St. Petersburg on how to proceed, and offered to send one of his students to preside over the observations at the official observatory of that academy. Lalande also kept an assiduous correspondence

56 See Aspaas, "Le père jésuite Maximilien Hell et ses relations avec Lalande," 133–37 (with a facsimile of Hell's letter to Lalande, dated Vienna, June 12, 1761, on 136–37). The observations of Hell were soon shared among the astronomers of Paris, who in turn communicated them to colleagues across Europe long before they had been printed (see, e.g., the letter from Lacaille to Tobias Mayer in Göttingen, dated Paris, June 28, 1761, published in Eric Forbes and Jacques Gapaillard, "La correspondance astronomique entre l'abbé Nicolas-Louis de Lacaille et Tobias Mayer," *Revue d'histoire des sciences* 49 [1996]: 538).

57 See, e.g., Pecker, "Jérôme de Lalande and International Cooperation," 52–62; Simone Dumont, *Un astronome des Lumières: Jérôme Lalande*, with a foreword by Jean-Claude Pecker (Paris: Vuibert/Observatoire de Paris, 2007), 36–43. Pertinent here is also the edition by Simone Dumont and Jean-Claude Pecker, eds., *Mission à Berlin: Jérôme Lalande, lettres à Jean III Bernoulli et à Elert Bode* (Paris: Vrin, 2014).

with fellow astronomers in Sweden and England in this period. Not surprisingly, Lalande received news from all over the world in the weeks and months after June 3, 1769. Thus, thanks to his close contacts with astronomers on the other side of the Channel, Lalande received all British observations and summarized them in the *Journal des Sçavans* long before they were printed in the *Philosophical Transactions*.[58] Similarly, the Imperial Russian Academy extracted the Venus transit observations from the expedition diaries of its observers, printed them immediately, and sent them to Lalande. And by mutual agreement, its secretary—Johann Albrecht (Jean Albert) Euler (1734–1800)—received news of French and British observations from Lalande in return.[59] Furthermore, Wargentin in Stockholm summarized all Swedish (including Finnish) observations in letters to Lalande soon after the transit had taken place.[60]

However, no comparable agreement existed between Lalande and the Royal Society of Sciences in Copenhagen—quite the contrary, in fact. Hell's refusal to share his observations with anyone else, as explained in his letter to Wargentin quoted above, evidently included the academicians of Paris. Despite Hell's status as a corresponding member of the Académie Royale des Sciences, with none other than Lalande as his personal contact, no details whatsoever were revealed to Lalande or his confrères until a copy of Hell's *Observatio transitus Veneris* [...] *1769* finally reached Paris on March 4, 1770, exactly nine months after the transit had taken place.[61] By that time, Lalande had received reports from all over Europe, and even from Hudson's Bay in present-day Canada. The only crucial observations he lacked were a couple of Siberian observations by Georg Moritz Lowitz (1722–74) and Ivan Islen'ev (1738–84) (published in French

58 See *JS* (September 1769): 644–45; (December 1769): 835–36; (April 1770): 227–28; (December 1771): 825–26 (the last being a "letter to the editors" dated September 13, 1771, in which he explains that he had received the Tahiti observations of Cook's team two days earlier). For an analysis of Lalande's contacts with British astronomers, see Danielle M.E. Fauque, "La correspondance Jérôme Lalande et Nevil Maskelyne: Un exemple de collaboration internationale au XVIIIe siècle," in Boistel et al., *Jérôme Lalande*, 109–28.

59 Johann Albrecht Euler to Lalande in Paris, dated St. Petersburg, May 14/26, 1769, and September 8/19, 1769 (RAN); Lalande to Johann Albrecht Euler in St. Petersburg, dated Bourg-en-Bresse, July 26, 1769, and Paris, January 12, 1770 (RAN).

60 Wargentin is known to have sent letters to Lalande in Paris, dated June 9 and July 11, 1769 (see the list of outgoing correspondence in Nordenmark, *Wargentin*, 399–424, here 406). It is probably the contents of these letters that appeared in Lalande's "Lettre sur le passage de Vénus; Adressée à Messieurs les auteurs du *Journal des Sçavans*," published September 1769, 645.

61 According to Hell, "De parallaxi Solis," 92.

in May–June 1770),[62] the observations of Chappe and his companions in Baja California in present-day Mexico (which reached Paris in December 1770),[63] and those of Captain Cook's crew in Tahiti, in what is now French Polynesia (which reached Paris in September 1771).[64] For all these cases, there were good excuses for the delay. Lowitz continued his expedition in Siberia for several years until he was actually killed by rioting local inhabitants,[65] and it took a while before the package containing his manuscripts arrived in St. Petersburg. Islen'ev's site of observation had been Iakutsk, almost 8,500 kilometers east of the capital, and even he continued his expedition for a long while before returning to St. Petersburg. Chappe, along with nearly all his travel companions, had perished from a plague while still in America; and Cook and his team had observed the transit literally from the other side of the planet and still had some explorative tasks ahead of them before they returned home. The professional astronomer of Cook's crew, Charles Green, even lost his life in Asia.

In the web of swift and open collaboration characterizing the Venus transit projects of the eighteenth century, Denmark–Norway had been—or had let itself be—left in a backwater in 1761. Its non-communicative mode of behavior continued in 1769, and it is reasonably clear that neither Hell nor the organizers in Copenhagen asked for Lalande's advice in the planning of the Vardø expedition. The Venus transit report from Vardø did indeed arrive quite late, it was unusually—and perhaps unnecessarily—long and detailed, and both its lateness and its wealth of detail left it open to attack. Let us now briefly look at the immediate reactions to Hell's report among four of his peers who, besides being astronomers of an international reputation, had another thing in

62 On June 19, 1770, Johann Albrecht Euler sent to Hielmstierne (secretary of the Royal Society of Sciences in Copenhagen) the two reports, "which were published quite recently" (DKDVS). As of March 18, 1770, Lalande had still not received any news concerning the observations of Lowitz and Islen'ev (letter to Euler, dated Paris, March 18, 1770 [RAN]). On April 16, Lexell informed Wargentin that the manuscript of Lowitz had just arrived and was about to be printed (letter to Wargentin in Stockholm, dated April 16, 1770 [CVH]).

63 Cassini IV, "Avant-Propos" in his edition of Chappe, *Voyage en Californie* (Paris, 1772), unpaginated.

64 Lalande, "Lettre sur le passage de Vénus [...]," *JS* (December 1771): 825–26. Observations made at Jesuit observatories in China had the potential of being valuable as well. Indeed, the observations of two Jesuits—François-Marie D'Ollières (1722–80) and a certain Dollas—in Beijing are commented on by Lalande in a paper originally read in 1771 at the Académie Royale des Sciences, but he does not state when the letter containing their observations reached him, cf. Lalande "Mémoire sur la parallaxe du Soleil, déduite des observations faites dans la mer du Sud, dans le royaume d'Astracan, & à la Chine" (1774), 789–91.

65 See, e.g., the "Précis de la vie de M. Lowitz," in Bernoulli, *Nouvelles littéraires de divers pays*, 6:41–50.

common: as of the spring of 1770, when they received the report from Vardø, they had never met Father Hell in person.

Anders Planman received his education in natural sciences in Åbo (Turku in present-day Finland) and Uppsala. As a *docent* of astronomy at Uppsala University, he was sent to Cajaneborg (Kajaani) in 1761 on behalf of the Royal Swedish Academy of Sciences. A couple of years later, he was appointed professor of physics at the university in Åbo, a position he kept for the rest of his life. From his base in Åbo, he presented a series of calculations of the solar parallax on the basis of the transit of Venus, arguing for a solar parallax of about 8.3 arc seconds. In 1769, Planman was again dispatched to Cajaneborg, where his observation was partly successful, insofar as he did see both the external and internal contact during ingress, but only the external contact during egress because of clouds. His datasets were reported by letter to Wargentin in Stockholm, who distributed them promptly to colleagues abroad. Like any other astronomer well versed in the noble art of calculating, Planman was eager to see the observations of his peers in order to recalculate to solar parallax from a completely new set of data. In late February 1770, Planman had not yet received the observation of Hell in Vardø. In a letter to Wargentin, he states that:

> I thank my Mister [Wargentin] humbly for the observations of Venus that he has deigned to share with me, and will shortly embark upon the calculation of the solar parallax. I find Father Hell highly puzzling, since he has not yet published his observations: such a way of behaving appears rather suspicious to me.[66]

At that moment, Hell's report had in fact just been released, and Planman's curiosity was soon satisfied. Seeing that the observations from Vardø did not match perfectly with any other observations, Planman "free[d] him from all suspicions about the veracity of his observation."[67] It might be added, however, that the Åbo professor was not only critical of the lateness of Hell's report. The swift and unpolished manner in which the Russian observations were published also had its disadvantages, mainly because they contained only the moments of contact of the transit along with the raw material for the latitude and longitude of each site, without any calculations or reductions to local mean time.[68] As he explained in a dissertation presented at Åbo University on May

66 Planman to Wargentin in Stockholm, dated Åbo, February 23, 1770 (CVH).
67 Planman to Wargentin in Stockholm, dated Åbo, June 22, 1770 (CVH).
68 Planman to Wargentin in Stockholm, dated Åbo, November 17, 1770 (CVH).

26, 1770, his own way of publishing the datasets—by an open letter first, then in brief articles in the proceedings of the Royal Academy of Sciences in Stockholm, and finally in a more elaborate dissertation—was superior to both the Jesuit of Vardø and the Imperial Academy in St. Petersburg:

> In this way, it will become evident what elements of the observation are certain and settled and what are dubious. For, those who publish their data stripped of the circumstances in which they were obtained, can hardly be considered to serve the world of learning better than those who delay sharing their observations until they have had the occasion to compare them with the observations of others. Whereas the latter can hardly avoid being stigmatized by suspicion that they may have wished to publish observations that were either made up or altered in order to fit those of others, the former leave the reader in suspense as to whether or not the datasets have been obtained under appropriate conditions. Both parties are all the more to blame when considering how crucial it is, in the comparison of observations involved in the investigation of the solar parallax, to apply observations that are trustworthy in all respects.[69]

Although no names are mentioned, the identity of the "two parties" would be recognizable for all astronomers. A university dissertation was not necessarily shared with many outside the circle that witnessed the ceremony, but from Planman's correspondence with Wargentin, it is evident that he expected his piece to be communicated to Hell: "It would hurt me, if he [i.e., Hell] should find himself offended by my disputation; however, my lack of awareness of what came to pass [in Vardø] will serve as my excuse," he wrote in a letter shortly after the dissertation.[70]

The reaction of Planman, then, can be summed up as rather implicit and ambiguous. He found Hell's behavior suspicious at first, but since the datasets from Vardø turned out not to match his own, the Jesuit could hardly be accused of having forged them on the basis of the Cajaneborg observations. There was also a discrepancy between the observers in Vardø. Although the observations of Sajnovics and Hell were almost identical, the moments recorded by Borchgrevink diverged by several seconds from the two Jesuits. Planman of course noticed this fact, and noted to Wargentin that "besides, the observations of

69 Anders Planman and Karl Gebhard Widqvist, *Expositio observationum transitus Veneris per Solem, Cajaneburgi A:o 1769, D. 3 Junii factarum* […] (Åbo: Joh. Christopher Frenckell, [1770]), [2].

70 Planman to Wargentin in Stockholm, dated Åbo, June 22, 1770 (CVH).

Mister Borgrewing [*sic*] match my own accurately, if a solar parallax of 8.3 arc seconds is supposed. That satisfies me."[71]

Our next interlocutor, Anders Johan Lexell,[72] was born and raised in Åbo, where he attended university and was noticed for his brilliance in mathematics. No positions were vacant in Swedish universities, however, and it may be that he had higher ambitions as well. Be that as it may, in 1768, he sent two treatises of mathematics to the Imperial Academy in St. Petersburg. Leonhard Euler (1707–83) examined them and made sure that Lexell obtained a position as his *adjunctus* (assistant) at the academy. One of Lexell's first tasks was to observe the transit of Venus from the academy building. He did so along with the secretary of the academy Euler and the two Jesuit visitors, Mayer and his assistant Gottfried Stahl (dates unknown).[73] Having gained access to the observations from St. Petersburg, Planman commented in a letter to Euler that the observations of Lexell were the closest match to his own, under the precondition that the solar parallax was 8.3 arc seconds.[74]

Unlike Planman, however, Lexell was not convinced of the accuracy of his own observation—or of a solar parallax of 8.3 arc seconds for that matter. He was soon entrusted the task of calculating the solar parallax on the basis of the observations of 1769. In this process, Lexell declined all temptation to accord the St. Petersburg observations any special reliability. Quite the contrary, in a letter to Planman dated June 25, 1770, Lexell said that

> as far as Father Hell's observations of both last contacts [of Venus with the limb of the Sun] are concerned, I do not know what to say. He may perhaps have tried to fabricate them according to the Petropolitan

71 Planman to Wargentin in Stockholm, dated Åbo, June 22, 1770 (CVH).

72 On Lexell, see Johan C.-E. Stén, *A Comet of the Enlightenment: Anders Johann Lexell's Life and Discoveries* (Cham: Springer, 2014); his role in the Venus transit observations is discussed in Chapter 5.

73 Stahl and Lexell used comparatively small telescopes, while the two largest and best were used by Euler and Mayer. Cf. Christian Mayer, "Expositio utriusque observationis et Veneris et eclipsis Solaris factae Petropoli in Specula Astronomica," *NcASIP* 13 (1769): 541–60.

74 Planman to Johann Albert Euler in St. Petersburg, dated Åbo, September 26, 1769 (copy in Planman's handwriting, CVH): "In order to be able to compare my observation with yours from St. Petersburg, it was necessary to calculate the effect of parallax with regard to these places. Assuming a solar parallax of 8.3 arc seconds, which I obtained from the observations of the transit in 1761, I found that, after calculation, the total emersion should have taken place twenty-two seconds earlier in Cajaneborg than in St. Petersburg [...]. Thus, my observation is closest to that of Lexell and least in harmony with that of [Christian] Mayer."

> observations. In that case, he was hardly that lucky, for our observations are surely not the most accurate that exist.[75]

This comment was made in a private letter and would no doubt have caused a strong reaction if it had reached Hell. It is intriguing to note, however, that Lexell was convinced that the Jesuit in Vardø had made up his observations: Lexell thought there could be no other cause for the late publication than the time needed to manipulate datasets.

A man in whom Planman and Lexell both confided, Wargentin in Stockholm, evidently felt responsible for the situation. Accordingly, he asked the amateur astronomer Hellant in Torneå (now Haparanda, Tornio) to check whether the weather conditions in Vardø really had been as favorable as Hell claimed. When Hellant visited a market in Utsjoki on the borders between the Danish–Norwegian and Swedish(–Finnish) realms, a representative of the local population of Vardø confirmed that the weather had been beautiful ("smukt"). This testimony appears to have convinced Wargentin, at least.[76]

The leading university of the German-speaking world during the Enlightenment, the Georgia Augusta in Göttingen, had been the workplace of Tobias Mayer, who passed away in 1762. His successor, Abraham Gotthelf Kästner, may not have been an astronomer of Mayer's eminence, but he made great services to the profession as a prolific reviewer for the *Göttingische Anzeigen von gelehrten Sachen*. Already in the issue for April 7, 1770, Kästner published a very positive, rather long review of Hell's Vardø report.[77] Kästner characterizes the method of determining the pole height as "sagacious" (*scharfsinnig*), and there is no hint of skepticism concerning any of the practical procedures or theoretical deliberations of Hell. Nor is it mentioned that the report arrived rather late. In sum, the overall assessment is that the *Observatio transitus Veneris* [...] *1769* contains "so much new and important, that this will excuse the length of this summary [i.e., review]."[78]

Even more lengthy was the review in the *Journal des Sçavans*, which appeared in the issue for September 1770.[79] Although the name of the author is suppressed, there can be little doubt about his identity—Lalande. The review is balanced. The boldness of Hell, who took upon himself this strenuous and

75 Lexell to Planman in Åbo, dated St. Petersburg, June 25, 1770 (Kansalliskirjasto, Helsinki, Planman-samlingen no. 61, transcript generously provided by Johan Stén).

76 Cf. Erik Tobé, *Anders Hellant: En krönika om sjuttonhundratalets märkligaste Tornedaling*. Tornedalica 49. ([Luleå]: Tornedalica, 1991), 147–49.

77 *GAgS* [18]:1, no. 42 (April 7, 1770): 353–56.

78 *GAgS* [18]:1, no. 42 (April 7, 1770): 356.

79 *JS* (September 1770): 619–22.

dangerous expedition, is emphasized at the outset, and the concluding lines are certainly full of flattery of both Hell and his sponsor, the king of Denmark, who "could have made no better choice than that of giving this task to Father Hell."[80] In-between, however, the reviewer raises some objections. "We are unaware of what might have forced Father Hell to keep an important observation hidden for so long, while Europe's astronomers made haste to publish their data,"[81] Lalande states, without exploring the matter further. Furthermore, he strongly criticizes Hell's determination of the latitude and longitude of Vardø, which Hell had calculated through a method—"hilarious," according to the critique—differing from that explicated by Lalande in his *Astronomie*. He also disagrees with the Jesuit's determination of the duration of the transit, questioning his peculiar definition of the moments of "true contact" between Venus and the limb of the Sun. However, all these objections did not detract from "the importance of this observation from Vardø, the most complete that we have received from the European north."[82]

For all its criticism, then, Lalande's official review was written in a sober style. The stinging sentence has to do with the incomprehensible "hiding" of the observation, but that is not the same as accusing the author of fraud. "Behind the scenes," however, the tone was harsher. In a letter to the Royal Danish Society of Sciences, probably written immediately after receiving Hell's report, Lalande raised queries about the belated communication of the Vardø observation, adding threats which Hell found rather abusive. Lalande also characterized the Danish society as "virtually unknown" and wondered whether it planned to publish memoirs, and if so, when. Unfortunately, the original of the letter is lost, and we know its contents only from the travel diary of Sajnovics.[83] It must be added that the criticism of Lalande was not shared by all Parisian savants. An anonymous reviewer in the *Journal enyclopédique* (Encyclopedic journal), May 1770, wrote very favorably about the *Observatio* and added flattery about "the thoroughness and clarity that are characteristic of him [i.e., Hell] and that render his works so useful for those who cultivate practical

80 *JS* (September 1770): 622.

81 *JS* (September 1770): 619.

82 *JS* (September 1770): 622.

83 Sajnovics's travel diary 1768–70, entry on April 3, 1770 (WUS): "A letter arrived from Lalande yesterday in which he rather arrogantly complains about the late communication of the observation to the astronomers of Paris, adding some rather abusive threats. Toward the end of the letter, he characterizes the Danish Society of Sciences as virtually unknown, and asks if it plans to publish some journal, and if so, when, etc."

astronomy." No hint of skepticism is detectable, except that Hell's observation had been awaited "with impatience."[84]

Even though substantial parts of Hell's correspondence are lost or await discovery, there is enough evidence to demonstrate that he was informed of far harsher accusations. In a letter dated June 23, 1770, the archbishop and amateur astronomer Paul d'Albert de Luynes wrote the following:

> My Honorable Father! I have received, My Honorable Father, and read with the greatest possible pleasure, the details of Your observation of Venus passing in front of the disc of the Sun. I admire Your good fortune in having had clear weather, and perfectly clear weather at that, during the two most important moments, as well as the excellent methods that You have employed to meet the lack of commodities that You were facing. Efforts have been made at our academy [i.e., the Académie des Sciences] to raise objections concerning the fact that the details of your observation reached us so late, a delay that was capable of making room for criticisms, claiming that Your lateness may give rise to suspicions that You, having had the time to receive the other observations, could have made Your observation match them.[85]

De Luynes did not state who had raised these allegations, but he vigorously rejected them, and assured the Viennese Jesuit of his full support. Nevertheless, at this time a five-year-long scientific controversy was already in the making, whose subject matter was not Hell's alleged manipulation of data, but the related issue of the solar parallax.

The parallax had already been a matter of debate in the aftermath of 1761. At one end stood Alexandre Guy Pingré, who observed the transit from the Cape of Good Hope in Africa. His observation was hard to reconcile with other datasets, and besides struggles over the accuracy of his observation, Pingré had a hard time defending his solar parallax of more than ten arc seconds. At the very other end of the scale was Anders Planman, who argued for a solar parallax of about 8.3 arc seconds. In this situation, Hell opted, in the *Ephemerides* for the year 1764, for a preliminary parallax of about nine arc seconds. Lalande agreed completely, and used almost exactly the same wording as Hell in the first edition of his textbook *Astronomie*, published in 1764. In a letter dated December 29, 1763, Lalande reveals to Hell that

84 *Journal encyclopédique* (May 1770): 344–52, quotation from 345.

85 De Luynes to Hell, dated Paris, June 23, 1770 (a copy in the handwriting of Hell at WUS).

> Monsieur Pingré was really annoyed because of the letter you wrote to him. He complained to me, as if I was behind it. However, it is first and foremost he himself who is to blame for criticizing in an indecent manner the observations of Yours, which are more valuable than his own.[86]

As we have seen, during the 1760s Hell gradually became more self-confident and disputed not only Pingré's parallax but also some other works by French astronomers. However, before 1770 he seems not to have been engaged in any disputes with "the most important French astronomer of the eighteenth century."[87] For all its fragmentary status, the epistolary evidence to hand suggests that Hell and Lalande remained close allies during the 1760s. That changed with Lalande's reaction to the Vardø report.

Around the year 1761, Hell and Lalande were both "shooting stars" on the international stage. Lalande waited impatiently behind the back of Delisle to become the main nodal astronomer of the time. Hell, no less ambitious, could not dream of similar laurels but was working strenuously toward securing Vienna a firm place on the same stage. By 1769, he succeeded, while by that time Lalande—in his own eye, certainly—emerged as the worldwide coordinator of the entire Venus transit enterprise. The first seed of discontent was probably sown when neither Hell nor Denmark–Norway asked for his advice in the planning of the Vardø expedition. But their independent behavior went beyond that. The datasets from Vardø were not shared with Lalande immediately: he had to wait in line behind the Danish king, along with every astronomer except the few Copenhagen-based savants who attended oral presentations at the sessions of the Danish Society of Sciences in November and December 1769. A third element that annoyed Lalande was the peculiar method in calculating the coordinates of Vardø, especially the pole height method described above. The fourth issue at stake was of course the conclusions drawn concerning the solar parallax itself. Unlike the previous occasion, Lalande and Hell disagreed fundamentally here. Instead of standing on the side-lines, the two stepped forward to become the main characters in a heated scientific controversy.

When calculating the solar parallax, contemporary astronomers could choose between two strategies. One option was to wait for all observations to be published and then undertake a thorough survey of all the available data. Ideally, such a survey would lead to a decisive conclusion, "the author's final word" on the matter. Another *modus operandi* was to make repeated calculations as the various datasets emerged. Tentative adjustments following

86 Lalande to Hell in Vienna, dated Paris, December 29, 1763, in Pinzger, *Hell Miksa*, 2:191.

87 Jean-Claude Pecker, "Préface," in Dumont, *Un astronome des Lumières*, 1–7, here 3.

preliminary calculations would be followed by new tentative adjustments and so forth. Hell chose the former, Lalande the latter strategy. Lalande had published parallaxes of 9″ (*Gazette de France* [January 1770]) or 9.18″ (*Journal des Sçavans* [April 1770]) before he had access to the observation of Hell. Having received the Vardø observation as well as Chappe's from California, he adjusted it to approximately 8.75″ (*Gazette de France* [December 1770]) or 8.80″ (*Journal des Sçavans* [May 1771]) or again 8.75″ (second edition of the *Astronomie* [August 1771]), until he upon the arrival of the Tahiti observation changed it yet again, to 8.50″ (*Gazette de France* [September 1771]; *Journal des Sçavans* [December 1771]). From then on, he stayed fixed on 8.50″, or 8.60″ as a maximum (third edition of the *Astronomie* [1792]).

If we look behind these numbers and pay attention to how Lalande arrived at the results, we find that he—although dismayed at its late arrival—initially held no prejudices against the Vardø observation. Quite the contrary: in a letter to Boscovich, dated December 15, 1771, he put together a table in which the observations of Cajaneborg and Vardø are compared with those of Hudson Bay, California, and Tahiti, adding that

> the largest difference between the three results yielded by comparisons with Cajaneborg is 0.5 arc seconds, whereas with Vardøhus it is only 0.3″. This makes it probable that the Vardøhusian observation is more exact than the former. Thus, if we were to take the mean between the three comparisons, staying closer to the observation of Vardøhus than that of Cajaneborg in a 5:3 relation and then taking the mean between the three last results, we get [a solar parallax of] 8.6″ rather than 8.5″.[88]

Simultaneously, Hell arrived at his conclusion of 8.70″, which he based primarily upon his own observation from Vardø and that of Green from Tahiti. The observers in Tahiti varied several seconds between each other in their determinations of the moments of contact, but Hell stuck to the observation of the professional astronomer Green, skipping those of Admiral Cook and natural historian Daniel Solander (1733–82). The same applied for the Vardø observation, where the inexperienced Borchgrevink diverged substantially from Hell and Sajnovics. Trusting the professional and most experienced observers, Hell rejected all other observations and tried to persuade his colleagues that the

88 Lalande to Boscovich, dated Paris, December 15, 1772, cited in Vladimir Varićak, "Drugi ulomak Boškovićeve korespondencije," *Rad Jugoslavenske akademije znanosti i umjetnosti, Matematičko-prirodoslovni razred* 52 (1912): ccclxviii–ccclxx.

question of the parallax was now settled to the accuracy of ±0.01″.[89] It is known that on December 20, 1771 Hell wrote a letter to Lalande, in which he tried to persuade his French colleague to exclude the observation of Planman entirely from the calculations of the parallax.[90] The tone of the letter was perhaps a bit too self-confident, for by March 10, 1772, Lalande had become convinced of the opposite, as is seen in a letter to Boscovich: "What is your opinion of Father Hell, have you seen him observing, is he able, is he well trained? I conclude with the utmost dismay that his observation from Vardøhus is in accordance with no other, and that it has to be discarded."[91] Similarly, he advised his colleague Bernoulli in Berlin, "do not trust the remarks of Father Hell, he is surely wrong, and this will do no honor to your work [i.e., the *Receuil pour les Astronomes*]."[92]

Lalande published his rejection of Hell's data in April 1772, in the *Mémoire sur le passage de Vénus devant le disque du Soleil* (Memoir on the transit of Venus in front of the disc of the Sun).[93] Here, Lalande explained how he had found the mean solar parallax to be 8.50″, by means of virtually every other observation than that of Vardø. As for the competing observation by Planman, Lalande's conclusion was quite devastating to Hell: "This observation from Cajaneborg has become the most important among all those that were made in Europe, for it has served as confirmation and the element of comparison for all remote observations, with which it is in perfect harmony."[94]

Lalande's memoir was received by the Viennese Jesuit as little short of a declaration of war. In less than three months, he managed to compose—and print—an apology nearly three times the size of Lalande's work, *De parallaxi Solis ex observationibus transitus Veneris anni 1769* (On the parallax of the Sun deduced from observations of the transit of Venus of the year 1769). The memoir contains both a detailed calculation of the solar parallax and a furious

89 Hell to Weiss in Trnava, dated Vienna, December 26, 1771, in Pinzger, *Hell Miksa*, 2:107–9; Hell to Fixlmillner in Kremsmünster, dated Vienna, July 17, 1772, cited in Rabenalt, "Astronomische Forschung," 117; Hell, "De parallaxi Solis," 107–8.

90 Hell, "De parallaxi Solis," 6.

91 Lalande to Boscovich, dated March 10, 1772, in Varićak, "Drugi ulomak Boškovićeve korespondencije," ccclxxiii–ccclxxvi.

92 Lalande to Bernoulli in Berlin, dated March 18, 1772 (UBB), published in Dumont and Pecker, *Mission à Berlin*, 86.

93 We had no access to the original but used the extensive summary in the *JS* (September 1772): 613–23 ("Mémoire sur le passage de Vénus devant le disque du Soleil, observé le 3 Juin 1769, pour servir de suite à l'explication de la carte publiée en 1764 [...] Paris") and other sources.

94 Lalande, *Memoire sur le passage de Venus* [...], 14, cited in *KVAH* (April–June 1772): 191.

attack on Lalande. As Hell wrote in one of his letters accompanying the monograph (to Wargentin, dated Vienna, July 15, 1772):

> If my style, so untypical of me until now, seems a little over-aggressive to you, I would like you to consider the unheard-of, and totally unfounded, accusation of having made up or altered the data, that has been put forward by Monsieur Lalande against my person (who did not exactly start my career in astronomy yesterday); this would actually have deserved a much stronger response. In more than one letter, I have advised Lalande to abstain from defending the Cajaneborg observation and cease attacking the one from Vardø, but in response to my friendly, even privately communicated advice, he has decided to brand me in public, an act I deemed I should certainly not pass by in silence.[95]

Hell's confession to "over-aggression" may seem to corroborate another charge sometimes leveled against him in the literature—not just a tendency to lose his temper, but even to resort to questionable means in the heat of the debate. He is alleged to have "used all kinds of tricks; erroneous calculations, wrong longitude determinations, and incorrect parallax effects."[96] To put this in context, one might add immediately that Lexell voiced exactly the same criticism against Hell, Planman, and Lalande alike. Even Hell's insistence that Lalande must have been led more by his personal ambition than by a quest to find the truth is echoed by Lexell. In January 1770, when Lalande published his first in a series of calculations of the parallax based on the observations of 1769, another correspondent of Wargentin's in Paris remarked that "the merit of this savant, however huge in itself, would have been doubled if only he had been less inimical to the merit of others."[97] Hell was probably neither better nor worse than any in this charged contest of heavy egos.

In the *De parallaxi Solis*, Hell blames Lalande for having shown too much of that arrogance characterizing representatives of great powers. Lalande, he argues, must clearly have felt dismayed that neither Hell nor the court in Copenhagen asked for his advice in the planning of the Vardø expedition. Besides, he and his French colleagues were obviously offended that Hell did not dispatch an extract of his observation journal in manuscript directly to Paris, "as to a tribunal of astronomy" (*tamquam ad Tribunal astronomicum*), with the first express mail possible. Hence, when the report finally arrived, they judged that

95 Hell to Wargentin, dated Vienna, July 15, 1772 (CVH).

96 Kragemo, "Pater Hells Vardøhusekspedisjon," 121–22.

97 François Charles de Baër to Wargentin, dated Paris, January 18, 1770 (CVH).

it must have been "adulterated."[98] This prejudice must have brought Lalande to neglect the fact that Planman had been stationed at a site (Cajaneborg) where the Sun was extremely low above the horizon, causing the limbs of the sun to undulate strongly, whereas Hell in Vardø had enjoyed perfect atmospheric conditions and the Sun elevated more than 6.5 and 10° above the sea during ingress and egress respectively. Hell meant he could prove Planman to have either defined the longitude of his site erroneously by at least thirty-five seconds, or observed the exterior contact of egress wrongly by thirty-five seconds.[99] Lalande, on the other hand, who considered Hell's report worthy of rejection, had made various sophisticated calculations in order to make the Cajaneborg observation as complete as he needed it. The interior contact of egress—unobserved by Planman because of clouds—was found by Lalande by altering the diameter of both Venus and the Sun by a number of seconds. In this way, he managed to fit Planman's observations to the data obtained in Tahiti and California, thereby defending his result of 8.50″ for the mean horizontal parallax of the Sun.[100] Repeatedly, Hell dismisses his Paris antagonist as "the protector and defender of the incomplete and erroneous Cajaneborg observation" and as a friend of his personal ambition rather than the truth.[101] But if Planman's observation really had been as exact as Lalande wanted it to be, each and every colleague of his must have been mistaken by between twenty-four and forty-eight seconds in time.[102] This absurdity would no doubt lead neutral colleagues to agree that the parallax value of Hell, rather than that of Lalande, was correct. In sum, Hell concluded that "*Tahiti* and *Vardø* will be the two columns upon which the true solar parallax of 8.70″ will rest firmly and be preserved—like upon pillars of bronze—to the eternal memory of posterity, a memory which coming generations will decorate again and again with their palms of victory."[103] For, "we are now living in a time […] when England, Germany, Italy, Denmark, Sweden, and Russia all excel in their own astronomers, who know very well how to decide for themselves what difference there is between truth and wrong."[104]

One of the "neutral" and able calculators alluded to by Hell was the young Lexell in St. Petersburg. Lexell published various attempts between the autumn of 1770 and the end of 1772, arriving at parallaxes of 8.80″, 8.76″, and

98 Hell, "De parallaxi Solis," 86–93.
99 Hell, "De parallaxi Solis," 8–39.
100 Hell, "De parallaxi Solis," 103–5.
101 Hell, "De parallaxi Solis," 8, 38, 86, 94, 110–15.
102 Hell, "De parallaxi Solis," 100–1.
103 Hell, "De parallaxi Solis," 109.
104 Hell, "De parallaxi Solis," 114–15.

8.63″.[105] During the controversy, he was virtually bombarded with letters by both Hell and Lalande, and the latter even went as far as asking the pupil of Euler to act as a judge in the quarrel that had broken out between himself and the Viennese Jesuit.[106] Lexell's correspondence with Hell and Lalande has—with one exception—not been available for this study. His reactions to their activities can be studied, however, in the frequent letters he sent to Wargentin in this period, all preserved in Stockholm.[107] In fact, Lexell found the arguments of both Hell and Lalande unconvincing. For one thing, he was puzzled that Planman (and Lalande) was so sure about the accuracy of the Cajanbeorg observation.[108] Instead of rejecting one of the observations, Lexell argued that the duration of the transit as observed in Vardø and Cajaneborg had to be adjusted by at least ten seconds in each of the two places.[109] In one of his published memoirs on the parallax, we find him criticizing Lalande and Hell equally when he sums up his arguments by explaining that

> I could not bring myself—contrary to all probability, and in favor of a single observation—to accuse all others of being erroneous, nor to put such faith in one particular astronomer, however experienced he may be, that I reckon him to be in possession of some sort of prerogative over others for being infallible.[110]

105 Anders Johan Lexell, "Determinatio accuratior verae parallaxis Solis et reliquorum elementorum," in Anonymous, ed., *Collectio omnium observationum quae occasione transitus Veneris per Solem A. MDCCLXIX iussu Augustae per Imperium Russicum institutae fuerunt una cum theoria indeque deductis conclusionibus* (St. Petersburg: Academia Imperialis Scientiarum, 1770), 533–74, esp. 538–39 and 556; Anders Johan Lexell, *Disqvisitio de investiganda vera qvantitate parallaxeos Solis, ex transitu Veneris ante discum Solis anno 1769: Cui accedunt animadversiones in tractatum Rev. Pat. Hell de parallaxi Solis* (St. Petersburg: Academia Imperialis Scientiarum, 1772), esp. 59.

106 Lexell to Wargentin, St. Petersburg, October 5, 1772 (CVH).

107 Altogether, 111 letters from Lexell to Wargentin are kept at the Centrum för Vetenskapshistoria in Stockholm. Of particular interest are his reaction to Lalande's *Mémoire sur le passage*, dated July 13, 1772 and his reaction to Hell's *De parallaxi Solis*, dated September 7, 1772.

108 Lexell to Wargentin, St. Petersburg, July 13, 1772 (CVH): "I find it awkward of Planman to maintain that his observations are so infallible, when I can demonstrate to him that, as sure as two and two makes four, his observation of the last contact is wrong by at least ten seconds."

109 Lexell, "Disqvisitio de investiganda parallaxi Solis ex transitu Veneris per Solem anno 1769" as printed in the *Novi commentarii* for the year 1772 (1773): 609–72, esp. 639–47.

110 Lexell, "Disqvisitio de investiganda […]" (1773): 669.

His wording in private letters is even harsher. To Wargentin, Lexell writes that Hell in the *De parallaxi Solis* has proven himself to be "the worst charlatan possible [...] not even endowed with sufficient theoretical knowledge to investigate the question of the parallax."[111] His judgment on Lalande is no less severe:

> What sway prejudices hold over human beings, even in such matters where they should be led by their love of truth alone, I have had occasion to witness in Lalande [...]. If every person who writes about this theme would act as honestly as him, one can easily find whatever parallax seems most agreeable.[112]

Another participant in the debate, Planman, followed the same line as Lalande and Lexell (who, however, did nothing to hold back his spite from Planman, either).[113] In publications ranging from the beginning of 1771 until the end of 1774, he argued for parallaxes of around 8.24″, 8.43″, 8.51″, and finally 8.40″.[114]

The debate was at its hottest in 1772. In December of that year, Planman published a dissertation where he found the parallax to be exactly as Lalande had concluded and rejected Hell's *De parallaxi Solis* as "a mishmash of errors" (*errorum farraginem*). The only data from Vardø that could possibly be used were those of the amateur Borchgrevink, he argued.[115] In this turmoil, we find a single diplomatic voice: Wargentin, the network figure who stayed in close contact with all the participants in the quarrel. As Lalande, Planman, Lexell, and Hell attacked each other in public, they all confided their feelings to Wargentin as a neutral, yet influential and respected colleague. The Swede was unhappy with the strife, however, and tried his best to cool down the temperature. In a letter to Hell's confrère Weiss, dated Stockholm, March 9, 1773, Wargentin says:

---

111 Lexell to Wargentin in Stockholm, dated St. Petersburg, September 7, 1772 (CVH).

112 Lexell to Wargentin in Stockholm, dated St. Petersburg, February 25, 1771 (CVH).

113 See Stén, *Comet of the Enlightenment*, 75–76.

114 Anders Planman, "Formuler, At Uträkna Parallaxens verkan för observerade in- och utgångs momenter, vid en Planets gång under Solen," in *KVAH* (January–March 1771): 66–74; Planman, "Om Solens Parallaxis, i anledning af Observationer öfver Venus i Solen, år 1769," *KVAH* (April–June 1772): 183–91; Anders Planman and Johan Kreander, *Animadversiones Subitaneæ in Appendicem Hellianam ad Ephemerides anni MDCCLXXIII, De parallaxi Solis* (Åbo: Johannes Christoph Frenckell, 1772); Planman, "Förklaring på de Formler, at uträkna Parallaxens verkan, för observerade in- och utgångs-momenter vid en Planets gång under Solen, som anfördes uti Handlingarne för år 1771," *KVAH* (October–December 1774): 306–19.

115 Planman and Kreander, *Animadversiones subitaneæ*, 12.

> I strongly dislike the all too harsh controversy that has arisen between Lalande, Hell, and Planman, over the observations of the last transit of Venus. There ought to be no doubt that both Hell and Planman have exerted all their efforts—their eyes as well as their intellect—while observing, and that they have published it *bona fide*. They may have made mistakes of a few seconds each, for they are, after all, human beings [...]. The safest solution would therefore have been to concede something to each observer, by placing one's faith in a mean parallax, calculated on the basis of both observations.[116]

The effect of Wargentin's (and perhaps other sensible minds') diplomacy can be seen in the *Journal des Sçavans* for February 1773, where Lalande allowed the printing of a "letter concerning the calculations by Monsieur Lexell and Father Hell" as well as a "letter on the solar parallax."[117] The tone had become milder.

> Father Hell [...] appeared to declare war on all the astronomers of Paris in his booklet, by contesting the quality of the observation of Monsieur l'Abbé Chappe, by bringing back old disputes concerning the alleged moon of Venus, the longitude of Vienna, the geodetic measurements made in Germany [...], but he should make these concessions to me: that our correspondence has always been filled with friendship and respect from my part, that I have praised him on every occasion, and that I have never given place in our dispute for any personal complaints except that which concerns his having made the astronomers wait for so long for an observation that was so necessary to them.[118]

Furthermore, Lalande was careful not to attack Lexell, and even admitted some errors in the *Memoire sur le passage* that the latter had pointed out. As to the parallax, he still believed that the value of 8.50″, or a maximum of 8.55″, was most likely to be true. But with surprising humbleness he added: "To sum up, if the parallax is 8.55 arc seconds or 8.70, the difference is no more than a fifty-seventh part of the total, and the expedition of Father Hell will nevertheless have the advantage of having contributed to draw closer the limits of our

116 Wargentin to Weiss in Trnava, dated Stockholm, March 9, 1773, in Vargha, *Correspondence de Weiss*, 106–7.

117 *JS* (February 1773), "Lettre sur les calculs de M. Lexell et du P. Hell" (90–93) and "Lettre sur la parallaxe du Soleil" (113–15).

118 *JS* (February 1773): 113.

uncertainties."[119] A rapid exchange of letters between Hell and Lexell in the winter of 1772–73 also ended in a sort of reconciliation. Hell in fact took the liberty of publishing one of Lexell's letters in his *Ephemerides*, but added to almost every sentence such long and intricate footnotes that, in effect, the voice of Lexell was almost drowned.[120] Remarkably, Hell recognized that he had committed several errors in the calculations of the *De parallaxi Solis* (although he blamed the printer for a number of the mistakes), but refused to alter his initial conclusion: the parallax, he maintained, was still nothing short of 8.70″, or 8.70″ ±0.03″ at the most.[121]

Simultaneously, Pingré was busy presenting a series of lectures to the Académie des Sciences, where he concluded that the solar parallax had to be 8.80″, "quite accurately" (*à très-peu-près*).[122] The approach of Pingré was more open-minded than that of Hell or Lalande. The only thing he rejected was the exterior contact of egress as observed in Cajaneborg; Planman's ingress data could still be used, he argued. As for Tahiti, Pingré upon investigation found that the observation of Green had to be left out; the same he did with Borchgrevink's data from Vardø. He even tested thoroughly Rumovskii's observation from Kola, something Lalande, Lexell, and Planman had all neglected.[123] Lalande was upset but felt confident that he would be able to make a fool of Pingré, as he said in a letter to Wargentin.[124] Hell, on the other hand, felt an enormous relief. The difference between their conclusions—8.80″ instead of 8.70″—he found to originate from Pingré's use of Cook's observation rather than that of Green. But this was hardly any offense: the Jesuit father found that his credibility had been restored and the notorious egress data from Cajaneborg had been rejected from the calculations.[125]

---

119 *JS* (February 1773): 115.

120 Letter from Lexell to Hell in Vienna, dated St. Petersburg, February 22, 1773, printed in the "Supplementum dissertationis de parallaxi Solis," *Ephemerides* 1774 (1773): 1–162, here 15–68.

121 Hell, "Supplementum dissertationis de parallaxi Solis," 62. It must be added that after having seen Hell's "Supplementum," on December 24, 1775 Lexell wrote about it with bitter irony to Bernoulli—"I found it to be just as I imagined and even worse"—and reproached the Swiss sage for "the remarkable contrast between your conduct towards me and father Hell." Cited in Stén, *Comet of the Enlightenment*, 76–77.

122 Pingré, "Mémoire sur la parallaxe du Soleil, déduite des meilleurs observations de la durée du passage de Vénus sur son disque le 3 Juin 1769," *HARS* (1775): 419.

123 Hell had, it is true, presented a brief investigation of Rumovskii's observation and concluded that it gave a parallax of 8.73″, but without putting much weight on this; cf. Hell, "De parallaxi Solis," 80–84.

124 Lalande to Wargentin in Stockholm, dated Paris, January 5, 1773 (CVH).

125 Hell to Weiss in Trnava, dated Vienna, April 6, 1773, in Pinzger, *Hell Miksa*, 2:114–17.

At least publicly, Lalande appears to have carried no more logs to the fire. And after publishing his bulky *Supplementum* to the memoir *De parallaxi Solis* in the autumn of 1773, Hell too withdrew from the debate. Planman published an apology against this last work of Hell in 1774. He there argued for a probable parallax of 8.40″, but the article appears not to have been widely disseminated.[126] Lexell groaned to Wargentin that the Jesuit could only have had two reasons for publishing a private letter of his in the *Supplementum*, the first being a desire to defend his conclusion of 8.70″ for the parallax, and the second, a desire to hurt Lexell's reputation. Lexell explained that he too planned to publish another apology against Hell, "if the academy agrees to its publication," but this plan appears to have come to nothing.[127]

The strife ended there, with parallaxes ranging from 8.40″ (Planman) to 8.80″ (Pingré). Hell's abilities as an observer and calculator were brought into question, and by the time the debate subsided in the mid-1770s, he was an ex-Jesuit. To what extent did religious antagonism play a role in the controversy? The debates following his Venus transit observation of 1769 have been described as "symptomatic of the highly charged feelings the Jesuits elicited on the eve of the dissolution of the Order."[128] The biographer of Hell's successor as director at the Vienna Observatory even suggests that Lalande as an atheist was a personal enemy of the Jesuits, "aggressively waging war against them."[129] Elsewhere, we also read of "the unfair suspicion of a notorious atheist against a priest with a predestined name."[130]

These characterizations are hard to corroborate. Lalande helped the Jesuit Christian Mayer go to St. Petersburg for the same purpose as Hell had traveled to Norway, and he cultivated a close friendship with Father Boscovich throughout the dispute with his confrère in Vienna. Lalande, himself a pupil of the Jesuits, is in fact known to have deplored the abolition of their "illustrious society."[131] Admittedly, in letters to Wargentin written in the heat of the moment Lexell did not hesitate to dismiss the arguments of his Viennese counterpart as

126 Planman, "Förklaring På de Formler."

127 Lexell to Wargentin in Stockholm, dated St. Petersburg, June 11/22, 1774 (CVH).

128 Mordechai Feingold, "Jesuits: Savants," in Feingold, *Jesuit Science and the Republic of Letters*, 1–46, here 1.

129 Kastner-Masilko, *Triesnecker*, 48.

130 Jean-Claude Pecker, "L'oeuvre scientifique de Joseph-Jérôme Lefrançois de Lalande (1732–1807)," *Les nouvelles annales de l'ain* (1985): 1–31, here 19. It should be mentioned that Pecker later revised his opinion on the quarrel between Lalande and Hell; cf. Pecker, "Jérôme de Lalande and International Cooperation."

131 See, e.g., Heilbron, *Electricity in the 17th and 18th Centuries*, 109.

sophisms characteristic of a Jesuit.[132] But such sentiments were never voiced in any serious, scientific publication on the parallax, nor did Lexell brand Hell for being Jesuit in his correspondence with him.[133] Much more conspicuous is Hell's polemic against French science as a whole. Whereas Hell in his survey of observations of the 1761 transit of Venus had extolled France as "the highly fertile parent and nurse of the best astronomers of our age," in the *De parallaxi Solis* of 1772 he criticized virtually anything the French did.[134] In the meantime, France had of course expelled the Jesuits (begun around 1761, finished by 1768) and was pressing the pope to order the same for every Catholic country. Hell is careful to protect against criticism not only his own observation from Vardø but also that of Jesuit missionaries in Beijing.[135] In fact, the Viennese Jesuit appears to have been more biased against Lalande—as a representative of French science—than anyone else, Lalande included, was against him as a Jesuit. Lalande, in his turn, reconciled himself fully with Father Hell. This is well illustrated by the *éloge* read by him at the Académie des Sciences (the post-revolutionary Institut National) upon the death of his correspondent:

> The [Vardø] observation of Father Hell [...] was a complete success; [...] it is in fact one of five complete observations that were made at huge distances from each other, where the positioning of Venus during its passage shifted the most. This has made us know the true distance of the Sun and all the planets from the Earth, an epoch-making feat in the history of astronomy, in which the name of Father Hell is deservedly inscribed. His expedition was just as rewarding, interesting, and painstaking as those made to the southern sea, to California, and Hudson Bay, for the sake of this famous transit of Venus in front of the Sun.[136]

---

132 Letters from Lexell to Wargentin in Stockholm, dated St. Petersburg, April 12, 1772, September 7, 1772, and March 23/April 3, 1773 (all located in the CVH).

133 Lexell to Wargentin in Stockholm, dated St. Petersburg, March 23/April 3, 1773 (CVH): "I have ensured him, that I find such petty arts loathsome, childish and ridiculous; I thought that they were worthy of a Jesuit, but I did not say so." It is also worth noting that Lexell developed a close friendship with the Jesuit Christian Mayer during his stay in St. Petersburg and recommended him to Wargentin; Lexell to Wargentin, St. Petersburg June 10/11, 1770 (CVH). Thus, neither Lexell nor Lalande were unequivocally biased against Jesuits as such.

134 Contrast Hell, "Observatio transitus Veneris [...] 1761," 36, and Hell, "De parallaxi Solis," 111–14.

135 Hell, "De parallaxi Solis," 79–80.

136 Joseph Jérôme de Lalande, *Bibliographie astronomique: Avec l'histoire de l'astronomie depuis 1781 jusqu'à 1802* (Paris: Imprimerie de la République, 1803), 722.

At the end of our analysis of the Arctic expedition and its aftermath, it is tempting to briefly reflect comparatively on the status of Hell's journey and that of Maupertuis to the same region a good generation earlier.[137] Besides the geographic proximity of the targeted area, several other factors warrant such a comparison. In both cases, a savant with already strong credentials and claims to celebrity status on the domestic and international scene ventured into the frost of the north with the goal of solving scientific problems of cosmic significance: the shape of the Earth in the one case, and the distance of the planet from the center of the solar system in the other. True, Maupertuis was far more successful in publicizing his identity in his *Figure de la terre* (Shape of the earth [1738]) and other works as a "hero of science" than Hell, whose design of the *Expeditio litteraria* became frustrated. But it is undeniable that Hell put as great an emphasis as his French predecessor on the combination of scientific expertise, resourcefulness, and accuracy required to meet technical challenges, with courage and physical prowess necessary to combat and conquer the adversity of circumstances, in reframing his persona. In this regard, the iconographic parallels between the image on our title page and the famous portrait of Maupertuis—originally conceived as a painting, and subsequently reproduced and distributed in a different version as an engraving[138]—both of them emphasizing the features just mentioned, are telling. By both Maupertuis and Hell, the good fortune with which their expeditions were ultimately blessed was represented as the reward of their perseverance, although the latter naturally accorded divine providence an important role, too—an element unsurprisingly missing from the accounts of the French libertine. In turn, while the sudden appearance of two "Lappish" (in reality, Swedish) women in Paris shortly after the return of the notorious womanizer of the *beau monde* gave rise to a flurry of gossip, this could hardly have been imaginable in the case of the Viennese Jesuit. The bitter polemics that ensued around the outcome of both expeditions constitute a further parallel, even though the reasons for and the substance of the debate were rather different. For Maupertuis, the emphasis on the shape of the Earth as a scientific problem in its own right, to be resolved by resorting to English instruments and mathematical skills, with a view to developing a distinctively French Newtonian physics, was a means to challenge a set of views and a whole way of life entrenched in the French academy and hallmarked by the Cassini dynasty, for whom the shape of the Earth was also a mere byproduct of a cartographic project pursued over several

137 Terrall, *Man Who Flattened the Earth*, esp. 88–172, which serve as the chief basis of comparison.

138 See Terrall, *Man Who Flattened the Earth*, frontispiece and 162.

generations. By contrast, the debate occasioned by Hell's Vardø observations was broadly international, and while issues of methodology were involved, considerations of loyalty and factors of patronage were at least as important. Despite—or precisely because of—such differences, both cases throw important light on the nature of the fissures that, without doubt, divided the eighteenth-century Republic of Letters.[139]

3 A Peculiar *Nachleben*

Despite the periods of embitterment and venom between Hell and his adversaries, during his lifetime he was never overtly accused of having forged his observations from Vardø. However, the debate had a peculiar *Nachleben* (afterlife), apparently not unrelated to the climate of hostility against Jesuits and their legacy during the post-suppression decades. Two astronomers of the next generation, Johann Franz Encke (1791–1865) and Karl Ludwig von Littrow (1811–77), were particularly active in denigrating Hell's name.

The child of a Lutheran pastor in Hamburg, Encke was educated by Carl Friedrich Gauss (1777–1855) at Göttingen. Thanks to Gauss's recommendation, in 1816 he gained a post as an assistant at the observatory at Seeberg near Gotha.[140] The director of the observatory was Franz Xaver von Zach (1754–1832), born in Pest, the twin city of the old Hungarian capital Buda just across the Danube, and the little we can know about his education suggests that he probably studied with Jesuits. From a troubled start as Liesganig's assistant in Lviv for the geodetic survey of Galicia, he embarked upon a tour of Europe that eventually brought him from London to a position as court astronomer in Gotha, in 1786.[141] From his base in peaceful Gotha, von Zach became a highly successful "networker" who published extensively. He became a staunch antagonist of the (ex-)Jesuits, and both Liesganig and Hell were frequently attacked in his writings. A point that von Zach pursued with particular vigor was Hell's "withholding" of the Vardø observation results:

139 See Daston, "Ideal and Reality of the Republic of Letters," 367–86.

140 For Encke's life, see August Kopff in *Neue Deutsche Biographie* 4 (Berlin: Duncker & Humblot, 1959), 489–90; Michael Meo in *Biographical Encyclopedia of Astronomers*, ed. Thomas Hockey et al. (New York: Springer, 2014), 1:661–62.

141 See Lajos G. Balázs et al., eds., *The European Scientist: Symposium on the Era and Work of Franz Xaver von Zach (1754–1832)*, Acta Historica Astronomiae 24 (Frankfurt am Main: Verlag Harri Deutsch, 2005); Peter Brosche, *Der Astronom der Herzogin: Leben und Werk von Franz Xaver von Zach (1754–1832)*, 2nd ed., Acta Historica Astronomiae 12 (Frankfurt am Main: Verlag Harri Deutsch, 2009).

> Father Hell had all the time in the world to adjust his observation (not upon the calculation [...], but upon the numerous observations of other observers who had published their reports earnestly). Father Hell excused himself by stating that the observation was not his own property and that he could not share it with others, nor make it public, until he had paid tribute to the king of Denmark, who had asked for Father Hell from Empress Maria Theresa in order that he should make this observation in his estates. However, an astronomical observation is not a state secret, and you hardly need nine months to print the couple of lines required to explain the entire observation.[142]

When in the 1820s Encke took upon himself the task of re-calculating the solar parallax on the basis of the observations of the 1760s, he was thus liable to a certain degree of skepticism toward the datasets from Vardø.

Encke first issued a calculation of the solar parallax based on all observations from 1761. This yielded a parallax of 8.490525″,[143] a figure in perfect agreement with Lalande's position. When he proceeded to investigate the issue on the basis of observations from 1769, Encke clearly had no doubts that the late Jesuit could have been capable of manipulating his datasets. As he saw it, Hell's calculations of the solar parallax were of no value, his abilities as an observer more than questionable, and his excuses for his report's late arrival "utterly futile."[144] Accordingly, in a treatise on the solar parallax based on the observations from 1769, Encke found on the basis of all observations—Hell's excluded—a parallax of 8.5776″ ±0.037″.[145] When he included the data of the Jesuit in the calculation, the result was 8.60″. As Encke himself conceded, that difference was "well within the limits of likely error."[146] However, given that his earlier investigation based on the 1761 observations had yielded 8.49″, Encke

142 Franz Xaver von Zach, *Correspondance astronomique, géographique, hydrographique et statistique du Baron de Zach* (Genoa: A. Ponthenier, 1818), 1:176.

143 Encke's *Die Entfernung der Sonne von der Erde aus dem Venusdurchgänge von 1761 hergeleitet* (Gotha: Becher, 1822) could not be consulted. The parallax value is, however, given in Verdun, "Die Bestimmung der Sonnen-Parallaxe."

144 Johann Franz Encke, *Der Venusdurchgang von 1769 als Fortsetzung der Abhandlung über die Entfernung der Sonne von der Erde* (Gotha: Becker, 1822), passim (quotation on 18).

145 Encke, *Der Venusdurchgang von 1769*, 109.

146 Johann Franz Encke, "Über den Venusdurchgang von 1769," *Abhandlungen der Königlichen Akademie der Wissenschaften zu Berlin: Mathematische Klasse* (1835; published 1837): 295–309, here 302: "The inclusion of the Vardøhusian observation yielded a parallax of 8.60 arc seconds, whereas all the other observations, the Vardøhusian excepted, yielded 8.58, a difference [etc.]."

was reluctant to pay heed to the Vardø observations at all. Like Lalande had done earlier, he simply discarded them. Unlike Lalande, however, Encke did not refrain from giving voice to prejudices against Father Hell as a representative of the Jesuit order.

Shortly before Encke made his calculations, a regime change had taken place at Hell's observatory in Vienna. Hell's one-time assistant and successor, the ex-Jesuit von Triesnecker, died in 1817. Von Triesnecker's assistant Johann Tobias Bürg (1766–1834), who had been attached to the observatory since the 1780s, was not viewed as a suitable candidate for the post because he was deaf.[147] Instead, the new director was recruited from outside. Originally educated in Prague, Johann Joseph von Littrow (1781–1840) rose to the director's chair of the Vienna University Observatory in 1819 after posts as an astronomer in Kraków, Kazan, and Buda. Shortly afterward, the observatory acquired the collection of manuscripts by Hell that it still keeps today. Johann Joseph gave the task of investigating Hell's papers to his son, the observatory adjunct Carl Ludwig von Littrow.

The results were published in 1835, in the sensational book *P. Hells Reise nach Wardoë* (Father Hell's journey to Vardø).[148] One of the charges against Hell that von Littrow—almost naturally—revived was the "delay" of the publication of his data:

> A circumstance that appears to be worth pointing out is that in the entire diary [of Sajnovics] there is no trace to be found of the ban that was supposed to have been issued by the king of Denmark against publication of the Vardø observation. This fact confirms the assumption that has already been put forward, that the whole thing may well have been invented by Father Hell, to serve him as an excuse for the late publication of his report.[149]

Besides the points already made above regarding the possible commitment vis-à-vis the sponsor of the expedition, it may be reiterated here that the part of Sajnovics's diary covering this period has been lost, along with nearly all his letters written from Copenhagen.

147 Kastner-Masilko, *Triesnecker*, 72.

148 According to Axel V. Nielsen, "Pater Hell og Venuspassagen 1769," *Nordisk Astronomisk Tidsskrift* (Copenhagen) (1957): 77–97, here 96n27, it had already been printed in 1834, despite the information on the title page.

149 Karl Ludwig von Littrow, *P. Hell's Reise nach Wardoe bei Lappland und seine Beobachtung des Venus-Durchganges im Jahre 1769: Aus den aufgefundenen Tagebüchern geschöpft und mit Erläuterungen begleitet* (Vienna: Carl Gerold, 1835), 163.

Upon inspection of the astronomical notebook, the younger von Littrow also concluded that Hell had altered and manipulated the datasets, often with a different kind of ink. He claimed that the Venus transit observations of Hell and Sajnovics—as published by Hell in the *Observatio transitus Veneris* [...] *1769*—were worthless, whereas that of the untrained Borchgrevink, whose moments differed many seconds from those of the two Jesuits, was "the only true" observation and could be used.[150] Von Littrow thereby restored the Vardø observations, but in doing so, he furnished the reader with "proofs" of Hell's unreliable character and incompetence as a scientist. Through von Littrow's book, the name of Hell became tainted with the worst thinkable scientific crime: manipulation of datasets.

Von Littrow's publication found an immediate response from the expert on the solar parallax to whom it was dedicated, Encke. At a session of the Berlin Academy of Sciences on April 30, 1835, Encke explained that his skepticism toward the veracity of Hell's Vardøhus observation originated in the general impression that he had formed of his personality, first and foremost because "he was a Jesuit."[151] Encke had now gladly embraced von Littrow's account and found that it confirmed all his prejudices toward the late Viennese Jesuit, who clearly not only had altered his datasets in a very clumsy and incompetent manner but had also been unable to keep correct track of the running of his clocks and had calculated the longitude and latitude of Vardø wrongly. Thanks to von Littrow's edition of the original astronomical notebook of Hell, Encke was now able to apply what he believed to be the necessary reductions of all the data. He entered the "restored" Vardø observation into his calculation, and found that it supported a solar parallax of 8.57116″, only 0.0064″ different from the one he had found without using the Vardøhusian datasets ten years earlier.[152]

The conclusions of the 1830s remained unchallenged for more than three decades. In 1864, however, astronomer Karl Rudolph Powalky (1817–81) at the University of Kiel defended a doctoral thesis on the Venus transit of 1769 and the solar parallax that could be calculated thereof. He inspected von Littrow's book as well as Encke's treatises, but could not bring himself to agree to their hostile conclusions. Instead, Powalky found that

> the corrections that Hell allowed himself to make in his manuscript appear to have been extremely unimportant. This, the good quality of the

150 Von Littrow, *P. Hell's Reise nach Wardoe*, 77.

151 Cf. Encke, "Über den Venusdurchgang von 1769," 301.

152 Encke, "Über den Venusdurchgang von 1769," esp. 309.

> telescopes used by himself and Father Sajnovics and the good accordance of the contacts observed during egress along with the remarks made on this occasion allow the observations to be treated as quite certain. [...] Furthermore, one should note that Hell and Sajnovics were skilled observers and that the Sun was higher above the horizon during both ingress and egress than in any other site in Europe, with the exception of Orenburg [in Russia], where only the egress was observed.[153]

In his thesis, Powalky concluded that the solar parallax probably was around 8.86″,[154] thus far larger than Encke's conclusions and more in tune with Hell.

In 1869, a prominent astronomer at the Académie des Sciences in Paris, Hervé Auguste Étienne Albans Faye (1814–1902), presented a paper in which he questioned some of Encke's and von Littrow's conclusions, particularly concerning the solar parallax (Faye advocated a solar parallax of 8.80 ±0.01″, which is indeed entirely correct).[155] Carl Ludwig von Littrow, who in the meantime had been appointed director of the Vienna Observatory, reacted promptly by dispatching facsimiles of Hell's manuscript to Paris. Of course, Professor Faye had no chance of detecting errors in von Littrow's conclusions on the basis of the sets of black-and-white reproductions offered to him. In a follow-up article, he therefore agreed that the original journal must indeed have been edited before publication. Nevertheless, while admitting that Hell had arrived at some misguided conclusions in his theoretical works, he maintained that the editing in any case had been made with the best of intentions and underscored that Hell's original manuscript proved his abilities as an observer. Looking ahead to the upcoming transit of Venus, Faye concluded that "the error of Father Hell's observation, which he made without understanding its meaning, thus does not exceed 2.2 seconds in time. It will be difficult for us to do any better in 1874."[156] The solar parallax question was not resolved by the new sets of international observations of the Venus transit in 1874, and the Swiss astronomer Rudolf Wolf (1816–93) in his *Geschichte der Astronomie* (History of

153 Carl Rudolph Powalky, *Neue Untersuchung des Venusdurchganges von 1769 zur Bestimmung der Sonnenparallaxe* (Kiel: C.F. Mohr, 1864), 15–16.

154 Cf. Hilmar W. Duerbeck, "Zach, Gotha, and the Venus Transits of the 18th and 19th Centuries," in Balázs et al., *European Scientist*, 60.

155 Hervé Auguste Étienne Albans Faye, "Sur les passages de Vénus et la parallaxe du Soleil" [parts 1–2], *Comptes rendus hebdomadaires des séances de l'Académie des Sciences* 68 (1769): 42–50 and 69–73; Faye, "Examen critique des idées et des observations du P. Hell sur le passage de Venus de 1769," *Comptes rendus hebdomadaires des séances de l'Académie des Sciences* 68 (1769): 282–90. See also Nielsen, "Pater Hell og Venuspassagen 1769."

156 Faye, "Examen critique," 287. See also Faye, "Sur les passages," esp. 47–49 and 70.

astronomy [1877]) still believed in von Littrow's and Encke's conclusions concerning Hell. Though Wolf, like Faye, conceded that the solar parallax probably was somewhat larger than Encke had concluded,[157] the main blemish on Hell's memory, the crime of having manipulated a set of scientific data, remained. Thus, when an article on him was included in the *Allgemeine Deutsche Biographie* (General German biography, vol. 11 [1880]), the story of his fraudulent alteration of the Venus transit observation from Vardø was repeated without any reservation.[158]

Only three years later, Simon Newcomb (1835–1909) published his remarkable demonstration that von Littrow was plainly wrong, a conclusion he further corroborated in his later works. During a study trip in the early 1880s, Newcomb visited the Viennese observatory, where he took the opportunity to investigate the notorious manuscripts of Hell. First, the manuscripts inspected by von Littrow—with one insignificant exception, which he overlooked—in fact contained no additions in a different-colored ink, as he claimed: as Newcomb discovered, the young von Littrow had been so blinded by his prejudices against the late Jesuit that he forgot to consider that he himself was in fact colorblind.[159] Second, regarding the issue of the parallax, Newcomb could draw upon experience from the transits of Venus in both 1874 and 1882, and his conclusion concerning the solar parallax was virtually identical to the one advocated by Faye in 1869. The datasets from Vardø corroborated this conclusion. Thus, Hell's Vardø observations turned out to support a parallax of 8.79″ (Newcomb) or 8.80″ (Faye), and have since then been "canonized."[160] Newcomb's demonstration found a reverberant echo among Jesuit apologists. The

157 Rudolf Wolf, *Geschichte der Astronomie*, Geschichte der Wissenschaften in Deutschland: Neuer Zeit, Sechzehnter Band (Munich: R. Oldenbourg, 1877), 645–46.

158 Christian Bruhns in *Allgemeine Deutsche Biographie* 11 (Leipzig: Duncker und Humblot, 1880), 691–93, here 692. See also Nielsen, "Pater Hell og Venuspassagen 1769," for more examples.

159 Simon Newcomb, "On Hell's Alleged Falsification of his Observations of the Transit of Venus in 1769," *Monthly Notices of the Royal Astronomical Society* 43 (May 1883): 372–81; Newcomb, "Discussion of Observations of the Transits of Venus in 1761 and 1769," *United States Nautical Almanac, Astronomical Papers* 2, no. 5 (1890): 259–405. Cf. Newcomb, *The Reminiscences of an Astronomer* (Teddington: Echo Library, 2006 [1903]), 78–82. For a brief assessment of Newcomb's career, see William Carter and Merri Sue Carter, "Simon Newcomb, America's First Great Astronomer," *Physics Today* 62 (2009): 46–51.

160 Recent advances in electronic measuring have brought the solar parallax to be fixed at 8.794148″. Ian Ridpath, entry on "solar parallax" in *A Dictionary of Astronomy* (Oxford: Oxford University Press, 2007), 431. The number of decimals could probably have been expanded. To translate it into familiar terms, this means that the Sun, in its mean distance from Earth, "is a couple of meters shy of 149,597,870,700 m[eters]" away. E. Myles Standish, "The Astronomical Unit Now," in Kurtz, *Proceedings*, 163–79, here 174.

Jesuit-run periodical *Stimmen aus Maria Laach* (Voices from Maria Laach, later renamed *Stimmen der Zeit*, Voices of the time) repeatedly announced Newcomb's detection as a remarkable feat,[161] and the German Jesuit historian Bernhard Duhr (1852–1930) included it in his widely read *Jesuiten-Fabeln* (Jesuit fables).[162] Eventually, the "vindication of Father Hell" became a topic of academic discussion in its own right.[163]

161 Johann Georg Hagen, "Washington und seine wissenschaftlichen Institute," *Stimmen aus Maria Laach* 34 (1888): 551–53; Ludwig von Hammerstein, "Der Astronom P. Hell S.J. und sein Verteidiger Professor Simon Newcomb," *Stimmen aus Maria Laach* 39 (1890): 455–58; Hagen, "Karl Littrow als Geschichtsforscher," *Stimmen der Zeit* 93 (1917): 108–14.

162 Bernhard Duhr, *Jesuiten-Fabeln: Ein Beitrag zur Culturgeschichte* 2nd ed. (Freiburg: Herder, 1892), 465. Altogether, four editions of this book appeared in the years 1891–1904.

163 George Sarton, "Vindication of Father Hell," *Isis* 35 (1944): 97–105.

CHAPTER 7

Disruption of Old Structures

After a seven-month stay in Copenhagen, on May 22, 1770 Hell and Sajnovics finally left for Vienna, which they reached on August 12. The route they took was different from the outward journey. Instead of a sea voyage to Travemünde, they traveled overland in a southwestern direction, visiting first of all the Academy for Nobles at Sorø, where they met the likes of Gerhard Schøning (1722–80), a historian specializing in Norway and the ethnographic history of far northern peoples.[1] Thereafter, they passed through Funen, southern Jutland, Schleswig, and Holstein to Hamburg. From Hamburg, they again chose a more westerly route, this time visiting Göttingen and Kassel before turning straight westward to Düsseldorf and then south through Cologne to Mannheim and Schwetzingen. They then headed east, via Würzburg, Ingolstadt, and Passau to reach Linz, Kremsmünster, Graz, and finally Vienna. The record of encounters with fellow astronomers or other scholars (apart from passing references to whom they met and where) is meager, but a desire to visit as many residences of Jesuit missionaries as possible, as well as observatories and other secular research institutions, appears to have been the reason behind this winding track.

Hell's grandiose dream of a long publicity tour of virtually all Western Europe, as outlined in his letter to the pope before the expedition, thus did not materialize.[2] Yet, he had no reason for disappointment. He and his companion were elected members of the academies of Trondheim and Copenhagen, and treated in the Danish capital as celebrities. In every respect, the expedition was a success: besides accomplishing the main task, the observation of the transit of Venus, during their nine-month stay in Vardø they carried out systematic work and collected materials in several academic fields whose processing would keep Hell busy for many years. They even managed to analyze some of these materials and publish the results while still in Copenhagen. Although in regard of the transit observation even this was considered late by some fellow astronomers and a bitter controversy ensued, during the two years and three

1 Sajnovics, travel diary, draft version (WUS). On Schøning, see Stian Bones Larsen, "Gerhard Schøning, Gothicism, and the Re-evaluation of the Northern Landscapes," *Acta borealia* 18, no. 2 (2001): 61–84.

2 As the letter to the pope is the only source where this idea is raised, it is naturally a question how realistic it was to begin with.

© PER PIPPIN ASPAAS AND LÁSZLÓ KONTLER, 2020 | DOI:10.1163/9789004416833_009
This is an open access chapter distributed under the terms of the CC-BY-NC-ND 4.0 License.

and a half months of Hell's absence from his post, his international reputation became further consolidated and reached a new height. It was from this new height that he may have reasonably expected to resume his activities in Vienna: managing the Imperial and Royal Observatory, editing the *Ephemerides*, now complemented with working on the *Expeditio litteraria* as the definitive product of the Arctic journey. However, the climate in Vienna was gradually changing, and around the time of the Vardø expedition the impulse of reform that had begun in the Habsburg monarchy in the late 1740s was turning into its phase known as enlightened absolutism. Roughly simultaneously, and not unrelated to the enlightened turn of reform from above, new platforms and tendencies of intellectual sociability—a critical "public sphere"—began to appear and exert an influence, too. These developments had a significant impact on the Jesuit court astronomer's status and scope of action, and more generally on the conditions of cultivating "Catholic knowledge" in the Habsburg realm.

1 Habsburg Centralization and the De-centering of Hell

The status of Hell and his observatory on the domestic and international scheme was an achievement undoubtedly attained thanks to a strategy carefully planned and realized through strenuous work by him and his associates. At the heart of this strategy was the endeavor to answer at all times the contemporary professional and ethical requirements of sound research: commitment, service, and accuracy. However, scientific adeptness and the cultivation of values associated with the dominant scientific ethos, while of paramount importance to the historical agents involved, were by themselves no guarantee of success. That depended on the confluence of several other factors, some of them outside the realm of the pursuit of knowledge. In the given case, these included a (still) powerful and well-networked religious order with a tradition of promoting science (a "science-friendly" Society of Jesus); the patronage of the dynasty and government of a Catholic power; and the choice of a universally accessible language for the dissemination of the information thus obtained in the *Ephemerides*. Hell's dedication to the Hungarus tradition could also be smoothly reconciled with each of these factors. The harmony among the elements of this combination, however, became subverted shortly after Hell's Arctic expedition; his observation of the transit of Venus and his calculation of the solar parallax had marked the zenith of his career and fame as an astronomer. Many of Hell's subsequent activities and moves—his plan for an Austrian Academy of Sciences in 1774–76, the uses to which he apparently turned the stock of international recognition embodied in the *Ephemerides*

during the later 1770s and the 1780s, the increasing number of German-language publications by him, and so on—may be helpful to interpret as a set of responses to the new circumstances in which a Jesuit scientist in the Habsburg capital found himself after the suppression of his order in 1773. More broadly, they were reactions to the shifting relationship between the Viennese government and the various religious and secular groups and organizations that constituted a challenge to its increasing efforts at consolidating the composite parts of the monarchy as a quasi-imperial *Gesamtstaat*.[3]

The governmental, administrative, and economic reforms adumbrated in the Habsburg monarchy during the first half of the reign of Maria Theresa were closely tied up with the lessons drawn from the wars it was compelled to fight. International competitiveness depended on a better alignment, mobilization, and utilization of internal resources, which at the same time could also be associated with unfolding ideals of the state's commitment to the public weal. The instruments to attain such ends—administrative streamlining, economic protectionism, customs regulations, the suppression of tax exemptions, and a general endeavor on the part of the state bureaucracy to reach out directly to the subject over the heads of privileged "intermediary powers"—were being tested on Austrian and Bohemian grounds already from the 1740s onwards. This further opened the gap between these areas and Hungary as far as their integration in the structures of the monarchy is concerned. On the one hand, historical experience warned that Hungary would remain "different" (despite the substantial support that the Habsburgs drew from the "insurrection"—personal military service: a kind of taxation through shedding one's blood—of the Hungarian nobility throughout the War of Austrian Succession and the

3 The literature on Habsburg enlightened absolutism (or "despotism") is vast. On the concept and its history, see Derek Beales, "Philosophical Kingship and Enlightened Despotism," in Beales, *Enlightenment and Reform in Eighteenth-Century Europe* (London: Tauris, 2005), 28–59, also printed in Mark Goldie and Robert Wokler, eds., *The Cambridge History of Eighteenth-Century Political Thought* (Cambridge: Cambridge University Press, 2006), 497–524. Besides relevant chapters in Evans, *Austria, Hungary and the Habsburgs*, already mentioned, see H.M. [Hamish Marshall] Scott, "Reform in the Habsburg Monarchy, 1740–1790," in *Enlightened Absolutism: Reform and Reformers in Later Eighteenth-Century Europe*, ed. H.M. Scott (London: Macmillan, 1990), 145–88; Scott, "The Problem of Government in Habsburg Enlightened Absolutism," in *Europa im Zeitalter Mozarts*, ed. Moritz Csáky and Walter Pass (Vienna: Böhlau Verlag, 1995), 252–64. The topic has often been discussed comprehensively with the principal actors in the focus. See Franz A.J. Szabo, *Kaunitz and Enlightened Absolutism 1753–1780* (Cambridge: Cambridge University Press, 1994); Derek Beales, *Joseph II*, vol. 1, *In the Shadow of Maria Theresa 1741–1780*, vol. 2, *Against the World 1780–1790* (Cambridge: Cambridge University Press, 1987–2009); Barbara Stollberg-Rilinger, *Maria Theresia: Die Kaiserin in ihrer Zeit* (Munich: C.H. Beck, 2017).

Seven Years' War). On the other hand, it was clear that the state could not afford the luxury of dispensing with the resources of its vast and potentially rich eastern half. While keeping up the momentum of reform in the western provinces, it was crucial to generate a similar process in the east as well. By the 1760s, a full-fledged know-how of the operation of the reform-minded, bureaucratic, enlightened state was in place at Vienna: *Polizeywissenschaft*, anchored in the university curriculum and textbooks of Joseph von Sonnenfels, committed to exploring and inculcating the requirements of the safety and convenience (*Sicherheit und Bequemlichkeit*) of the citizens and thereby achieving the higher ends of the state (*Staatszweck*).[4]

Central to this administrative (as against rights-and-obligations-based) vision of the state and government was the idea that the existence of all exceptions and exemptions, together with the social groups whose status is defined in terms of such special privileges, is in principle antithetical to the attainment of the above-mentioned goals; that in the eyes of the state all citizens are to be regarded as individuals, bound to the state as individuals, not as members of any legally distinct group or estate. One of the natural targets of policies based on these principles was the Catholic Church. Catholicism as a moral cement and as a force connecting subjects with their ruler in a shared spiritual experience was still regarded as highly important. However, patriotic loyalty elicited by the state's competence in providing, through good laws and their rigorous execution, for the "safety and convenience" of its citizens, began to loom as large on the minds of the architects of the Viennese reforms as the quasi-religious devotion to the dynasty. At the same time, Catholicism as an organized hierarchy with a separate structure of allegiances and patronage (which

4 On *Polizeywisswenschaft* in the larger context of the development of the sciences of the state in the seventeenth and eighteenth centuries in Central Europe, see Keith Tribe, "Cameralism and the Sciences of the State," in Goldie and Wokler, *Cambridge History*, 525–46; on von Sonnenfels as an emblematic figure in the tradition, see Helmut Reinalter, ed., *Joseph von Sonnenfels* (Vienna: Verlag der Österreichischen Akademie der Wissenschaften, 1988); Simon Karstens, *Lehrer—Schriftsteller—Staatsreformer: Die Karriere des Joseph von Sonnenfels (1733–1817)* (Vienna: Böhlau, 2011); on the aspects summarized here, see László Kontler, "Polizey and Patriotism: Joseph von Sonnenfels and the Legitimacy of Enlightened Monarchy in the Gaze of Eighteenth-Century State Sciences," in *Monarchism and Absolutism in Early Modern Europe*, ed. Cesare Cuttica and Glenn Burgess (London: Pickering & Chatto, 2012), 75–91, 232–36 (notes); on the practical impact of von Sonnenfels's courses and textbook, see Olga Khavanova, "Joseph von Sonnenfels's Courses and the Making of the Habsburg Bureaucracy," *Austrian History Yearbook* 48 (2017): 54–73. On how the consideration of the ordering function of the state was also connected with "statistics" in the sense of the science of the state based on data collection and numbers, see several studies in Gunhild Berg, Marcus Twellmann, and Borbála Zsuzsanna Török, eds., *Berechnen/Beschreiben: Praktiken statistischen (Nicht-)Wissens 1750–1850* (Berlin: Duncker & Humblot, 2015).

nevertheless deeply infiltrated domains of the secular administration), especially the existence of "idle" enclaves of religious orders, seemed to them a detrimental anomaly. Besides increasing suspicion toward, and ultimately the abolition of these orders, steps toward limited religious tolerance—beginning with minor improvements in the condition of non-Catholics in the later 1770s and culminating in the toleration legislation of Joseph II in the 1780s—also followed from these principles. So did the elimination of church control over education and censorship, and assuming it by the state.

It is important to recognize that while the ensuing reforms did amount to an incremental elimination of the church from an expanding range of spheres of public life, it is more helpful to see them rather as the integration of the church in the management of secular affairs increasingly dominated by the state: as the expansion of the power of the state through its interference in ambiguous areas in the role of the regulator of social tensions.[5] It was concern about education—famously defined as *politicum*, a political affair, by Maria Theresa and also central to raising patriotic citizens according to von Sonnenfels's pamphlet *Ueber die Liebe des Vaterlandes* (On the love of the fatherland [1771])—that appears to have motivated the empress's first attempts at ecclesiastical reform back in the 1750s. To be precise, the motivation was exactly pious. In the first, 1750 draft of her "Political Testament," she was critical of the all too generous donations of her predecessors to ecclesiastical orders because "on the one hand they do not need it, and on the other they do not, unfortunately, utilize what they have in the way it should."[6] If we are to judge from the purposes to which the income of ecclesiastical property confiscated later on were turned, "the way it should" meant primarily parish work, in conjunction with popular education, in the expectation that this would improve genuine, personal Catholic devotion. Maria Theresa believed that the condition of her realm in this regard left much to be desired, and required a "great remedy." The first attempt by her and her government to convert these ideas into practice by imposing a ten percent levy on the revenues of monasteries in the mid-1750s was thwarted by the refusal of papal approval. The effort was revived a decade later, at first in Lombardy, where in 1765 the Giunta Economale was created as a bureaucratic unit for exploring the incomes of the church and their uses. In

5 Cf. Michael Mann, "The Autonomous Power of the State: Its Origins, Mechanisms, and Results," in *States in History*, ed. John A. Hall (Oxford: Blackwell, 1986), 109–36.

6 Josef Kallbrunner and Clemens Biener, eds., *Kaiserin Maria Theresias Politisches Testament* (Munich: Oldenbourg, 1952), 38, cited in Ernst Wangermann, *The Austrian Achievement, 1700–1800* (London: Thames and Hudson, 1973), 75–76. The whole text is available in Alfred Ritter von Arneth, "Zwei Denkschriften der Kaiserin Maria Theresias," *Archiv für österreichische Geschichte* 47 (1871): 267–354.

a memorandum of 1768 to this body (later also redrafted for publication as a pamphlet), Kaunitz—effectively the first minister of the province—formulated a clear-cut position regarding the boundaries between secular and spiritual power. He declared all ecclesiastical matters subject to the jurisdiction of the state, except those assigned by Christ to the Apostles: preaching the Gospels, defining Christian doctrine, performing sacraments and services, and maintaining the inner discipline of the clergy.[7] From 1769, the suppression of smaller monasteries (more precisely: their integration in larger ones) in Lombardy began, but the scale remained relatively modest (around one in five), and even more so a few years later on the other experimental ground, newly annexed Galicia.[8] Further measures taken in 1771 raised the minimum age of taking monastic vows to twenty-four, and limited the "dowry" novices could bring into a monastery to 1,500 florins; in 1772, the number of public holidays was reduced, and pilgrimages were curbed.

While these reforms were still not overwhelming, they indicate a changing climate in Vienna almost exactly during the period of the court astronomer's absence from the Habsburg capital. Besides the initiative taken by Kaunitz, the role of Joseph II, who succeeded his father as emperor and became co-regent with his mother in the Austrian dominions in 1765, was pre-eminent in the major steps. The most important—indeed, the only really important one during the reign of Maria Theresa—among these was the one that affected Hell most directly: the suppression of the Society of Jesus in 1773. While, as it has been and shall be argued in this book, Jesuit competence was appreciated and resorted to under the reforming regime in Vienna until the last moment and beyond, the order as a corporation had suffered gradual setbacks since the late 1750s. The criticism of Jesuit educational practices (such as the frequent change of teaching personnel, the occasionally all-too-fervent Counter-Reformation programmatics, or the method of university lecturing by sheer dictation from the professor's own manuscripts, resisting the thrust toward the use of standardized textbooks) led to the piecemeal limitation of the role of the Society in Austrian schooling. University chairs in theology and philosophy began to pass from Jesuit hands to members of the secular clergy or representatives of the older religious orders. In Vienna, the Jesuit directors of these faculties were removed by a decree of 1759 and replaced by the Jansenist bishop of Wiener Neustadt, Simon von Stock (1710–72) (followed by Franz Stephan Rautenstrauch

7 Harm Klueting, *Der Josephinismus: Ausgewählte Quellen zur Geschichte der Theresianisch-Josephinischen Reformen* (Darmstadt: Wissenschaftliche Buchgesellschaft, 1995), 120.

8 Derek Beales, "Joseph II and the Monasteries of Austria and Hungary," in Beales, *Enlightenment and Reform*, 227–55, here 233–34; Beales, *Joseph II*, 1:445–50, and 2:186–92.

[1734–85], the Benedictine abbot of Braunau) and the reformist canon Johann Peter Simen (1715–75), respectively. The censorship commission, formerly fully controlled by Jesuits, had not a single Jesuit member by the eve of the suppression: what is more, Jesuit works now became indexed because of the condoning of regicide in Jesuit political thought.[9] From 1760, Jesuit confessors of members of the dynasty were dismissed one after the other, and in 1767 the empress—whose growing uneasiness with excessive forms of baroque piety and emphasis on private devotion drew her closer to the increasingly influential Jansenists—herself decided to replace in this position the Jesuit Ignaz Kampmiller with the Augustinian and Jansenist (and staunchly anti-Jesuit) Ignaz Müller (1713–82).[10]

At the turn of the 1760s and 1770s, the situation was still ambiguous. On the one hand, the Catholic powers of Western Europe that had recently expelled the Jesuits from their lands—including, importantly, the Habsburgs' new ally: France—were pursuing a strong campaign for the wholesale suppression of the Society of Jesus with the newly elected pope, Clement XIV (1705–74, r.1769–74), known to be amenable to listening to them. Influential voices in Vienna, including Van Swieten and von Sonnenfels as well as jurist Karl Anton von Martini (1726–1800), also spoke out in favor of following the example of the Bourbon monarchies. Yet, in 1769–71, when the establishment of a state education system was intensely discussed in the highest government circles, the consensus of the chief decision-makers was that—contrary to a proposal by Count Johann Anton von Pergen (1725–1814) as minister of state to completely exclude all regular clergy from education—it was impossible to dispense with the contribution of ecclesiastical orders in the field. Given their still central role in education, this was essentially a debate about Jesuits, whom Maria Theresa, Joseph II, and Kaunitz continued to hold in respect, and claimed to be largely innocent of the abuses that led to their expulsion from the other Catholic realms. Even Kaunitz, who by this time seems to have been the most actively hostile of the trio vis-à-vis the monastic orders, thought that Jesuits were not as bad as others, and keenly emphasized that it was the institution that

9 Norbert Bachleitner, *Die literarische Zensur in Österreich von 1751 bis 1848* (Vienna: Böhlau, 2017), 50–51. Chapter 2 (41–92) of this book is fully dedicated to censorship "in the service of the Enlightenment."

10 On these developments, particularly in censorship, the most comprehensive, contextualized account is Grete Klingenstein, *Staatsverwaltung und kirchliche Autorität im 18. Jahrhundert* (Munich: Oldenbourg, 1970). See also Hersche, *Spätjansenismus*, esp. Chapter 2, 103–62; Winfried Müller, "Der Jesuitenorden und die Aufklärung im süddeutsch-österreichischen Raum," in Klueting, with Hinske and Hengst, *Katholische Aufklärung*, 225–45.

ought to be targeted, while the Portuguese, Spanish–Neapolitan, and French practices vis-à-vis individual members, such as incarceration or expulsion, were inhuman and ought to be avoided.[11] The position of the main decision-makers on the suppression of the Society of Jesus can be described as one of pragmatic aloofness, aptly summarized in a letter of 1768 by Joseph II to his brother, Grand Duke Leopold of Tuscany (1747–92, r. as grand duke 1765–90, as emperor 1790–92): "We have not been ready to involve ourselves either for or against, having insufficient reason to desire their destruction, but not regarding their existence as so necessary that we must protect them."[12]

These were the principles actually followed by the Habsburg government upon the issuance of Clement XIV's breve *Dominus ac redemptor noster* on July 21, 1773, announcing the suppression of the Society of Jesus on the grounds that it had not only ceased to produce the desired benefits but even gave rise to resentment and strife among the peoples of Christendom, and therefore support must be withdrawn from it. Once the papal decision had been made—and it must be borne in mind that the pope was the sovereign ruler over the Society of Jesus as an international order—the only issue for the Habsburg government was not the dissolution of the 192 houses in Austria and Hungary, but the future of Jesuit property and of individual Jesuits. On both points, the approach of Joseph II, supported by both his mother and Kaunitz, prevailed. The emperor opposed the curia's original plan to transfer the property to the administration of bishops and insisted that it should be taken over by the state, and—again contrary to the wishes of the pope—the *Jesuitenfond* created out of it was to be turned not only to religious purposes but to re-employing Jesuits as professors, paying pensions to those for whom no suitable job was found, and other educational purposes as well.

A broadly similar pattern of implementation, albeit on a much larger scale, was followed in the more radical steps taken immediately after Joseph had become sole ruler in 1780. Unlike previously, when the justification for the measures against the religious orders and for ecclesiastical reform altogether was based chiefly on the (real or alleged) abuses found in particular houses, the general principle of "usefulness" now became paramount. The Patent of

11 Ferdinand Maas, "Die österreichischen Jesuiten zwischen Josephinismus und Liberalismus," *Zeitschrift für katholische Theologie* 80 (1958): 66–100, here 66–67.

12 Cited in Derek Beales, "Maria Theresa, Joseph II, and the Suppression of the Jesuits," in Beales, *Enlightenment and Reform*, 206–26, here 206. Cf. Beales, *Joseph II*, 1:460–64. The summary in the whole of this paragraph and the next largely follows Beales's analysis. Cf. also Helmut Kröll, "Die Auswirkungen der Aufhebung des Jesuitenordens in Wien und Niederösterreich: Ein Beitrag zur Geschichte des Josephinismus in Österreich," *Zeitschrift für bayerische Landesgeschichte* 34 (1971): 547–617.

Toleration, promulgated for the German and Bohemian provinces on October 13, 1781 (and for the rest of the monarchy at different dates over the following months), removed the civil disabilities of Lutherans, Calvinists, and the Orthodox and thus expanded the pool of competent citizens as assets for the state. It was followed on January 2, 1782 by a similar Edict of Tolerance for the Jews. In the same month (in separate decrees for Austria–Bohemia and Hungary) the monasteries of purely contemplative orders were suppressed, and then an inquiry began into those maintained by other orders to ascertain whether they were performing any "useful functions" (including not only education and medical services but also pastoral care). Although about half of them eventually survived this test (with significant regional variation),[13] their resources became severely curbed and strictly controlled, their independence and integrity as communities undermined, and their members intimidated.

The noble estates, especially of Hungary, where they stood up in staunch resistance whenever they felt their "ancient liberties and immunities" under threat, were also exposed to the offensive of enlightened government. The latter's attitude to them was ambivalent in ways similar to the case of the Catholic Church and the religious orders. The traditions of social and political leadership accumulated and fostered among the members of the nobility were welcome insofar as they could be harnessed into the service of the newly defined "goals of the state," but to the extent that these traditions were intertwined with a system of constitutional and fiscal-economic privilege, they were seen as an obstacle to good government and undermining the achievement of those goals. Any intention of social leveling was far from the intentions of Viennese policy-makers and the administrative rank-and-file, but the political influence of the nobility was to be counterbalanced and kept in check by the perpetual creation of new offices and reorganizing old ones. Simultaneously, every effort was made to squeeze out of the nobles—by constitutional bullying or blackmail or by other means—some contribution to the financial burden of efficient governance. A conspicuous manifestation of the antagonism that arose was the session of the Hungarian diet in 1764–65. At this assembly, the Hungarian estates, jealous of their privileges, but also infuriated by a series of publications apparently commissioned by the government and directly challenging those privileges, refused the ruler's demand for increased war tax, a general overhaul of the entire system of taxation, and military reform at their own expense. In response, Maria Theresa's government decided to implement its plan by abandoning the dialogue with the estates, and neglecting the diet in its

13 Beales, "Joseph II and the Monasteries," 246–48.

future pursuit of the much-needed reforms.[14] This provoked the members of the nobility to a concentrated effort to entrench their ancient privileges, while some of them were to combine this reaction with a vernacular version of enlightened improvement.

A policy line that, however, did smack of an endeavor at homogenization, was the propagation of the use of the German language for an expanding range of public purposes. Decrees issued in 1774, and especially the *Ratio educationis* of 1777, contain paragraphs on the desirability of increased teaching of the German language in the schools of Hungary. By 1783, German became the language of instruction at the University of Vienna. Finally, administration in general all over the monarchy followed. The language decree of April 26, 1784 ordered the replacement of German for Latin as the official language of Hungary (to be effective from November 1, 1784 in central government offices, and in a year's time on the level of municipal administration as well).[15] From the point of view of the emperor and his government, there was a perfectly sound rationale for this measure. It was absurd, so the argument went, for a large country to be governed in a dead language that was incomprehensible for most of its inhabitants, while the very fact that this was so proved that the local vernaculars were deficient and thus unsuitable for the purpose. All around Europe, Hungary and Transylvania, along with Poland, were alone in retaining Latin as the language of administration (this was wrong: by the middle of the eighteenth century, the Poles had virtually abandoned the use of Latin in offices), while the example of the French, the British, and the Russians demonstrated the benefits of a uniform administrative tongue. The logical conclusion from these considerations was apparently to promote German to this status in Hungary, many of whose inhabitants already had at least some familiarity with it.

Joseph II's language decree has been described as a turning point in the relationship between Hungary and the ruler: while earlier measures concerned only partial interests or those of the politically sensitive (such as the abolition of religious orders in the one case, and the removal of the Hungarian crown, the symbol of the country's integrity, to Vienna, in the other), this time the very

14 The most comprehensive and up-to-date treatment of the Hungarian estates, the diet, and their relationship with the Viennese government is M. István Szijártó, *A diéta: A magyar rendek és az országgyűlés 1708–1792* (Budapest: Osiris, 2005). Concisely, see R.J.W. Evans, "Maria Theresa and Hungary," in Scott, *Enlightened Absolutism*, 189–207.

15 Éva H. Balázs, *Hungary and the Habsburgs: An Experiment in Enlightened Absolutism 1765–1800* (Budapest: Central European University Press, 1997), 205–11; István Soós, "II. József nyelvrendelete és a 'hivatalos Magyarország.'" in *Tanulmányok a magyar nyelv ügyének 18. századi történetéből*, ed. Ferenc Bíró (Budapest: Argumentum, 2005), 261–301.

crassness of the initiative triggered a new awareness of the issue of vernacular language in a much wider circle. Though the emperor made it clear that the decree had no intention to force his subjects to abandon their mother tongue, and it only required those who dealt with public affairs to exchange German for Latin, the genie was released from the bottle. A torrent of angry responses from the counties and municipalities of Hungary, formulated by men of superior learning, challenged the decree by pointing to examples of cultural and linguistic tolerance in imperial settings from the ancient Persian king Ahasverus (Xerxes [519–465, r.486–65 BCE]) to the Mongol conqueror Tamerlane (1336–1405). While many of the individual contributions seem to have promoted Magyar, the official position of the counties was in favor of the retention of Latin, partly because of its being the language of science and international communication—as it were, echoing Jean le Rond d'Alembert's (1717–83) observations in the preliminary discourse of the *Encyclopédie*, where he admitted that the use of Latin was "highly expedient in the works of *philosophes*; its clarity and precision are of great benefit to those who stand in need of a universal language."[16]

2 Critical Publics: Vienna, Hungary

Besides this rudimentary sketch of the aspects of top-down reform that, in one way or another, affected the predicament in which Hell found himself shortly after his return from the north, developments on the broader cultural and intellectual scene with a similar impact need some attention. These amounted to the rise, from the 1760s and 1770s, of vernacular versions of the Enlightenment in the Habsburg monarchy, thanks to the confluence of local traditions of learning and communication, active engagement with and reception of general European trends, and stimulation by the government's reforming drive. The growing literature on these vernacular Enlightenments—of which, because of the protagonist of this book, this outline shall only tackle briefly the Viennese and the Hungarian—has shown the simplifications of an earlier perspective on the subject, in which they were represented as "unoriginal" and merely derivative, with the "national awakenings" of the educated elites of the peripheral peoples of the monarchy being based on the rejection of the "enlightened absolutist" policies of the imperial center.[17] With the important

16 Cited in Balázs, *Hungary and the Habsburgs*, 210.

17 For the common roots of both of these in the "Counter-Counter-Reformation" of the first half of the eighteenth century, see Evans, *Austria, Hungary, and the Habsburgs*, 36–55. For

correctives in mind, it nevertheless remains true that the flowering of Enlightenment both as rational criticism through free and unbiased discussion, and as improvement through the quest, systematization, dissemination, and application of up-to-date knowledge in contexts other than the reform initiatives of the government, owed a great deal to the constant dialogue with it from the outset.

In the case of the rise of an enlightened public in Vienna,[18] a look at some of the central figures might illustrate this point. Von Sonnenfels—as the son of a recently converted and ennobled teacher of Hebrew, pretty much an outsider—first made a mark on the Viennese scene in the Deutsche Gesellschaft (German society) of the early 1760s, dedicated to promoting the improvement of the German language as propagated by Gottsched, and of vernacular literary culture in general. It was the recognition of his qualities and potential as a local *philosophe* by the aristocratic reformers around the government, who had personal experience of and were fully conversant with the "world of the Enlightenment" in Paris and elsewhere—besides Kaunitz, members of his Council of State like Egid Valentin Baron von Borié (1719–93), or the Zinzendorf brothers,

correctives to the view of the Enlightenment in the region as "unoriginal" and "derivative," see Teodora Shek Brnardić, "Intellectual Movements and Geo-political Regionalization: The Case of the East European Enlightenment," *East-Central Europe/L'Europe du Centre-Est* 32, nos. 1–2 (2005): 147–77; Brnardić, "The Enlightenment in Eastern Europe: Between Regional Typology and Particular Micro-history," *European Review of History: Revue européenne d'histoire* 13, no. 3 (2006): 411–35; László Kontler, "Introduction: The Enlightenment in Central Europe?," in *Discourses of Collective Identity in Central and Southeast Europe (1770–1945)*, vol. 1, *Late Enlightenment: Emergence of the Modern National Idea*, ed. Balázs Trencsényi and Michal Kopeček (Budapest: Central European University Press, 2006), 33–44. For more recent studies of the Enlightenment in the Habsburg realm in non-Viennese and non-Hungarian contexts, see Ivo Cerman, Rita Krueger, and Susan Reynolds, eds., *The Enlightenment in Bohemia: Religion, Morality, and Multiculturalism* (Oxford: Voltaire Foundation, 2011); Marija Petrovič, "Austrian Enlightenment in Cyrillic: Joseph Kurzböck's Cyrillic Printing Shop and the Transmission of the Enlightenment to Austria's Serbs," *Austrian History Yearbook* 48 (2017): 25–38. On how such studies "redress the habitual imbalance of an Enlightenment historiography [in the Habsburg lands] mainly focused on Vienna," see Franz Leander Fillafer, "Whose Enlightenment?," *Austrian History Yearbook* 48 (2017): 111–25.

18 For comprehensive treatments, see Oszkár Sashegyi, *Zensur und Geistesfreiheit unter Joseph II: Beitrag zur Kulturgeschichte der Habsburgischen Länder* (Budapest: Akadémiai Kiadó, 1958); Ernst Wangermann, *Die Waffen der Publizität: Zum Funktionswandel der politischen Literatur unter Joseph II* (Munich: Oldenbourg, 2004). The topic is explored from the perspective of literary scholarship in Leslie Bodi, *Tauwetter in Wien: Zur Prosa der österreichischen Aufklärung 1781–1795* (Frankfurt: Fischer Verlag, 1977). See also Heather Morrison, "Pursuing Enlightenment in Vienna, 1781–1790" (PhD diss., Louisiana State University, 2005).

Counts Ludwig (1721–80) and Karl (1739–1813)—that led to von Sonnenfels's recruitment to his university chair.[19] In other words, in the given circumstances these qualities supported his candidacy for a position as a state servant performing strategic tasks in state-building, while at the same time they were deeply rooted in his ability to apply critical common sense to public affairs—which he also did in his simultaneous capacity as a public intellectual. Committed to the ideals of the freedom of expression and the press, and taking advantage of the relaxation of censorship, in 1765 von Sonnenfels launched the first significant Viennese equivalent of European moral weeklies, under a title—*Der Mann ohne Vorurtheil* (The man without prejudice)—that speaks for itself. This was the first German periodical raising social and political issues directly,[20] including the improvement of the condition of peasants, the suppression of guilds, restrictions on torture, and the abolition of the death penalty—all based on assumptions about the monarch's legislative obligations deduced from natural law and humanitarian principles. The journal ceased to exist in 1767; in 1769, a new Penal Code—aptly (nick)named *Nemesis Theresiana*—if anything, only aggravated the regulations on torture and the death penalty; and von Sonnenfels was ordered to stop discussing these issues. In the formal protest he submitted, he stressed his obedience to the existing laws, but also his view that the free criticism of their shortcomings was a key condition to improvement in the administration of the state. That he continued to voice and publish his views on the subject had a part in the abolition of torture in 1776.

In a like fashion, from the 1760s on the government demonstrated an increasing awareness of the importance of appealing to and shaping a critical public opinion in canvassing its reform agendas by commissioning or sponsoring publications, whether in opposition to the Hungarian diet or concerning the dissolution of monasteries. In accordance with this recognition, a further relaxation of censorship accompanied the ecclesiastical reforms at the beginning of Joseph II's reign, in order to enable his supporters to counter the clerical protests against these measures. One of the collateral effects was a much greater exposure of the public to the large stock of literature formerly indexed, including most classics and lesser works of the European Enlightenment. In addition, these developments elicited a veritable *Broschürenflut*, "flood of

19 Grete Klingenstein, "Between Mercantilism and Physiocracy: Stages, Modes, and Functions of Economic Theory in the Habsburg Monarchy, 1748–1763," in *State and Society in Early Modern Austria*, ed. Charles W. Ingrao (West Lafayette: Purdue University Press, 1994), 181–214.

20 Wolfgang Martens, *Die Botschaft der Tugend: Die Aufklärung im Spiegel der deutschen Moralischen Wochenschriften* (Stuttgart: Metzler, 1968), 141.

pamphlets": close to 1,800 opinion pieces and critical essays published within the span of a mere year and a half that, initially as substitutes for a genuine political press, generated eager debate beyond the printed word, in salons, inns, and coffee houses. A prime example of the close intertwining of the political process and the public sphere was the pamphlet *Was ist der Pabst?* (What is the pope?) by former Jesuit Josef Valentin Eybel (1741–1805). Published on the eve of Pope Pius VI's (1717–99, r.1775–99) 1782 visit in Vienna aimed at persuading Joseph II to revise his ecclesiastical policies, the pamphlet claimed the pope to be merely the first among otherwise equal bishops. Dozens of new journals and newspapers were launched, the volume of the book trade increased significantly, and publishers, booksellers, and lending libraries proliferated. The topics discussed expanded way beyond the one that triggered the process—church reform—and embraced all the typical subjects of enlightened sociability, from virtue and manners, through social orders and emancipation, to new developments in the full array of fields of learning. If not overnight, certainly at a very quick pace, a critical public sphere sprouted in Vienna with "almost as extensive" freedom of debate as in England, according to the British ambassador.[21]

This was as remarkable as it was ephemeral, as the scene began to change in the second half of Joseph II's reign. As the momentum of anti-clerical polemics boosting the government's legislative efforts spent itself, writers increasingly saw themselves not merely as supporters of these efforts, but as "voices of the nation" whose self-appointed task was to critically assess government policies themselves. This attitude was also fostered by their uneasiness with the emperor's headstrong centralism and propensity for authoritarian control, not to speak of his unconcealed, patent contempt for the profession of letters. In the subsequent process of alienation, many of them became disaffected, and during the crisis of the final years of the Josephian regime some of them found themselves in the anti-government camp. This precipitated a new, more restrictive Censorship Patent issued in January 1790, the month before Joseph II's death, in tune with the more general tendencies of the surveillance and control of public opinion by *Stimmungsberichte* (reports on the people's "mood,"

21 Wangermann, *Austrian Achievement*, 138. While the commission on censorship—rehashed under the name Studien- und Zensurkommission, initially chaired by von Sonnenfels and then the younger Van Swieten, Gottfried (1733–1803)—certainly kept a close eye on the pamphlets, it is probably an exaggeration that they were effectively commissioned by the government, as suggested by Wangermann, *Waffen der Publizität*, 11 and passim. For a criticism, and the assertion of a much greater integrity of the contributors, see Morrison, "Pursuing Enlightenment," 44 and passim.

to be submitted to the emperor weekly by every provincial police chief) and other means.[22]

In many ways, a similar trajectory can be outlined in the case of one of the quintessential venues of enlightened sociability: freemasonry. The first lodge was created in Vienna in 1742, and by the 1780s there were altogether seventeen of them in the whole of Austria (besides a good number in the other provinces).[23] Despite the sympathy of Emperor Francis I (who had famously joined a lodge in the Netherlands as early as the 1730s), they faced many difficulties under the devout empress, both on account of their secrecy and obscure ritual, and their real or suspected religious heterodoxy. The accession of Joseph II brought about a change in this regard, although he also warned against the "superstitious" aspects (as he was later to express: the "mumbo-jumbo") of masonic practices, and made it clear that his toleration of them is pragmatic: an acknowledgment of their potential good works, as well as the common sense that prohibition only makes a secret society more attractive.[24] Nevertheless, also in light of the fact that freemasonry was generally allied with the emperor in his anti-clerical projects, in the early 1780s there was a wind of opportunity in Vienna for the unrestrained expression and assertion of the masonic commitment to the enlightened values of improvement through the pursuit of virtue, fraternity, and science.[25]

22 Paul B. Bernard, *From the Enlightenment to the Police State: The Public Life of Johann Anton Pergen* (Urbana: University of Illinois Press, 1991), 115–69.

23 The classic treatment is Ludwig (Lajos) Abafi, *Geschichte der Freimaurerei in Österreich-Ungarn*, 5 vols. (Budapest: L. Aigner, 1890–99). In more recent literature, see Helmut Reinalter, ed., *Freimaurer und Geheimbünde im 18. Jahrhundert in Mitteleuropa* (Frankfurt: Suhrkamp, 1983); Reinalter, *Joseph II und die Freimaurer im Lichte zeitgenössischer Broschüren* (Vienna: Böhlau, 1987).

24 Karl Gutkas, *Kaiser Joseph II: Eine Biographie* (Vienna: Paul Zsolnay Verlag, 1989), 326; Beales, *Joseph II*, 1:486.

25 For a portrayal of European freemasonry in terms of this combination of values, see Margaret C. Jacob, *The Radical Enlightenment: Pantheists, Freemasons, and Republicans* (Cambridge: Cambridge University Press, 1981); Jacob, *Living the Enlightenment: Freemasonry and Politics in Eighteenth-Century Europe* (Oxford: Oxford University Press, 1991). It must be added that more recent research has shown this commitment to have been far from universal. Cf., e.g., Nicholas Goodrick-Clarke, *The Western Esoteric Traditions: A Historical Introduction* (Oxford: Oxford University Press, 2010), 131–53; Cécil Révauger, "English Freemasonry during the Enlightenment: How Radical, How Conservative?," *Lumières* (*Lumières radicales et Franc-maçonnerie*) 22, no. 2 (2013): 33–48. For a concise overview of the state of the art in research on freemasonry and its relationship to strands of the Enlightenment, see Róbert Péter, "General Introduction," in *British Freemasonry 1717–1783*, ed. Róbert Péter, 5 vols. (London: Routledge, 2016), 1. xi–xlvi.

The vehicle for this was a newly established lodge, Zur wahren Eintracht (For genuine harmony), which first met on March 7, 1781, with von Born as its moving spirit.[26] Like in the case of von Sonnenfels (also a member of the lodge, and for a while its vice-master), in von Born, too, the character of a public servant and the public intellectual—which otherwise sit awkwardly together—were not only reconciled but drew mutual reinforcement. His passion for natural inquiry led him to do cutting-edge research in the earth sciences, and he even defied the laws regulating the publication of information on mines as industrial secrets by publishing, in several languages, an account of his experiences on a journey made in 1770 across the mining regions of Hungary and Transylvania,[27] earning him membership in several European academies. His organization of several learned associations has already been noted. At the same time, his scientific adeptness combined with his administrative and management skills made this freethinker an ideal candidate for governmental and courtly positions, such as councilor at the chamber of mines and mints, and custodian of the imperial cabinet of natural history. Von Born, who had been a freemason since his Prague years and in the meantime also joined the more radical brotherhood of the illuminati,[28] was elected master of Zur wahren Eintracht a year after its foundation and a few months after his own entry, in March 1782.

Under von Born's leadership, the constitution of the lodge was democratized, and it quickly began to operate as a substitute academy of sciences, promoting and publishing works in the arts and sciences, and opening a space for lectures and discussions to audiences well beyond the scope of its own membership. The lodge cultivated an ethos not only of virtue achieved through sociability[29] but also of duty, purpose, and strenuous work—persistent intellectual exertion

26 For an analysis of the central role of this lodge in the Viennese Enlightenment, see Morrison, "Pursuing Enlightenment," Chapter 4, 178–242. On von Born, see the literature mentioned above in Chapter 1, 52 n 45.

27 Von Born's *Briefe über mineralogische Gegenstände auf seiner Reise durch den Temeswarer Banat, Siebenbürgen, Ober- und Nieder-Ungarn* was published under the pseudonym of Johann Jakob Ferber in 1774 in Frankfurt and Leipzig, and then in translations in London (1777), Venice (1778), and Paris (1780).

28 On the secret society of the illuminati, founded at the University of Ingolstadt by professor of canon and natural law Adam Weishaupt (1748–1830) in 1776, see Richard van Dülmen: *Der Geheimbund der Illuminaten* (Stuttgart: Frommann-Holzboog, 1977); Helmut Reinalter, ed., *Der Illuminatenorden (1776–1785/87): Ein politischer Geheimbund der Aufklärungszeit* (Frankfurt: Peter Lang, 1997).

29 On the overtones of Shaftesburian moral aestheticism in the Viennese Enlightenment, see Ernst Wangermann, "'By and by we shall have an enlightened populace': Moral Optimism

and the regular discussion of its outcomes with fellow masons at reading sessions specifically designed for this purpose (*Übungslogen*)—and the social responsibility of men of learning to effect positive change.[30] Besides the more arcane *Journal für Freymaurer* (Journal for freemasons) intended for masonic audiences, from 1783 Zur wahren Eintracht also published as its own learned journal the *Physikalische Arbeiten der einträchtigen Freunde in Wien* (Works in physics of the harmonious friends in Vienna), dedicated to the dissemination of specialized but synthetic knowledge, aimed at the general public and presented as conducive to progress, about the "physics" of the lands of the Habsburg monarchy.[31] This was a broadly understood concept, derived, as in physiocracy, from *physis*: besides natural history in the strict sense, the purview of the journal included topics like agriculture and mining and so forth, in a cameralist perspective. On top of the patriotic endeavor, placing domestic developments in the context of recent advances in these fields in the international Republic of Letters, and the ambition to integrate Austrian scientific discourse in it, added a distinctly cosmopolitan flavor. Zur wahren Eintracht became a coveted target for foreign visitors in the Austrian capital—several of them also inducted as members—while letters of introduction from the lodge carried by members during their own travels identified them as its representatives and gave them access to similar exclusive venues of sociability all over Europe.

The reasons for the brevity of the flourishing and the quick demise of Zur wahren Eintracht and, more generally, freemasonry in the Habsburg realm in the later 1780s, are too complex and controversial to discuss here in any detail. The insufficient "density" of true "republicans of letters" who could be mobilized for the scientific–philanthropic–universalist–patriotic utopia of the lodge and the *Physikalische Arbeiten*; the loss of leverage from the illuminati after the banning of the order in Bavaria (where it had originated) in 1784; tensions among the lodges in regard of the overall direction and institutional strategy of freemasonry; tensions between von Born and von Sonnenfels; and

and the Fine Arts in Late-Eighteenth-Century Austria," *Austrian History Yearbook* 31 (1999): 1–15.

30 Morrison, "Pursuing Enlightenment," 201, 210–12.

31 On the journal, its relation to the lodge, and their integration in the scene of Viennese intellectual and scientific sociability, see Heather Morrison, "Harmony and Discord in the Sciences: Vienna's Scientific Enlightenment and Its Engagement with the Republic of Letters," in *Multiple kulturelle Referenzen in der Habsburgermonarchie des 18. Jahrhunderts*, ed. Wolfgang Schmale, Das achtzehnte Jahrhundert und Österreich 24 (Bochum: Dieter Winkler, 2010), 103–22.

other internal factors played a part.[32] The decisive blow, however, was dealt by the Patent on Freemasonry, issued on December 11, 1785 by Joseph II, who was always ambivalent about the movement, and decided to bring it under stricter control in line with the general thrust toward greater surveillance over the public sphere. There was to be only one lodge per provincial capital, obliged to regularly report to the police about meetings, membership, and so forth.

According to the German naturalist, philosopher, traveler, and later "Jacobin" Georg Forster (1754–94), who joined Zur wahren Eintracht during a visit to Vienna, "the first occasion for the reform of freemasonry in Austria arose from the secret gatherings of the Hungarians, who wanted to work against the system of the emperor. Namely, these gentlemen used masonic meetings as the pretext to discuss the principles of their opposition."[33] This observation leads us to the last contextual aspect we briefly need to consider before resuming the narrative of Hell's trajectory in the 1770s and 1780s: the Hungarian Enlightenment,[34] whose relevance to this section arises from Hell's newly conceived interest in the Hungarian language and history, and more generally in his country of origin.

As regards freemasonry in Hungary, by 1775 it had developed its own, full-fledged "Constitutional System"—the Draskovich Observance, so named after one of the founders[35]—and soon enough it united "the best brains of all the counties," as eminent writer Ferenc Kazinczy (1759–1831) wrote of the Pest lodge Magnanimity in his recollections.[36] Besides organizational issues, one noteworthy feature of the constitutions is the assignment of various tasks to different classes of the brethren, while all of them were required to seek the

32 Morrison, "Harmony and Discord in the Sciences," 120–21; Karstens, *Lehrer—Schriftsteller—Staatsreformer*, 269–75.

33 Forster (conveying the account of a Galician official) to Christian Georg Heyne, October 12, 1786, cited in Reinalter, "Ignaz von Born und die Illuminaten," 364. Cf. Wangermann, *Waffen der Publizität*, 126.

34 For overviews in Western languages, see Moritz Csáky, *Von der Aufklärung zum Liberalismus: Studien zum Frühliberalismus in Ungarn* (Vienna: Verlag der Österreichischen Akademie der Wissenschaften, 1981); Domokos Kosáry, *Culture and Society in Eighteenth-Century Hungary* (Budapest: Corvina, 1987); Gábor Vermes, *From Feudalism to Revolution: Hungarian Culture and Politics in the Habsburg Monarchy, 1711–1848* (Budapest: Central European Press, 2014).

35 János Draskovich (1740–81). Previously, the Hungarian lodges had been under the direction of the Grand Landlodge of the Freemasons of Germany. An excerpt from the new "system" has been published in the valuable source collection Réka Lengyel and Gábor Tüskés, eds., *Learned Societies, Freemasonry, Sciences, and Literature in 18th-Century Hungary* (Budapest: MTA Bölcsészettudományi Kutatóközpont, 2017), 157–61. See also Balázs, *Hungary and the Habsburgs*, 137–42.

36 Cited in Balázs, *Hungary and the Habsburgs*, 270.

best ways of reconciling love for the fatherland with the love of mankind, serving the public good, and discovering the morality conducive to the attainment of these ends. These endeavors were in harmony with individual initiatives aimed at improvement and taking momentum during the same period—in a predominantly agrarian country, almost necessarily in forms such as establishing model farms, or launching philanthropic and educational projects to better the lot of the peasantry. Many of these evolved from local antecedents, including the increasing emphasis on the values of social welfare and harmony in the reception of German Pietism early in the eighteenth century, which also inspired an early beginning of *Staatistik*, "the science of the state": the collection and systematization of data on geography, natural resources, history, and legal and political institutions as exemplified by the *Notitia Hungariae* (Description of Hungary [1735–42]) by Bél. The same development can also be traced back to the thrust of the early Enlightenment that would be the most influential in Hungary, along with the rest of Central Europe: the one hallmarked by the name of Christian Wolff, in which the emancipation of the individual was seen as part of a process whereby it was mainly order and efficiency that were to be increased in society, with a very serious role assigned to established authorities. All of these trends received a further strong impetus from Josephism, so it is small wonder that, by the early 1780s, Hungarian freemasons, Hungarian adherents of the Enlightenment, and Hungarian Josephists were broadly overlapping constituencies. They included noblemen and aristocrats trained at the Theresianum as well as bureaucrats and lawyers, clergymen, and members of an arising secular intelligentsia, many of whom had their education at leading German, Dutch, or Swiss Protestant universities. Men among them like Count Ferenc Széchényi (1754–1820), founder of the collection that became the Hungarian National Museum and Library; his secretary, the splendid lawyer József Hajnóczy (1750–95), regarded as the first Hungarian liberal; the petty nobleman and outstanding economic writer Gergely Berzeviczy (1763–1822), and many others were prepared to go a long way in assisting the headstrong emperor in the implementation of his ever more autocratic reform measures.

The limits of such willingness can be deduced from another feature of the "Constitutional System" of Hungarian freemasonry: its strong indebtedness to Montesquieu (1689–1755). While Voltaire and Rousseau, as well as other major and minor figures of the French Enlightenment were widely read and appreciated in Hungary, despite censorship, none of the *philosophe*s had an intellectual impact on the scale of Montesquieu.[37] Besides many other aspects of

37 Balázs, *Hungary and the Habsburgs*, 134–37; cf. Péter Balázs and Olga Penke, "Montesquieu műveinek és gondolatainak fogadtatása a 18. század végétől napjainkig Magyarországon," *Irodalomtudományi Közlemények* 116, no. 1 (2012): 3–21.

Montesquieu's *oeuvre*, this was substantially owing in general to his analysis of monarchy in the *Spirit of the Laws* (1748) as a system dependent on the vitality of "subordinate or intermediary powers," and in particular to his illustration of this point in a remarkable passage of book 8, Chapter 9 by a tribute to the Hungarian nobility, which—despite the endeavor of the house of Austria to "oppress" it—"forgetting the injuries done to themselves, took up arms to avenge her cause."[38] This was understood by enlightened Hungarians as a gesture both to the virtue and honor of their political elite and to the liberties enshrined in the assemblage of their ancient customs and statutes, soon to be reinterpreted as a constitution established on the principle of the separation of powers.[39] The injunction of the Hungarian masonic constitutions to brethren—especially those in the legal profession—to inquire into the best form of government and into the nature of their country's constitution was an acknowledgment of the quasi-biblical status of Montesquieu's text among them, with the implication that the pursuit of the enlightened goals of freemasonry was compatible with the preservation of Hungary's political system and autonomy. From this vantage point, the administrative reforms of Joseph II in the mid-1780s—the German-language decree, already mentioned; the imposition of a second tier of administration by "districts," packed by reliable bureaucrats, over the traditional institutions of self-government by counties; the commissioning of a country-wide census, suspected of anticipating a circumscribing of the nobility's tax privileges—were viewed with anxiety, and caused the kinds of stirrings described by Forster.

The completion of the census was an apparent success for Joseph II, but together with the creation of the district system it created an irreparable breach between him and the counties, whereas the language decree was not only impossible to put into practice but also gave impetus to the unfolding movement for the modernization and the embellishment of the Hungarian language. This endeavor was not entirely new in the mid-1780s. Its hotbed was Habsburg enlightened absolutism itself, providing training for many young Hungarian nobles in the Theresianum or the Royal Hungarian Bodyguard in Vienna, and employing them on missions into the western centers of social

38 Montesquieu, *The Spirit of the Laws* (Cambridge: Cambridge University Press, 1989), 119. The passage commemorates the Hungarian nobility's spectacular show of support for Maria Theresa at the outset of the War of Austrian Succession.

39 László Péter, "Montesquieu's Paradox of Freedom and Hungary's Constitutions 1790–1990," *History of Political Thought* 16, no. 1 (1995): 77–104, republished in Péter, *Hungary's Long Nineteenth Century: Constitutional and Democratic Traditions in a European Perspective*, ed. Miklós Lojkó (Leiden: Brill, 2012), 153–82.

and intellectual ferment. The "bodyguard-writers"[40] became familiar, among other things, with the movement for the improvement of German, which developed into the language of Goethe (1749–1832) by the 1770s. The publication of *The Tragedy of Agis* in 1772 by the most outstanding among them, György Bessenyei (1746–1811) is usually considered to mark the starting point of a similar process in the case of Hungarian. Bessenyei went on to publish pamphlets on educational policy, endorsing Maria Theresa's comprehensive educational reform, the *Ratio educationis* of 1777, but emphasizing the need for the extensive use of Hungarian. In order to make the language worthy of that task, in 1781 he also proposed the establishment of a "patriotic" learned society dedicated to the cultivation of letters in the vernacular.[41]

The linguistic and literary revival thus began to overflow into a general cultivation of native traditions: a sizeable elite group was emerging whose members' cultural and intellectual sensibilities were broadly European, but whose identity was shifting from Hungarus to Magyar. It is also worth emphasizing that their vision of the future restoration of the erstwhile greatness of the Hungarian nation was predicated on galvanizing their own class to a new dynamism through modern letters and knowledge practices. This was a vision of improvement that, in their own view, depended on maintaining a discourse of identity built on a prestigious pedigree and social exclusiveness, both under serious attack from the mid-1760s by the Viennese court and government, toward which their attitudes were therefore highly ambivalent. The *oeuvre* of Bessenyei, who was not only a writer but also an accomplished moral and social philosopher, testifies to such ambivalences in a way that, as we shall see, is highly relevant to Hell's recently conceived interests in the Hungarian language and history.

---

40 On the Hungarian Guards, with references to the figures mentioned, see László Deme, "Maria Theresa's Noble Lifeguards and the Rise of the Hungarian Enlightenment and Nationalism," in *The East Central European Officer Corps, 1740–1920s: Social Origins, Selection, Education, and Training*, ed. Béla Király and Walter Scott Dillard (Boulder, CO: Columbia University Press, 1988), 197–212. The Hungarian-language literature is respectable. However, historians have hitherto largely yielded the field to literary scholars, whose main preoccupation has been the rise of vernacular literature and are yet fully to discover the subject and approach it with their own questions. The standard monograph is Ferenc Bíró, *A felvilágosodás korának magyar irodalma* (Budapest: Balassi Kiadó, 1994), esp. 69–92, 161–85;

41 [György Bessenyei], *Egy magyar társaság iránt való jámbor szándék*, excerpts in English as *A Benevolent Plan for a Hungarian Society*, published in Lengyel and Tüskés, *Learned Societies*, 80–89.

Among many other literary pursuits and genres, Bessenyei was active in the field of philosophical history,[42] translating and adapting texts by Voltaire, Claude-François-Xavier Millot (1726–85), Louis-Sébastien Jacquet de Malzet (1715–1800), and Vaissète, and writing original works devoted to the history of Hungarians in the period of settlement and state foundation in a European context, through a comparative analysis of manners, laws, and institutions. In his *A magyar néző* (Hungarian spectator [1779]), Bessenyei surveyed the history of the world, from a Hungarian perspective, in a thoroughly Voltairian framework. He proposed to give an account of the successive stages of the "mitigation" of rude manners, resulting from religion and learning, but also claimed that military glory and polite letters, rather than being antagonistic, could mutually supplement one another.[43] This, of course, dovetailed with his overall conviction that *vera nobilitas*, "true nobility" could derive from proficiency in letters as well as arms-bearing, a claim he made to urge a re-evaluation of the social roles of the nobility, which he still regarded as the chief repository of improvement—although it also depended on "emulation between the great and the little."[44] Then, in *A magyar nemzetnek szokásairul, erköltseirül, uralkodásának modjairul, törvényeirül, és nevezetesb viselt dolgairul* (The customs, manners, modes of government, laws, and important deeds of the Hungarian nation [1778]), he again provided a set of present-oriented historical reflections, intended as a historical underpinning of his program. Achievements by the sword and by the pen are represented, in a somewhat labored fashion, as two equally feasible paths to ennoblement—although Bessenyei held that among certain circumstances, such as in eleventh-century Hungary and Europe as a whole, the one took precedence over the other. His point in this work is, ultimately, the parallel development of society in Hungary and Europe in the past, and the consequent chance to re-establish synchronicity for Hungary with European progress in the present. (It is tempting to recognize here an association with the notion advanced by Montesquieu, that the shared "deep structures" of European societies predestine them to progress toward a similar present and future, despite the empirical variations within the overall system of monarchy based on intermediary powers.) "It seems as if the Hungarian nobility originated fully from warfare. It could not have been otherwise, for in old

42 On the views of Bessenyei and his fellow "bodyguard writers" on history, see Bíró, *A felvilágosodás*, 161–86; and Penke, *Filozofikus világtörténetek és történetfilozófiák*, 161–82.

43 György Bessenyei, *Magyarság; A Magyar Néző*, Magyar irodalmi ritkaságok 16 (Budapest: Királyi Magyar Egyetemi Nyomda, 1932), 17.

44 György Bessenyei, *A Holmi*, ed. Ferenc Bíró, György Kókay, and Andor Tarnai (Budapest: Akadémiai Kiadó, 1983), 16.

times it was impossible to rise to nobility by writing and the pen in a nation, which could neither write nor read, but only fought, triumphed, plundered, and ruled." But Bessenyei adds immediately that "all nations in the world, which have since developed arts and sciences, began their nobilities in this way [...]."[45] An appendix entitled "Egész Európa' formája a XI[dik] Százban" (The form of the whole of Europe in the eleventh century—excerpted from Voltaire's *Essai sur les moeurs*, chapters 39–46) is intended to demonstrate that in those times Hungarians were no more barbarous than other European nations. "If you observe only Hungary in the eleventh century, you will find that it dealt improperly with its kings; but was there anything other nations did not commit, although they had been Christians for a long time?"[46] Religious war and forced conversion is also described as the order of the day. The ubiquity of violent passions and ignorance was directly related to the overall rusticity of manners: "The sum of customs and manners was excessive eating and drinking, pillage, recklessness in combat, and cruelty."[47]

Thus far, this is more or less the standard Enlightenment narrative[48] of the feudal past, with the potential of the assessment of the present in equally standard terms of enlightened patriotism. Bessenyei indeed hinted at the anachronistic distribution of social power and privilege in eighteenth-century Hungary: in the beginning,

> the plowman paid taxes to the bearer of arms in return for his own protection. So, in old times everything was based on services; but since servants became masters without bearing arms, the one part always obeys, and the other always commands. [...] This great nobility was once a standing army; now they lay idle in their homes [...].[49]

Bessenyei, however, nowhere arrived at the explicit conclusion that noble privileges, being no longer justified, ought to be eliminated, although—as the

45 György Bessenyei, *A magyar nemzetnek szokásairul* [...], in Bessenyei, *Összes művei: Társadalombölcseleti írások 1771–1778*, ed. Péter Kulcsár (Budapest: Argumentum-Akadémiai Kiadó, 1992), 89–154, here 96.

46 György Bessenyei, "Egész Európa' formája a XI[dik] Százban," in Bessenyei, *Társadalombölcseleti írások*, 155–66, here 164.

47 Bessenyei, "Egész Európa' formája," 163.

48 For this concept and its application to mainstream Western European material, see Karen O'Brien, *Narratives of Enlightenment: Cosmopolitan History from Voltaire to Gibbon* (Cambridge: Cambridge University Press, 1997); Pocock, *Barbarism and Religion*, esp. vol. 2, *Narratives of Civil Government* (Cambridge: Cambridge University Press, 1999).

49 Bessenyei, *A magyar nemzetnek szokásairul*, 153.

commissioner of Hungarian Protestants in Vienna—he was more inclined to compromise with the policies urged at court in social and national as well as confessional issues than most others. On the contrary: assigning an unassailable social preeminence to the nobility on account of its historical roles, what he sought was a new justification for these roles, to be found in superior learning, while he still regarded the gulf that separated the nobility from the peasantry as unbridgeable.

Bessenyei supported this by referring to Werbőczy and his own *A' törvénynek útja* (Of the course of the law [1777]). As a matter of fact, as the whole of this treatise addressed the relationship of the nation and the ruler in law-making, its topic and argument closely followed Werbőczy, whose work Bessenyei was obviously thoroughly familiar with. His claim that the people raised "captains" and masters above themselves through the voluntary consent of all echoes the relevant passages of the *Tripartitum* as well as Kézai's *Gesta*—although without explicit reference to the Huns and the presumed continuity with the Hungarians, in its political terminology recalling the staples of Scythianism.[50] The same applies to the justification of differences between the "people" and the "common folk": more generally, in terms of voluntary subordination of the cowardly to the brave warriors, and specifically by reference to forfeiture of right as a result of rebellion (almost a word-by-word quotation of Werbőczy's argument from the consequences of the 1514 peasant war).[51]

In a later work, *Magyarországnak törvényes állása* (On the legal status of Hungary [1802]), Bessenyei leaves no doubt that his strong commitment to important Enlightenment values and goals was fully compatible not only with this kind of social conservatism but also with cherishing the medieval legacy of the Hun–Hungarian discourse of origin:

> The people of Áttila is marked by triumph, valor, thirst for glory, and prudence required for domination, despite its paganness, ignorance, and ferocious nature. The only thing Attila wanted was conversion to Christianity, together with his foremost men, like Saint Stephen. Had he formed a kingdom and settled in his country in a Christian manner, no court would have been superior to his in the prudent wisdom of government, in splendor, wealth, triumph, and glory.[52]

50 György Bessenyei, *A' törvénynek útja*, in Bessenyei, *Társadalombölcseleti írások*, 167–90, here 175.

51 Bessenyei, *A' törvénynek útja*, 177.

52 György Bessenyei, *Magyarországnak törvényes állása*, in Bessenyei, *Összes művei: Prózai munkák, 1802–1804*, ed. György Kókay (Budapest: Akadémiai Kiadó, 1986), 209–54, here 233.

Soon enough, the "moral strength and dignity" identified in the Huns by Bessenyei is associated with the fundamental character of the Hungarians:

> The Hungarian nation has always lived by prudence; it has always been governed under freedom, and was full of princely men. For such were the captains. The fight, war, triumph, has been its nourishment and domestic art since time immemorial. Its moral talent is not surpassed by any nation in the world. If it applies itself to science, art, or gallantry, it excels. And if it lags behind the English, the German, and the French to a certain extent, this is not because of its feebleness, but because it does not possess the proper ways and means. It has already been established, that until elevating its own language, no nation in the world will be learned, nor any has ever been.[53]

In what appears an amazing flight of fancy, Bessenyei proceeds from a eulogy of Scythian–Hun–Hungarian military prowess through the supposedly concomitant adherence to the values of liberty and the resulting proneness to excel in learning as well, to the urging of the establishment of a Hungarian academy of sciences, dedicated to the cultivation of the mother tongue as a tool of raising the nation to the status it deserves among modern European nations. However, in view of Bessenyei's overall intellectual project, and his program for social and cultural reform in Hungary, this is not at all surprising. Hailing the Hun–Scythian ancestry of Hungarians was intimately connected with standing up for a notion of national dignity understood in terms of ancient constitutional liberties that were being undermined by a purportedly enlightened but increasingly autocratic regime.

Where does this inevitably selective sketch of strands of the Enlightenment in the Habsburg monarchy leave us with regard to the purpose it serves, an assessment of the prospects Maximilian Hell had shortly after his return from the northern expedition to Vienna? The changes brought about in his personal circumstances amid these broader processes of transformation compelled him to re-situate himself on the Central European map of learning. Previously, it was relatively easy for Hell to reconcile his loyalties to the Habsburg dynasty and the ruler, to the Catholic Church and the Jesuit order, to the multi-ethnic and multi-confessional Kingdom of Hungary, and to the international Republic of Letters (together with the Latinate culture that marked each of the latter three). His position as imperial and royal astronomer (thus, a state servant) proved to be unassailable, nor did he ever cease to issue his *Ephemerides*. However,

53 Bessenyei, *Magyarországnak törvényes állása*, 234.

the suppression of the Society of Jesus and the overall context of reform and Enlightenment in the Habsburg monarchy meant the breakdown of the harmony that had existed among these various loyalties, and the air around him became thinner. Hell could either choose to accommodate to the new cultural–political climate and make the most out of it, or try to remain in contact with a network of loyal ex-Jesuits and other conservative forces. In a way, he did both. Above all, he reacted actively, feeling a need to create new institutional leverages, to forge new social alliances, and to develop new intellectual allegiances in order to maintain the status of authority he had attained during his career up to that time. Before following him on this path, let us briefly consider generally the impact of the suppression of the Society of Jesus on the personnel and infrastructure of Jesuit learning, particularly in Hell's field, in the Habsburg lands.

3 Ex-Jesuit Astronomy: Institutions and Trajectories

Between the suppression of the Society of Jesus and the death of Hell in 1792, new conditions for astronomical activity arose in the former Austrian province of the order. As mentioned above, Hell remained at his workplace after the suppression, but his case was special since his institution had been founded and was funded by the state. Other observatories and observers experienced a different plight. These include the Jesuit observatories of Vienna, Cluj, Buda, Graz, and Trnava; and other locations of institutionalized astronomy, such as Lviv, Melk, and Lambach, where ex-Jesuits[54] had a role to play.

While authors with pro-Jesuit leanings have usually emphasized the detrimental effect of the suppression on the cause of science,[55] others have argued that at least as far as the "favorite pet" of Jesuit scientific activity—astronomy—is concerned, "the status of ex-Jesuits [in it] remained unchallenged,"[56] and

54 "Ex-Jesuit" has been used in at least two different meanings: those who, through voluntary exit or as the result of expulsion, left the Society after having delivered their vows, usually after spending a relatively long part of their life as a member; and those who, through the suppression of the order sanctioned by the church in 1773, were freed from their vows and forced to take another direction in their life. Cf. Hermann Haberzettl, *Die Stellung der Exjesuiten in Politik und Kulturleben Österreichs zu Ende des 18. Jahrhunderts*, Dissertationen der Universität Wien 94 (Vienna: Verband der wissenschaftlichen Gesellschaften Österreichs, 1973), 9. Here, it is used only in the second sense.

55 See, e.g., John (Johann) Schreiber, "Jesuit Astronomy," parts 1–2, *Popular Astronomy* 12 (1904): 9–19, 94–112; Steinmayr, "Geschichte der Universitätssternwarte."

56 Haberzettl, *Stellung der Exjesuiten*, 196.

more specifically that "the dissolution of the Jesuit order had almost no impact on the work at the Vienna Observatory."[57] This would have been in conformity with the overall situation of Jesuits in the Habsburg lands after the suppression. Whereas in Western Europe large numbers of Jesuits had been either imprisoned or expatriated and deported to the Papal States, in Austria and its hereditary lands the former Jesuits were allowed to stay. As *Weltpriester* (*presbyteri saeculares*, "secular priests"), they were given state pensions. In the field of learning, although former Jesuit professors of theology and philosophy proper were in most cases replaced, quite a few professors in other branches of science found themselves in a position where they could continue their careers. The personal trajectories of some of Hell's interlocutors mentioned earlier in this book may illustrate the complexity of the picture. György Pray at first languished in a rather meager priestly position in the diocese of Esztergom, but then he was accorded by Maria Theresa the title historiographer royal for Hungary, and in 1777 he was appointed first custodian of the University Library in Buda. Both of the two Trnava history professors, Katona and Kaprinai, were initially lodged to parishes in the same diocese, but the former was then able to reclaim his chair at the university relocated to Buda. On a larger plane again, while some former Jesuits of the Austrian province chose emigration, mainly to Prussia and Russia,[58]

57 Kastner-Masilko, *Triesnecker*, 47.

58 In the Prussia of Frederick the Great, all former Jesuit gymnasia as well as the Jesuit university in Wrocław (Breslau) were taken over by the state, but the former Jesuit staff was allowed to continue, meaning that the education system remained effectively unchanged, to the dismay of Voltaire among others. See Hermann Hoffmann, *Friedrich II von Preussen und die Aufhebung der Gesellschaft Jesu*, Bibliotheca Instituti Historici S.I. (Rome: Institutum Historicum Societatis Iesu, 1969); cf., e.g., James van Horn Melton, *Absolutism and the Eighteenth-Century Origins of Compulsory Schooling in Prussia and Austria* (Cambridge: Cambridge University Press, 1988), 171–99. In the parts of the old Polish assistancy of the Society of Jesus, annexed to Russia as a result of the partition of Poland in 1772, the few hundred Jesuits who were around were never secularized, but reorganized themselves around a new general "in diaspora." Catherine II protected them for the same reason as her Prussian counterpart, seeing that they were essential to the school system. Jesuit centers existed in the form of four *collegia*, in Polack (Polock, Polotsk), Viciebsk (Vitebsk), Orsha and Daugavpils (Dźvinsk, Dvinsk, Daugpilis), and two principal residences, in Mstislav (Mścisław) and Mogilev (Mohylów). In the first half of the 1780s, a novitiate as well as a tertianship (house for the third year of probation) was set up in Polack, thus a complete program of Jesuit formation was in place. This elicited a certain degree of immigration of former Jesuits from European states where the Society was still suppressed. See Daniel Beauvois, "Les jésuites dans l'Empire Russe 1772–1820," *Dix-huitième siècle* 8 (1976): 257–72; Marek Inglot, *La Compagnia di Gesù nell'Imperio Russo* (*1772–1820*) *e la sua parte nella restaurazione generale della compagnia* (Rome: Editrice Pontificia Gregoriana, 1997); Ludwik Grzebień, "11. Provincia de la Rusia Blanca (1773–1820)," in the entry on "Rusia" in O'Neill and Domínguez, *Diccionario histórico de la Compañía de Jesús*, 4:3441–49; Daniel R. Schlafly, "The Post-suppression Society of Jesus in the United States and Russia: Two

some others even ended up as bishops or senior officials in the state bureaucracy.[59]

In the strictest sense, the positive assessment of the prospects of "ex-Jesuit astronomy" is not far from the truth. Despite radical changes in the institutional organization of science in the Habsburg lands in the wake of the year 1773, the Imperial and Royal Observatory of Vienna remained intact. The number of assistants may have been reduced, but the court astronomer himself sat safe in his chair. While his colleagues abroad feared that the *Ephemerides* might be discontinued or the Imperial Observatory shut down,[60] nothing of the sort happened. Instead, the annual volumes of the Viennese almanac were churned out of the press as before (albeit, as we shall see, with some significant changes of emphasis in content), with supplements presenting long lists of observations as well as theoretically ambitious treatises.[61] It is also important, however, to listen to Hell's laments concerning the impact of the Society's suppression, which were quite frequent. In one of these, he wrote in 1790:

> As a result of this dissolution of the Society of Jesus, I was utterly deprived of all those assistants and adjuncts, paid by the Society of Jesus, who used to aid me in my astronomical duties and activities. Thus, by my own efforts solely and uniquely I must both do the calculations for the annual *Ephemerides astronomicae* and preside over their publication, as well as take care of the planning, conducting, and continuation of astronomical observations, and even take care of my scientific correspondence with astronomers all over Europe (in addition to Beijing in China); and whatever other astronomical tasks that called for my attention, must be done without any assistants or adjuncts, solely and uniquely by myself.

Unlikely Settings," in O'Malley et al., *Jesuits*, 2:772–83. But even for those who stayed in Central and Western Europe, the survival of the Society in the East was of symbolic importance: devout ex-Jesuits—Hell among them—looked to Prussia and especially Russia for comfort.

59 Besides Haberzettl, *Stellung der Exjesuiten*, see Trampus, *I gesuiti e l'Illuminismo*; Müller, "Der Jesuitenorden und die Aufklärung"; and Ritchie Robertson, "Curiosity in the Austrian Enlightenment," *Oxford German Studies* 38 (2009): 129–42.

60 See, e.g., Bernoulli, *Nouvelles littéraires* 1 (1776): 9–10.

61 There were some difficulties, though, with the production. In the mid-1770s, a conflict of interest seemed to arise between Hell and the publisher, on which see the discussion of Hell's scientific academy plans below. A decade later, Hell complained about the "chaos" arising in the printing house from the frequent changes of the workers, and the extra burden resulting from his own agreement to publish the *Ephemerides* not one but two years in advance of the given year. Hell to Kästner in Göttingen, March 6, 1786 (NSUBG; see Hungarian translation in Csaba, *Hell Miksa írásaiból*, 58).

> In this time of hardship, I was left only with two choices: either to bid farewell to my chair as imperial and royal astronomer, if I wished to finish my vast, three-volume work *Expeditio litteraria* as promised, or to suppress this work, if I decided to continue in my chair as an astronomer, a chair in which I, for as long as the Society of Jesus existed, was helped by assistants in my work.[62]

In other words, while the routine activities of the observatory—those prescribed to Hell in the instructions of 1755—were indeed unaffected, the logistics had to be revised. What emerges from these lines is that, before 1773, the imperial and royal astronomer was able to delegate such basic tasks to personnel put at his disposal not by the maintainer (the state), but via the established practices of apprenticeship in the Society of Jesus, so that he could dedicate a good part of his own time and energies to other scientific projects. Hell also seems to have staked the execution of his ambitious plan of publishing a comprehensive, multi-volume account of the Arctic expedition on the continuation of such arrangements, and he blamed the failure of completing the *magnum opus* on the frustration of these expectations by the suppression of his order, as a result of which he was forced to deal with much of the daily chore himself.

To be sure, this was still far better than the fate of the Jesuit Observatory of Vienna, just two-hundred meters away, which was closed shortly after the suppression of the Society. The director Liesganig was appointed professor at the former Jesuit college of Lviv in Galicia, which had come under Austrian rule in the aftermath of the first partition of Poland in 1772.[63] As mentioned above, from his base in Lviv Liesganig conducted extensive surveys of the new Habsburg province of Galicia and served as the director of an observatory that had been founded by the Jesuits around 1771.[64] As Liesganig passed away in

62 Maximilian Hell, "Observationes astronomicae latitudinum, & longitudinum locorum borealium Daniae, Sueciae, Norwegiae, & Finnmarchiae Lapponicae per iter arcticum annis 1768, 1769, & 1770 factae," *Ephemerides* 1791 (1790), 301–2.

63 The Jesuit college of Lviv was founded in 1661 and received papal approbation as a university as late as 1759, a status it lost in 1773. For the next decade, it was known as the Theresianum, or academy for noblemen, until Joseph II renewed its university status in 1784.

64 In some of the literature, this observatory is missing entirely, cf. Derek Howse, "The Greenwich List of Observatories: A World List of Astronomical Observatories, Instruments, and Clocks, 1670–1850," *Journal for the History of Astronomy* 17, no. 4 (1986). Elsewhere, it is conjectured that it was founded by Liesganig, who came to Galicia in 1774, cf. Udías, *Searching the Heavens*, 31. However, an engraving of "the observatory of the Jesuit college, 1771" is included in Brosche, *Der Astronom der Herzogin*, 25. Von Zach, in an article in his *Monatliche Correspondenz* 4 (November 1801): 547–57, here 550, claims that a Jesuit

1799, he left a large collection of manuscripts from his surveys in Galicia. However, just as earlier, he did not submit any observations from Lviv to the *Ephemerides astronomicae* edited by Hell and then von Triesnecker. Back in Vienna, the Jesuit observatory seems not to have been manned at all after Liesganig's departure for Lviv in 1774. In a much later letter to Weiss, Hell explains that "I have managed to save the observatory of the Viennese academic collegium, which surely, in case I had been absent from Vienna at that time, would have been removed and demolished, because the architect had misunderstood the words of the emperor."[65] The Jesuit observatory is described as still in existence in Pilgram's work on meteorology published in 1788. Exactly when it was demolished is not known.[66] As to Hell's action to preserve it, this may be interpreted as a sign of his hopes that the Society of Jesus would one day be restored and activities resumed at the former observatories.[67]

Before the suppression, the Society of Jesus had been in a position to construct observatories and equip them with instruments and personnel by its own means. Although the growth around 1750 was followed by a period of standstill, it remains a fact that between 1745 and 1756 the number of Jesuit observatories grew from one (Vienna) to three (Graz and Trnava added). In the course of the 1750s, the Benedictines constructed their sole observatory in Kremsmünster, led by Fixlmillner, and the state funded the Imperial and Royal Observatory in Vienna, headed by the Jesuit Hell. No major expansions appear to have taken place during the 1760s. Just on the threshold of the calamity of 1773, however, the Jesuits found that the time was ripe for new establishments.

---

observatory existed in Lviv "since long before the Austrian occupation of Galicia and Lodomeria in the year 1772." As proof, von Zach points to the observation of a solar eclipse made by Hell's former student Lysogorski in 1764. It was this same Lysogorski that had left Vienna for Lviv in 1761, allegedly equipped with a decent set of instruments, but he seems never to have fulfilled Hell's high hopes as stated in his 1761 Venus transit report (cf. above, Chapter 3). Thus, according to the authors of the article "First Astronomical Observatory in Lviv" (S. Apunevych et al., in *Kinematics and Physics of Celestial Bodies* 27, no. 5 [2011]: 265–72), Lysogorski's observations were made from the mansion of Archbishop Sierakowski, whereas the date of foundation of the Jesuit observatory was as late as May 15, 1771, without Lysogorski playing a part. Instead, a certain Ludwik Hoszowski (1732–after 1773) served as professor of mathematics at the Jesuit college in Lviv from 1769 to 1773 according to Fischer, "Die Jesuiten-Mathematiker des Nordostdeutschen Kulturgebietes," 139–47. During 1771–73, Hoszowski was also entered in the Jesuit catalogs as professor of astronomy and prefect of the "mathematical museum" in Lviv. After the suppression of the Society of Jesus, Hoszowski left for an ecclesiastical post in Przemysl and seems never to have become part of the team around Liesganig.

65 Hell to Weiss, dated Vienna, November 12, 1783 (Vargha priv.).

66 Steinmayr, "Geschichte der Universitätssternwarte," 178.

67 Cf. Hell's letter to Bernoulli in Berlin, dated Vienna, February 15, 1777 (UBB).

Enlightened interest in astronomy certainly peaked around the transit of Venus in 1769, and when Hell returned as an explorer of worldwide reputation in the following year, the conditions for a revitalization of institutional astronomy were probably as good as they could ever become.

The failure to finalize the construction of an observatory even by this time at the Jesuit college of Cluj, where Hell had been appointed to oversee it in the 1750s, has already been mentioned. That of Buda, the old capital of the Kingdom of Hungary, is a similar story. A Jesuit convent was established there almost immediately after the liberation of the town from the Ottomans in 1686, and a college was in full operation by 1701. The first professor of mathematics was appointed there in 1744, and soon after Hell and Sajnovics returned from their expedition, the post was given to Sajnovics. At the same time, plans were being laid to make the former assistant of both Hell (Vienna, Vardø) and Weiss (Trnava) the director of a new Jesuit observatory in conjunction with the Buda college.[68] With scarcely concealed pride, Sajnovics exclaimed: "I am destined to become a professor in Buda, where I am supposed to lay the foundations for practical astronomy. In this way, I hope to become the royal astronomer of Hungary, which is the most illustrious title I can ever imagine."[69] In the abovementioned letter to Bernoulli, Hell explains that as the suppression of the Society arrived in 1773, everything was ready, the funds had been secured, and Sajnovics appointed for the job of supervising the construction.[70] Evidently, the suppression of the Society of Jesus brought these plans to a halt.

At the dawn of the 1770s, the Jesuits did not limit themselves to their plans for expansion in Cluj and Buda, but also promoted developments outside their own ranks. While the Benedictines founded and maintained a high-standard observatory in Kremsmünster, the historiography on the order's role in the history of Central European astronomy is meager. It is clear, though, that the pressure of the anti-monastic sentiment gaining currency in the period had consequences in this regard, too. An attempt was made in the late 1760s and early 1770s to establish an observatory at the splendid Benedictine monastery of Melk,[71] whose abbot tried to set in place various innovations in order to give

68 In a letter to Weiss, dated Vienna, May 24, 1771, Hell wrote (Vargha priv.; also found in Pinzger, *Hell Miksa*, 2:106): "I have not yet been able to discuss the Buda observatory with the honorable *pater provincialis* [i.e., the head of the Austrian Society of Jesus]. I would really hope that astronomy may be cultivated in the very same place that I, as a teacher of mathematics so long ago, had planned to become my workplace."

69 Sajnovics to János Nagy, dated Trnava, May 12, 1771, facsimile in Kisbán, *Sajnovics*, 40–41.

70 Hell to Bernoulli in Berlin, dated Vienna, February 15, 1777 (UBB).

71 Gottfried Glaβner and Christina Preiner, "'[…] Physica autem sine omni experimento sicca sit et sterilis': Warum im Jahr 1771 trotz guter Argumente der Plan, in Melk eine

his institution a more "modern" profile. One of the plans he nurtured was remaking the monastery's powder tower into an astronomical observatory. The abbot was encouraged in this project by, among others, the Jesuit astronomers Paolo Frisi (1728–84) from Milan and Liesganig from Vienna, who both paid visits to Melk in order to offer support and advice. In the end, however, this project was also dropped because of internal strife within the monastery.

Somewhat later, a modest Benedictine observatory was in fact founded at the monastery in Lambach. In a letter to Bernoulli in Berlin from the summer of 1777, Fixlmillner explained that an observatory was being established at this place, and that a monk by the name of Julian Ricci (1745–1812) had been sent from the abbey to Vienna to receive instructions.[72] Ricci stayed at Hell's place in Vienna for several months, until he traveled back to Lambach in the autumn of 1777 along with the imperial astronomer, who was to assist in the practical arrangements for this observatory.[73] Whatever its position internally in the Benedictine system, the observatory in Lambach never gained anything near the prominence of its Kremsmünster counterpart. In the latter place, Fixlmillner continued his observations as before, unaffected by the Theresan and Josephian monastic reforms. His observatory became a "node" of European astronomy in its own right, but Fixlmillner seems not to have promoted his colleague in Lambach or his observations to any significant extent.

No further attempts to establish astronomical observatories either by religious orders or private individuals seem to have been made in the geographical area of the former Austrian province of the Society of Jesus during, or in the aftermath, of the suppression. The plight of the Jesuit observatories that were in operation as the suppression arrived remains to be described. The Jesuit observatory of Vienna has already been mentioned, and the less-than-glorious early history of its younger sister observatory in Graz has also been summarized

---

Sternwarte zu errichten, nicht zur Ausführung kam," in "[…] *und das Firmament kündet vom Werk Seiner Hände" (Ps. 19:2): Faszination Astronomie; Eine Spurensuche in der Melker Stiftsbibliothek*, ed. Gottfried Glaβner, Thesaurus Mellicensis 1 (Melk: Stift Melk, 2009), 123–31.

72 Fixmillner to Bernoulli in Berlin, dated Kremsmünster, June 23, 1777 (printed in Bode's *Astronomisches Jahrbuch* and quoted in the *JS* [December 1778]: 801–15, here 814). "Il dit, à la fin de sa Lettre, qu'on va établir à l'Abbaye de Lambach, près de Cremsmunster, un Observatoire; & qu'un Religieux de cette Abbaye est à Vienne pour prendre les instructions nécessaires." For Ricci, see Rabenalt, "Astronomische Forschung," 129n2.

73 In a letter to Bishop Eszterházy in Eger, dated Vienna, September 8, 1777 (FLE AV 2629), Hell wrote: "Tomorrow, that is, the 9th of September, I will go to Upper Austria along with another astronomer of the Benedictine Monastery of Lambach. I have trained him in astronomy for four months, and upon invitation from the Most Honourable Abbot I will go there to arrange a new observatory that has been constructed at that place."

in Chapter 2. The latter was also closed not long after the suppression of the Society in 1773. Its last director was almost certainly Anton Mayr (or Mayer [1738–?]).[74] Born in Vienna, Mayr entered the Society of Jesus around 1756, held a chair as "professor of higher mathematics" (*prof*[*essor*] *math*[*eseos*] *repet*[*itae*]) in Graz in 1765–72, before being appointed director of the astronomical observatory there for the university year 1772–73.[75] At the latest by 1776, however, Mayr's days in Graz were over. His chair was judged to be redundant and became abandoned, and the observatory itself was at first closed, and then finally demolished in 1787.[76] Mayr returned to Vienna, where he had a short career at the side of Hell: on the title pages of the *Ephemerides astronomicae* for the years 1777 and 1778, he is presented as a calculator of the almanac as well as Hell's *adjunctus*. In November 1776, Hell explained to Bernoulli that to replace his two former assistants "I have received only one, the adjunct Anton Mayr. He is an ex-Jesuit, but will need to be instructed in astronomical calculations first" (a rather peculiar comment on an individual who had already served a period as the director of an observatory).[77] It appears that these instructions were no success, for after 1777 Mayr is no longer mentioned as Hell's assistant in the *Ephemerides*.[78] His subsequent whereabouts are uncertain, except that he published a book on poisonous frogs in Vienna in 1783. He is said to have died there, but not even the year of death is known.[79]

The career of another representative of the Graz university, Triesnecker is far better known. Born in Mallon close to Kirchberg am Wagram in Lower Austria, he entered the Society of Jesus in 1761 and studied philosophy in Vienna and mathematics and languages in Trnava. In 1770–71, he taught humanities in Linz before enrolling as a student of theology in Graz. Despite the suppression of the order, von Triesnecker continued his studies to become a doctor of philosophy in Graz in 1775. Von Triesnecker's biographer has not been able to

74 According to Michaela Scheibl at the Universitätsbibliothek Graz, his real name was not Anton, but "Alois Mayr." Under this name, on April 9, 1774, the ex-Jesuit Mayr was granted a salary of five hundred gulden to serve as professor of astronomy in Graz. Communication by e-mail from Michaela Scheibl to Per Pippin Aspaas, January 17, 2011.

75 Fischer, "Jesuiten-Mathematiker in der Deutschen Assistenz."

76 Schreiber, "Jesuit Astronomy (Part I)," 16.

77 Hell to Bernoulli in Berlin, dated November 30, 1776 (UBB).

78 It may be this adjunct Father Hell refers to in a letter to Wargentin in Stockholm, dated Vienna, July 29, 1778 (CVH): "Lacking assistance from my adjunct, who is constantly ill, I have not had the time needed to write scientific works."

79 Information on Anton Mayr, unless otherwise stated, has been found in Cornelia Maria Schörg, "Die Präsenz der Wiener Universitätssternwarte," 100; Fischer, "Jesuiten-Mathematiker in der Deutschen Assistenz" (Schörg has not used Fischer); Wurzbach, *Biographisches Lexikon* (1868), 18:82–83.

establish his whereabouts in the interval from 1775 to 1780, in which year (or early in the next one at the latest) he emerged as the adjunct of Hell in Vienna. Von Triesnecker was to stay in this role throughout the 1780s and early 1790s. After Hell's death in 1792, he inherited the position of imperial astronomer, and kept it until his own passing in 1817. As an editor of the *Ephemerides* and its appendices, von Triesnecker loyally followed the principles that had been laid out by his predecessor until the series eventually had to be discontinued in 1806 as a result of financial problems caused by the Napoleonic Wars.[80] Unlike Mayr, von Triesnecker appears to have been a success as an adjunct. Exactly who taught him astronomy is not known, but it is tempting to conjecture that he learned the rudiments of astronomy in Graz before he was called to Vienna at the age of thirty-five. Like Liesganig, von Triesnecker was to become an active surveyor in the service of the state: in the 1790s and 1800s, he took part in field works in both Galicia and Lower Austria.[81]

In the Kingdom of Hungary, developments for former Jesuits were slightly more auspicious than in Austria.[82] The leading astronomer on Hungarian soil, Franz Weiss, remained the director of the university observatory in Trnava until 1777, when it was decided that the university itself was to be moved to Buda. A new observatory was then constructed at the new Royal Palace in Buda, with the imperial astronomer taking part in the construction process by personally traveling to Buda and providing advice in the spring of 1777.[83] By 1779, construction works were finished. Observations began in 1780, with Weiss the undisputed director. Sajnovics was to remain in the background, and although he did publish a textbook of astronomy in 1778,[84] he never received a chair as a professor of astronomy, far less the title "royal astronomer," which he had dreamed of a few years earlier. Whether Sajnovics formally took over as director

80 On von Triesnecker's career, see Wurzbach, *Biographisches Lexikon* (1883) 47:197–99; Schörg, "Die Präsenz der Wiener Universitätssternwarte," 83–86; Nora Pärr, "Wiener Astronomen: Ihre Tätigkeit an Privatobservatorien und Universitätssternwarten," Diplomarbeit (Vienna: Geisteswissenschaftliche Fakultät der Universität Wien, 2001), 41–43; Kastner-Masilko, *Triesnecker*, passim. Kastner-Masilko's biography should, however, be used with caution, see Per Pippin Aspaas's review in *Beiträge zur Astronomiegeschichte*, ed. Wolfgang R. Dick and Jürgen Hamel, 9, Acta historica astronomiae 36 (2008): 269–73.

81 Kastner-Masilko, *Triesnecker*, 116–23.

82 For an overview, see Paul Shore, "Enduring the Deluge: Hungarian Jesuit Astronomers from Suppression to Restoration," in *Jesuit Survival and Restoration: A Global History 1773–1900*, ed. Robert A. Maryks and Jonathan Wright (Leiden: Brill, 2015), 148–61.

83 Hell to Bernoulli in Berlin, dated Vienna, June 20, 1777 (UBB).

84 János Sajnovics, *Idea astronomiae* (Buda: Landerer, 1778); reprint with a Hungarian translation, ed. Rezső Nagy (Székesfehérvár: n.p., 1993).

in the interval between Weiss's passing in January 1785 and his own death in May of the same year is unclear.

After Weiss's departure for Buda in 1777, a former assistant of his and another ex-Jesuit, Franz Taucher (1738–1820), took over as director at the observatory in Trnava. Originally from Cluj, Taucher was educated in Trnava during the flourishing period of the Austrian province. When Sajnovics left for Vardø in 1768–69, Taucher rose to the rank of adjunct and finally director. After Weiss and the rest of the university staff and students had left, Taucher carried on a dreary existence at the former university compounds until the year 1785, when Weiss passed away.[85] He then brought with him the remaining instruments from the Trnava observatory to Buda, where he once again followed in the footsteps of Weiss as director of the university observatory, a position he retained until his retirement in 1806.[86] After 1785, the observatory of Trnava was neither equipped nor manned. The team in Buda included an assistant—first to Weiss and then to Taucher—a Hungarian-Croat ex-Jesuit born in Zagreb, Ferenc Xavér Bruna (1745–1817), appointed as professor of mathematics in 1798 and even emerging to the rector's seat in 1811.

The downfall of the Jesuit order thus prevented what might have become a "second wave" of observatory establishments in Habsburg-ruled lands after the "first wave" in the period from the mid-1730s to the mid-1750s. Without the resources of the Society of Jesus, it was up to the state or the still surviving orders to fund new institutions. The claim that the status of the ex-Jesuits in astronomy remained unchallenged is true in the sense that there were no obvious inheritors or competitors. It is, however, correct only from a strictly internal-scientific point of view. Seen from another angle, the Jesuits had now lost their ability to decide for themselves, since all former colleges, including their observatories, had been taken over by the state. The imperial astronomer himself was never removed, but other Jesuit astronomers became more vulnerable, which may be illustrated with a few further examples.

The title page of the *Anni 1776* volume (published 1775) of the *Ephemerides astronomicae* states that this particular issue had been "determined through calculations made under the direction of Maximilian Hell, by the Honorable Freiherr Ignaz Baron von Rain (1737–after 1776) and Franz Güsman (1741–1806),

85 Taucher's letters to Weiss in Buda from this period (e.g., those dated Trnava, August 29, 1776, May 5, and December 4, 1784) offer dark reading. Witness, for example, his constant fear of a decree ordering the closing down of his observatory; his sentimental account of the celebrations of Saint Loyola, patron saint of the Jesuit order; or his stubborn refusal to give Emperor Joseph II, sworn enemy of the Jesuits, access to the observatory during his visit to Trnava in 1784. Vargha, *Correspondence de Weiss*, 1:127–28, 2:210–13.

86 Vargha, *Correspondence de Weiss*, 2:226–27.

astronomers of the university." The former, born in Rijeka (Flumen, Fiume, Vitopolis, Szentvit, Sankt Veit am Pfaum) in present-day Croatia, entered the Society of Jesus in 1753.[87] Of noble birth, he was educated at the Theresianum in Vienna, presumably with Scherffer as his foremost teacher in astronomical subjects. He is probably identical with a certain *M. Rain S.J. repetens matheseos* (M[agister?] Rain of the Society of Jesus, teacher of mathematics) that observed the Venus transit from the Imperial Observatory in 1761.[88] The same Rain is also said to have served, this time as "second assistant," at Hell's observatory in the year 1770, during Hell's absence in Denmark–Norway.[89] In the university years 1771–73, however, Rain held the chair as professor of mathematics at the college in Linz, while a letter from Hell to Bernoulli reveals that by 1776 Rain had already departed for a post as a professor of mathematics in Lviv.[90] Rain here served as an assistant of Liesganig in his survey of Galicia, where he may also have ended his days.[91] In any case, his post-suppression collaboration with Hell and the *Ephemerides* was limited to the *Anni 1776* volume. The other character mentioned in the same quality in the same volume, Franz Güsman (or Güssmann, Gueßmann, Guessmann) was born in Wolkersdorf (just north of Vienna), and entered the Society of Jesus in 1757. He was preparing for departure for the Jesuit missions in China just as the suppression arrived in 1773.[92] His participation in the calculations of the *Ephemerides* appears to have been limited to the year in question. By November 1776, Güsman had left Vienna and arrived—along with Rain—in Lviv to take up a chair in physics.[93] Also like Rain, he took part in Liesganig's survey of Galicia from the late 1770s onward. In 1787, he returned to Vienna, allegedly because of health problems, and was appointed professor of experimental physics at the Theresianum.[94]

87 Dates according to Steinmayr, "Geschichte der Universitätssternwarte," 199–200. The year of 1757 as Rain's year of birth as given in Fischer, "Jesuiten-Mathematiker in der Deutschen Assistenz" must be a misprint, for he is also said there to have entered the Society in 1753.

88 Hell, "Observatio transitus Veneris [...] 1761," 17. In a letter to Taufferer in Ljubljana, dated Vienna, April 6, 1761, Hell speaks of a *bidellus* (assistant, servant) by the name of Rain. One of Hell's biographers also states (sadly, without source reference) that Hell received assistance from "Ignác Rain" in 1760–61. Ferencová, *Maximilán Hell*, 29.

89 Steinmayr, "Geschichte der Universitätssternwarte," 200, likewise without source citation.

90 Hell to Bernoulli in Berlin, dated Vienna, November 30, 1776 (UBB).

91 Information on Rain, unless otherwise noted, has been culled from Fischer, "Jesuiten-Mathematiker in der Deutschen Assistenz."

92 Steinmayr, "Geschichte der Universitätssternwarte," 181.

93 Hell to Bernoulli, dated November 30, 1776 (UBB). The content of this letter is reiterated (in French) in the second cahier of Bernoulli's *Nouvelles littéraires* (1777): 8–9.

94 Haberzettl, *Stellung der Exjesuiten*, 168. See also Brosche, *Der Astronom der Herzogin*, 22–23.

He taught partly there and partly at the Wiener Technische Hochschule, until he retired and eventually died in Seitenstetten.[95]

However limited the evidence we have on some of these figures, it is striking to see both that Hell still had some means left to recruit his collaborators from former Jesuit circles, and the limits of those means. As an ex-Jesuit, he was at least not entirely isolated from his former Jesuit network. But he had difficulties retaining these assistants: when the state called them to imperial purposes outside Hell's sphere of influence, they disappeared from sight. The infrastructure for practical astronomy was still in place, and the very continuation of the *Ephemerides* is strong testimony that theoretical work was being done at Hell's observatory in Vienna. But Hell's work pace was definitely affected negatively, and—above all—as a "nodal astronomer" he had lost much of his momentum and impact. The fate of observatories across the Habsburg lands depended on the preferences of other decision-makers. The Jesuit observatory of Graz was quickly closed, and those of Trnava and Vienna followed in its wake. Instead of growth in the number of observatories, there came a period of decline. The Benedictine order made no considerable expansion in astronomy, either: only a minor "satellite" was added to its prestigious observatory of Kremsmünster in nearby Lambach. New university observatories in Buda and Lviv, both run by ex-Jesuit staff, were neither sufficient to foster a new generation of astronomers, nor provide career opportunities to those trained elsewhere.

Secular talent thus also hardly found more opportunities in the Vienna-ruled territories after 1773 than earlier. An example is the highly gifted Franz Xaver von Zach, whom we have already met briefly in conjunction with the posterior defamation of Hell's Venus observation results. Between his fallout with Liesganig in Galicia and his European journey, which eventually managed to secure him sufficient patronage to embark on a career in Germany, von Zach traveled to Vienna in 1781–82 in search of a position, and appears to have visited Hell, to no success.[96] Having finally established himself in Gotha and become one of Europe's leading astronomers by the turn of the century, von Zach's bitterness toward the Jesuits never waned, and in his publications he continuously accused them of devious scholarly practices as well as nepotism designed to keep outsiders out of science.[97]

95 Information on Güsmann, unless otherwise noted, has been taken from Wurzbach, *Biographisches Lexikon* (1860) 6:21–22; cf. Schörg, "Die Präsenz der Wiener Universitätssternwarte," 99.

96 Brosche, *Der Astronom der Herzogin*, 31.

97 See Brosche, *Der Astronom der Herzogin* (with ample references).

Some of von Zach's accusations toward Liesganig and Hell sound, as we shall see, like resonances of the contemporary anti-Jesuit propaganda pursued by freemasons (von Zach was, by the way, a freemason himself). However, it should be stressed that it was not only the ex-Jesuits who made things difficult for aspiring astronomers in Central Europe in the final quarter of the eighteenth century but factors that also affected former Jesuits themselves. The utilitarian approach promoted by Joseph II implied some reluctance to direct resources toward sciences that were not "useful"—if one is to believe Hell, who complained about this situation in a letter to Bernoulli in 1777:

> The above-mentioned damages that have been inflicted upon Austrian astronomy by the destruction of my order are, however, less grave than the fate that would have befallen the observatories that once upon a time were erected by the Society, namely the ones in Bohemian Prague, in Styrian Graz, and at the academic collegium in Vienna, in case I had not—encouraged by a hope that our Society will one day be brought back to life—resisted it with all my might. For you see, there are enemies of the Society and of the hard sciences who have persuaded Her Highness the Empress that these three observatories, which our Society once erected and equipped, were worthy of being destroyed and demolished because they allegedly were superfluous and thus extracting worthless funds for their conservation. Enough worthless funds, they said, were already being spent on the Imperial Observatory of Vienna and on the observatory in Trnava, for "the sole purpose of retaining reputation abroad." And in order to eliminate astronomy along with the Jesuits, they claimed that astronomical observatories were useless to rulers except for those who have a fleet at sea or are engaged in maritime trade; accordingly, since the lands subjected to Austria lack these properties, the observatories were of no use, the astronomers were of no use, and all funds were unworthy of being wasted on astronomy: as if astronomy had no use except for navigation![98]

In Hell's rendering, the dominant ideology under Joseph II had little respect for the heritage of Jesuit science not merely because it was Jesuit but because

98 Hell to Bernoulli in Berlin, dated Vienna, February 15, 1777 (UBB). Transcriptions in Aspaas, "Maximilianus Hell," 176, and Aspaas, Posch, and Müller, "Astronomische Observatorien der Jesuiten in der 'Provincia Austriae,'" 108, which were based on scannings from the University Library of Basel, contain conjectures that have been verified during a recent inspection of the original manuscripts.

of its allegedly non-utilitarian character. We have seen that although Hell lingered in Vienna, Liesganig and Weiss were moved to Lviv and Buda, respectively, upon orders from the state, and at least in the case of the former involved in a project immediately serving practical purposes of the state. None of these three places are indeed likely to have been particularly welcoming to "new men" in astronomy; there were enough former Jesuits around to recruit for the few vacancies that existed. Altogether, it would be harsh to subscribe to von Zach's verdict that the nepotism of ex-Jesuits was the main problem. If the observatory of Buda is discounted as a replacement for that of Trnava, we find that the only new facility for institutional astronomy created in the former Austrian province of the Society of Jesus in the fifteen years following the year 1773 was founded and funded not by the modernizing state, but by Eszterházy, the conservative bishop of Eger in eastern Hungary. In the last chapter, we shall examine the development of Hell's relationship with this new hero of his, besides pursuing the imperial astronomer in the labyrinths of metropolitan and provincial politics and controversies during the final period of his career.

CHAPTER 8

Coping with Enlightenments

1 Viennese Struggles

Hell's own engagement with the problem of the general suppression of his order began as a recurrent theme in letters written during his Arctic expedition to the general of the Jesuit order in Rome, to Bishop Gondola in northern Germany, and to Jesuit friends in Vienna. Hell assured his correspondents that he was doing what he could to make a good impression of the Society of Jesus in Denmark–Norway. When rumors had it that the young king Christian might visit Rome in addition to London and Paris during his grand tour of 1768–69, Hell was full of hope that this would bring good news concerning future policies toward Catholics (and Jesuits) in the lands ruled by the Copenhagen court.[1] As late as the spring of 1773, in a letter to Weiss Hell assured his confrère that

> things are going quite well with our Society, we are expecting more joyful news from Rome any day soon. One thing is certain: a declaration that is most favorable toward the Society has long since been sent from our court to Rome, not directly to the pope, as a false rumor has it, but to the kind of men from whom the pope is likely to be told about it, and by now he has been told. They say they have learned from a French letter something I think is highly likely to be true, namely that an instruction has been sent from the king of the French to his ambassador in Rome [François-Joachim de Pierre] Cardinal de Bernis [1715–94] that he shall from now on refrain from all negative actions against the Society vis-à-vis the pope; […] after a week or two, we will learn from official news exactly what impression the declaration of our court has made in Rome.[2]

Fifteen weeks later, on July 21, Pope Clement XIV issued the *Dominus ac redemptor noster*, the draft of which had in fact been ready since the previous

1 See the letters edited by Pinzger, *Hell Miksa*, 2:48, 76, 80–81.

2 Hell to Weiss in Trnava, dated Vienna, April 6, 1773. Pinzger, *Hell Miksa*, 2:116–17. Neither the supposed "declaration" of the Viennese court, nor the "instruction" by the king of France, could be identified. As Hell's claims run counter to the current state of scholarship on the suppression of the Society of Jesus, they are puzzling.

© PER PIPPIN ASPAAS AND LÁSZLÓ KONTLER, 2020 | DOI:10.1163/9789004416833_010
This is an open access chapter distributed under the terms of the CC-BY-NC-ND 4.0 License.

December, bringing an end to the Society of Jesus in all Catholic countries. On September 10, 1773, the suppression of the order in the entire Habsburg monarchy was officially announced and all its estates taken over by the state.[3]

If Hell was unable to read the signs of the times before the summer of 1773, he seems to have made the first steps of adjustment quickly: half a year later, we already find him drafting plans for an Austrian academy of sciences, to be established in Vienna.[4] This was already the fourth time such plans were entertained. The project drafted by Leibniz in the beginning and von Petrasch in the middle of the century were mentioned in Chapter 2. Apparently, in 1764 Hell himself wanted to revive the idea of an academy of sciences, again without success.[5] According to the report of a Danish visitor of Hell's, this attempt failed because Hell rejected an (unnamed) minister's insistence that members of the academy should be appointed by the government.[6] The government decision to review the possibility of establishing an academy of sciences in Vienna in January 1774 may have been actually triggered by the suppression of the Society of Jesus: scientific life in Austria would have to be reorganized anyway. Hell's invitation to participate in the project can be understood as a token of the measured disposition toward ex-Jesuits as individuals, urged by Kaunitz and pursued with some consistency as mentioned above. After all, the court astronomer was a significant asset: as of 1773, he was at the height of his fame in the Republic of Letters, elected a member of prestigious scientific bodies in Copenhagen, Trondheim, Stockholm, Göttingen, and Bologna, as well as a corresponding member of the main scientific academy in the Catholic world, the Académie Royale des Sciences in Paris. Besides, Hell was not only an astronomer of international reputation but also an encyclopedist in the sense that his research interests encompassed historical research, language studies, geophysics, meteorology, magnetism, electricity, and so forth. As such, by strictly academic standards he hardly had any local competitor in the same league for the task.

Hell's "rival" in forging plans for an academy in the spring of 1774 was a recently appointed young professor of universal and literary history at the University of Vienna, Ignaz Mathes von Hess (1746–76), who opted for an institution consisting of two branches, a "physical-mathematical" and a

3 For a detailed chronological account, see Gerhard Winner, *Die Klosteraufhebungen in Niederösterreich und Wien* (Vienna: Herold, 1967), esp. 33–48.

4 The literature includes Feil, *Versuche*, 45–69; Haberzettl, *Stellung der Exjesuiten*, 182–85; Steinmayr, "Geschichte der Universitätssternwarte," 267–70.

5 See Joseph Feil, *Zur Gründung einer Akademie der Wissenschaften unter Maria Theresia* (Vienna: Gerold, 1860).

6 Hviid, *Andreas Christian Hviids Europa*, 370 (entry on November 21, 1778).

"historical-philosophical" one. The academy, von Hess argued, ought to be financed either by issuing calendars, or by imposing a nationwide tax on the book trade. Hell's proposal[7] was more modest in scientific terms but seemingly more detailed with regard to financial planning. He argued that the Viennese academy, like its older sisters in London and Paris, ought to focus on "physikalisch-mathematische" disciplines—astronomy, geometry, mechanics, physics, botany, anatomy, and chemistry—only. Hell established this proposition on epistemological and methodological grounds. The goal of a learned society is "the elevation of the sciences on a higher level; and the society achieves this goal by new findings and discoveries, which do not yet exist, in the sciences" by the application of the spirit of observation and invention that imbues men of science.[8] Fields of learning that, in the strict sense, are not suitable for making such new discoveries—like theology and metaphysics (Hell is emphatic about the need for a sharp distinction between knowledge and faith), as well as the arts and antiquarian studies—should not be mingled in the academy, and if they are to be organized in a learned society at all, it ought to be a separate one. Hell asked rhetorically:

> Should the refined mind, that possesses no knowledge in mathematics, physics, astronomy, mechanics etc., follow lectures and profound demonstrations, watch subtle experiments, formulate judgments on these, of which he understands nothing and grasps nothing, and which have no influence on his field, nor any use for it; and similarly, should the profound astronomer, mathematician, geometer, physicist admire and appreciate the fine essays on the improvement of the German language, orthography, poetry, and theater?[9]

Besides the thematic focus, Hell also pressed for following the London and Paris models in the ethos of sociability as the basis of the convening and the operation of the academy as a "friendly association of a few men of superior learning" who "assemble voluntarily as friends thanks to their harmony of temper." At first sight, this closely resembles the enlightened values cherished

7 The full text of Maximilian Hell, "Patriotischer Plan einer Kayserlich-Königlichen zu Wienn errichtenden gelehrten Gesellschaft, oder Academie der Wissenschaften" is available in Hans Schlitter, *Gründung der kaiserlichen Akademie der Wissenschaften: Ein Beitrag zur Geschichte der vormärzlichen Österreich* (Vienna: Hölder, 1921), 66–112. Excerpts (the substantive parts, without the lengthy sections on organization and procedure) have been published in Lengyel and Tüskés, *Learned Societies*, 67–75.

8 Lengyel and Tüskés, *Learned Societies*, 68.

9 Lengyel and Tüskés, *Learned Societies*, 69–70.

(though not always practiced) in the Republic of Letters. More pragmatically and likely, it may have been intended as an "early warning" that, just as a decade earlier, Hell would not welcome any attempt by the government to appoint academicians at will: "From this, it is clear why sovereigns who established a learned society in their states and took it in their high protection, themselves made it a rule not to harm the free election of members, and refrained from nominating any new member without the voluntary consent of the society."[10] Finally, the repeated emphasis on the personal bond and *esprit de corps* in the proposal—"friend," "friendship" appears no fewer than eight times in the three paragraphs explaining what a scientific society is—also prepares the ground for Hell's own recruitment strategy, targeting kindred spirits. Half of the proposed salaried members (initially, there were to be only six of them—in the longer run, Hell planned three in each of the seven classes, plus two secretaries and a treasurer) were ex-Jesuits: besides Hell himself, Scherffer and Pál Makó (1723–93), a professor of mathematics and philosophy from the Theresianum. The most prominent of the non-Jesuits was the professor of chemistry and botany and director of the Viennese botanical gardens, von Jacquin. The team also included the court mathematician, Joseph Nagel (1717–95), and the military engineer and general Leopold Freiherr von Unterbergen (1736–1819).

Hell devised a complex financial model to support the academy. Some of the money was to emerge from the so-called Jesuit fund (*Jesuitenfond*) created from the income of the confiscated Jesuit property, and a portion of the profit from the sales of the newspaper *Wienerisches Diarium* was also to be turned to the noble end. Additional money was promised by the Kingdom of Hungary, on condition that one-third of the members of the academy were to be Hungarians and half of these Protestants. However, Hell hoped to raise the bulk of the funding from what would have amounted to a complete reform of the production and dissemination of calendars. Calendars were big business in the period, provided one had the means of buying from the state a privilege to issue one and having it renewed at ten-year intervals. Hell now proposed the elimination of the existing system, and the establishment of a Calender-Administrations-Collegium out of the members of the academy, with himself as the *collegium*'s director. This would have ensured expert overseeing of the contents of the calendars—so that instead of a store of idle telltale and superstitious beliefs, they could become a means of disseminating useful knowledge, a goal that resonates with the instruction for the imperial and royal astronomer issued nearly two decades earlier. Besides, through the collection

10 Lengyel and Tüskés, *Learned Societies*, 68.

of a "calendar tariff" in exchange for this service, the academy would have made a hefty income.[11] This deal would not have been unique in eighteenth-century Europe: in Sweden, Hell's colleagues had secured income for the Academy of Sciences in Stockholm in exactly the same manner.[12]

The first and the second source initially seemed rather unproblematic, whereas the Hungarian proposal was in any case insufficient to finance the entire project. It was the third and most substantial source of income that in the end toppled the entire project. The government committee on academic affairs (Studien-Hof-Commission)[13] discussed the matter on November 14, 1774, and four days later a calendar privilege was issued for the academy.[14] Already in the same year, Hell published his first German-language calendar, and soon he produced others: an almanac for the knightly order, a *Physikalischer Almanach* (Physical almanac), a chronological almanac, an almanac for children, and an almanac with riddles.[15] Hell also informed the public about the expected benefits of the scheme in announcements in the Viennese newspapers, using his new official title.[16] There were thus hopes that the proposed scheme would be adopted, but the optimism soon began to subside. While provincial authorities were instructed to make sure that upon the expiry of existing calendar privileges their publishers stop issuing them, they were also requested reports on the print-run and pricing of existing calendars. From the responses, Hell calculated that the predictable income was substantially short of what had been expected:[17] twenty-four to twenty-six thousand florins, while

11 A large number of documents have been preserved among the holdings of the Österreichisches Haus-, Hof- und Staatsarchiv. Allgemeines Verwaltungsarchiv (HHStA AVA). Studienhofkommission. 75: Wien Akademie der Wissenschaften (Sig. 15); 132: Protokolle der Studienhofkommission (Sig. 28.)

12 Lindroth, *Vetenskapsakademiens Historia*, 1:1, 102–10.

13 The committee at this time consisted, among others, of long-standing and experienced servants of the Theresan reforms, such as Kollár and law professor Martini, as well as more recent recruits like Rautenstrauch—but also Ignaz Müller, by now dismissed as the confessor of the empress and an ex-Jesuit, but still the abbot of the prestigious Viennese Stift St. Dorothea.

14 For the protocols, HHStA AVA Studienhofkommission, 132. Sig. 28. fols. 724–25; 75. For the privilege, Sig. 15. Akademie. Kalenderwesen 1774–1776: 1775. No. 2, fols. 1–2. "Privilegium impressorium privativum für die […] Akademie der Wissenschaften auf alle Kalender."

15 Sommervogel, "Hell," 256. On the encompassing meaning of "physical," see above, 321.

16 See, e.g., *WD*, no. 92 (November 18, 1775): 8.

17 The reason for this was the amount of state duties included in the price of almanacs. Hell requested exemption from these duties. He, however, never requested "to be relieved of responsibility" as claimed in the introduction to the publication of the academy plan in Lengyel and Tüskés, *Learned Societies*, 67.

the academies of Paris, London, and Berlin were maintained from about twice as much.

The other difficulty was that the whole scheme implied a deep conflict of interest between Hell as the future "director of calendar issues" and the man on whom the continuous publication of the *Ephemerides* depended: court publisher and printer Johann Thomas von Trattner (1717–98), who made fortunes on the lucrative trade in calendars. Von Trattner, arguably the most successful book-dealer of the time in Austria,[18] seems to have spared no effort to ruin the financial scheme, and by implication the academy project. One of his strategies was to annoy Hell by delaying the delivery of the 1775 volume of the *Ephemerides*. In a letter to Weiss, Hell felt the need to thus apologize and avert the responsibility:

> The *Ephemerides*, which were finished at the end of the year, I have not yet been able to acquire from Trattner despite repeated requests. I suspect that he has deliberately chosen to cause me this bother because he has learned of the imperial decree, by which all the calendars that used to be printed throughout the hereditary lands have now been earmarked to finance the academy of sciences that is to be established here in Vienna. In this way, he has been bereaved of an income of thousands of florins. As soon as I receive these *Ephemerides*, I will send a copy to my Highly Honorable Mister Colleague [i.e., Weiss] in Trnava.[19]

Trattner did not stop there. During an audience, he "moaned and begged" the empress to revise the plans, unless she wanted to send him, together with his creditors, to bankruptcy.[20] This story is confirmed by a Danish theology student, Andreas Christian Hviid (1749–88), who visited Vienna from October 27, 1778 to January 20, 1779 with the aim of transcribing ancient manuscripts. His travel diary is crammed with detailed information not only on archives and libraries but also on the intellectual elite of the Habsburg capital. Hviid met Hell on several occasions, both in the home of the highly sociable papal nuncio Giuseppe Garampi (1725–92) and in the observatory. Despite their diverging views on religion and politics—Hviid was a Protestant and highly supportive of Enlightenment ideas—he describes Hell in sympathetic terms. Hviid was

18 See, e.g., Peter R. Frank and Johannes Frimmel, *Buchwesen in Wien 1750–1850: Kommentiertes Verzeichnis der Buchdrucker, Buchhändler und Verleger* (Wiesbaden: Harrassowitz Verlag, 2008), 198–200.

19 Hell to Weiss, January 27, 1775, in Pinzger, *Hell Miksa*, 2:118.

20 Feil, *Versuche*, 65.

allowed to look through Hell's works in progress on the *Expeditio litteraria* and heard him praise Danish science. An entry in the diary also includes a rumor on the failed efforts to establish an academy of sciences in Vienna:

> Professor … tells me that Hell a few years ago was given orders to draw up a plan for the establishment of an academy of sciences in Vienna. In it, physics, astronomy, and mathematics were to be included, just like in the English and French academies. He did draw up this plan, and suggested for the funds of the society the income from the almanacs, which in the first year probably had run to some forty thousand *Reichstaler*, but which would possibly increase to an annual eighty-eight thousand in the future. A publisher named Trattner was publishing the almanacs of the entire monarchy. He had access to the empress, and having heard rumors of the society, he demanded an audience at her place. Upon entering the chamber, he fell to his knees before the portrait of Emperor Francis, which was hanging there on the wall, wailed to it as if to the living emperor, telling him that he was going to lose his monopoly and all his income be diverted for physics and heresy. The empress thereupon rejected Hell's plan.[21]

"On the other hand," Hviid presumes that "there may have been a hint of Jesuitism involved. For if the first members of the academy came from that company, then the rest were likely to be selected from the same regiment as well."[22] Following Hviid, one may interpret Hell's plan of 1774–75 as, at least in part, an attempt to retain the Jesuit heritage. In his letters to Bernoulli and Weiss from this period,[23] Hell emphasizes that a part of the funds of the academy were to be used to preserve the Jesuit observatories in Graz, Vienna, and Prague, whose directors were going to be members of the academy as well.

If there was, as seems to have been the case, a Jesuit bias in Hell's academy project, it did not escape the attention of the highest decision-maker. True, throughout the autumn of 1775, Hell still maintained steady communication with the chancellery on the subject of the calendar, and the plan of setting up the Calender-Administrations-Collegium was on the agenda of the Studien-Hof-Commission as late as in April 1776. The committee took pains to find

21 Hviid, *Hviids Europa*, 370 (entry on November 21, 1778). The manuscript version of Hviid's diary has not survived. Several names of persons are deliberately left out in the published version of 1787, as here. See the introduction of Michael Harbsmeier and Morten Petersen to the annotated edition referred to here.

22 Hviid, *Hviids Europa*, 370 (entry on November 21, 1778).

23 Hell to Bernoulli in Berlin, dated Vienna, March 1, 1775 (UBB); Hell to Weiss in Trnava, dated Vienna, January 27, 1775 (Vargha priv.).

alternative sources of funding, but ultimately all this was to no avail. Already in a note on a memorandum of the committee of November 25, 1775, Maria Theresa seems to have made up her mind on the matter. A reference to the "poor bookkeepers and bookbinders" and the stress of the need to raise funds "without oppressing the citizens" gives the impression that her heart had indeed been softened by von Trattner's appeals. However, she also adds that she

> couldn't possibly decide to launch an *accademie des scienses* [*sic*] with three ex-Jesuits and a professor of chemistry, however worthy, we should be a laughing-stock in the world [...]. The *accademie* [...] should present a regular plan on how, and what subjects and objects, this *accademie* would treat with benefit and honor. I find the Abbé Hell not strong enough, an *accademie* that is worse than the already existing ones would be worth neither the costs nor the effort.[24]

Despite the comment on Hell's qualities, Maria Theresa's fulmination should not be taken as an expression of contempt for Jesuits or Jesuit science, but rather as a sober acknowledgment that soon after the suppression of the Society of Jesus, establishing an academy effectively under Jesuit control would be a strange and inconsistent step. From Hell's point of view, the result was all the same: there was to be no Austrian Academy of Sciences. The empress renewed the patents of the principal book dealers, among them the prosperous von Trattner. Hell was at the same time allowed to publish his own calendars.

The empress's words show that besides the embitterment of a representative of powerful commercial interests in the realm, the ruler's decision to abandon the project of the academy was also motivated by considerations that had to do with the substance of the enterprise. Ever since Hell had arrived in Vienna in 1755, he had felt the unfailing support of Viennese officialdom for his projects. The outcome of the strenuous efforts he was making over two and a half years to establish an academy of sciences—which, from his perspective, may indeed have been an antidote to the blow that Jesuit learning had suffered as a result of the suppression—demonstrated that such support was no longer unequivocal and to be taken for granted. The special relationship with the court and the dynasty became broken.

Even among such circumstances, Hell's personal merits, and the scientific contribution and representational value of his institution, continued to be acknowledged and utilized. A case in point is a highly important diplomatic visit

24 HHStA AVA Studienhofkommission, 75. Sig. 15. Akad. d. bildenden Künste. 1775: 3007. fol. 10^{v}. Cf. Feil, *Versuche*, 64; Evans, *Austria, Hungary, and the Habsburgs*, 50.

in Vienna by Grand Duke Paul of Russia (1754–1801, r. as tsar 1796–1801) along with his duchess Sophia Dorothea of Württemberg (in Russia re-named Maria Feodorovna [1759–1828]), as well as the duke of Württemberg and his family, at the turn of 1781–82.[25] The high stake for Joseph II was to detach these realms and dynasties from their Prussian sympathies, and one of the means was to arrange the marriage of a niece of Charles Eugene of Württemberg (1728–93, r.1737–93), Elisabeth (1767–90), to Joseph's nephew Francis (1768–1835, r.1792–1835) who—as the emperor lacked a male heir—by this time was a long-term candidate for the imperial throne. Accordingly—and contrary to Joseph's character and inclinations—lavish entertainment was carefully designed, with feasts, balls and outings, visits to the imperial collections, opera performances, a demonstration of Farkas (Wolfgang von) Kempelen's (1734–1804) famous chess-playing machine, and a piano competition between Mozart and the Italian musician and composer Muzio Clementi (1752–1832). Besides these attractions, the program included two visits to the university: a formal one at the university's annual celebration on the day of Immaculate Conception, and an informal one, on December 15, 1781, to the observatory. Hell showed the guests around and gave them an account of the "Lapland expedition," whereupon "His Majesty deigned to take the place of the teacher and, to the admiration of all, described the many instruments there, particularly the meridian line, and the use of those that H.M. had brought to the observatory from the museum of prince Charles of Lorraine."[26] Despite such occasional honors, the fate of the academy plans showed that Hell's scope of action on the institutional front had narrowed in the capital, while he was also becoming one of many respected but equal agents on a public scene that had its own rules of emulation, competition, recognition, and conflict resolution. This is also how he is recorded by the enthusiastic portraitist of that scene—from academic and polite sociability and literary life, through manners and morals, to hygiene and crime, and many more—writer and librarian Johann Pezzl (1756–1823) in his "sketches of Vienna": as one of the remaining former Jesuit savants still capable of enhancing the renown of the university.[27]

One of the developments on that scene that Hell followed with a blend of dismay, consternation, and accommodation was the spread of German and the shrinking space for Latin. As a Hungarus, he wished to see Latin prevail as the *lingua franca* of his multi-ethnic fatherland. As a partisan of the Catholic Church, he savored a glorious past in which there existed a single, universal

25 For a detailed account of this episode, see Beales, *Joseph II*, 2:126–32.

26 Beales, *Joseph II*, 2:131. Cf. *Wiener Zeitung*, no. 101 (December 19, 1787): 10.

27 Johann Pezzl, *Skizze von Wien* (Vienna: Krauss, 1787), 5:746.

language for the servants of God. As a representative of the Republic of Letters, he saw the benefits of Latin for communication across linguistic and political barriers. Thus, in his arguments for the preservation (or restoration) of Latin, his old loyalties ran together, and while his mother tongue was German, he saw little benefit of it within this matrix. For pragmatic purposes, back in the early 1760s he explained to Bishop Eszterházy that if there was any modern vernacular Balajthi ought to master when the latter came to study with him in Vienna, it was French, "which is of utmost importance for a mathematician."[28] A good decade later, Hell reported that Madarassy was learning French with ease, but struggled to make progress with German. In the end, Madarassy asked the bishop for money to move out of Hell's apartment and hire a room in a private home, so that he could speak the language on a daily basis.[29] Hell did not oppose this, which may be taken as an indication that he was beginning to understand the voice of the times, and the stakes of listening to it. Privately, he still continued to express his reservations about the use of modern vernaculars in learned communication. As Hviid reported in 1778, Hell told him: "Danes always wrote in Danish; this was an impediment to our scientific image abroad [...]. We [i.e., the Danes] should write more in Latin, he argued, or at least in French, which is also a universal language."[30] Hell did so despite the fact that his own knowledge of French, as we learn from Hviid, was passive: during dinners at Garampi's, he spoke "kitchen Latin" only, and that "in an unusual rapidity," since "this erudite does not speak French."[31] Even as late as the early 1790s, in a particularly long and bitter letter to the bishop of Eger, Hell lamented over the dissolution of the Society of Jesus, and what he called the "seminars of Antichrist" (*seminaria Antichristi*) that had replaced the theology studies at the university since the Jesuit professors were removed from their posts. As a result of the implementation of compulsory teaching in German, knowledge of Latin had seen such a rapid decline among university students that even Mass at the university church was now held in the vernacular. As a result, young women attended, and flirted overtly with the students. The fair sex would not have been present, Hell argues, if only the Masses had been celebrated in Latin as they used to be in the good old days before the suppression of the Society of Jesus:

28 Hell to Eszterházy in Eger, dated Vienna, October 24, 1762, FLE, AV 2629.

29 Hell to Eszterházy in Eger, dated Vienna, August 22, 1775 and July 1, 1776; Madarassy to Eszterházy, dated Vienna, April 2, 1776, FLE, AV 2629.

30 Hviid, *Hviids Europa*, 369 (entry on November 21, 1778).

31 Hviid, *Hviids Europa*, 401–2 (entry on December 6, 1778).

> After the discontinuation of the congregations of Mary, which had been introduced by the Society [of Jesus] and which offered schooling in true Christian virtues and morals, there were no exhortations *pro majoribus* until the present year, when such were finally ordered to be held on every Sunday in the university church, but for no more than half an hour, and not aimed at the students, since few of them show up anyway. Instead, they are aimed at women, who occupy the better part of the church, not without scandal, dressed as they are for the seduction of the youth, attracting the gaze of the youngsters by nodding and gesticulating, etc. The cause of this evil is the German language [...]; in case the sermons had been in Latin as they ought to [...], the female sex, ignorant of the Latin tongue as she is, would never have entered the university church at all.[32]

These grumblings of the old man notwithstanding, one cannot help observing that after the suppression of the Society of Jesus, Hell published in German quite extensively and regularly. His issuing of German-language almanacs around 1775 has already been mentioned. In the same period, he also published numerous articles in German-language newspapers, journals, and books. When in 1775 a collection of essays by ex-Jesuit professors, entitled *Contributions to Various Sciences by a Few Austrian Erudites*,[33] was issued in Vienna, Hell apparently welcomed the German rendition of some selected astronomical works of his. After all, his two pieces in this volume had already been published in Latin in the appendices of the *Ephemerides*. Toward the end of his life, at the very same time that he bewailed the widespread decline of proficiency in Latin to Eszterházy, he allowed a colleague in Wrocław, Anton L. Jungnitz, to translate nearly all the appendices of his *Ephemerides* into German and publish them in quick succession, as *Contributions to Practical Astronomy, in the Form of Various Observations, Treatises, and Methods Taken from the* Astronomical Ephemeris *of Mr. Abbé Maximilian Hell*.[34] Hell also discussed astronomy in ordinary newspapers. One increasingly verbose series of articles were published in the *Mannheimer Zeitung* (Mannheim newspaper) and the *Wienerisches Diarium* in late 1777. Here, two ex-Jesuit astronomers, Mayer and Hell, engaged in

32 Hell to Eszterházy in Eger, dated Vienna, November 11, 1791, FLE, AV 2629.

33 Karl Scherffer et al., *Beyträge zu verschiedenen Wissenschaften von einigen Oesterreichischen Gelehrten* (Vienna: Augustin Bernhardi, 1775).

34 Maximilian Hell, *Beyträge zur Praktischen Astronomie, in verschiedenen Beobachtungen, Abhandlungen, Methoden aus den astronomischen Ephemeriden der Herrn Abbe' Maximilian Hell*, trans. and ed. A. [Anton] L. Jungnitz (Breslau: Korn, 1790–93). In 1789, Jungnitz had already published a German translation of Hell's proposal of new constellations in honor of King George III and William Herschel (Vienna: Trattner, 1789).

a discussion of the phenomenon that is nowadays known as double stars.[35] Hell asserted—in response to inquiries from "partly learned, partly curious men"—first, that while on the basis of observations of "satellites around fixed stars" earlier in 1777, Mayer claimed to have discovered a new phenomenon, it had in fact been known at least since the times of Tycho Brahe, as Hell himself had mentioned in a report to the Parisian academy in 1759. What is more, he disagreed with Mayer in his interpretation of the phenomena as "satellites" (*Fixsterntrabanten*, *Nebenplaneten*) and claimed that they were in fact small stars themselves, only seeming to be planets because of their vicinity to larger ones.[36] An anonymously published response in the *Mannheimer Zeitung* called Hell an "unashamed liar" unable to prove his points, and the court astronomer replied in kind: as the author "has revealed his unbearable ignorance, I must deal with him as a teacher with a pupil, and first refer him to a book that every student of astronomy must have in his hand"—namely Lalande's 1771 textbook.[37] Mayer continued publishing (and debating) on the phenomenon in both German and Latin, whereas Hell appears to have withdrawn from the public debate.

In the same year as the controversy over double stars, Hell even had a short spell as an outright popularizer of science in the vernacular, in contributions to the Viennese *Realzeitung*.[38] In the third issue of 1777, the editors announced that from then on, the famous court astronomer would give regular accounts of celestial occurrences, meteorological observations, and other "astronomical news" for those interested in the subject. Hell himself went on to explain that

> as our annual *Ephemerides* are only accessible to those lovers of astronomy who are proficient in Latin, and there are still many lovers of astronomy among our learned German nation who spend their spare time pleasantly and usefully with astronomical observations: so we flatter ourselves that we render a welcome service by the monthly publication of a very brief excerpt [on the above topics].[39]

35 For an excellent analysis of the polemics surrounding Mayer's work on double stars, see Moutchnik, *Forschung und Lehre*, 273–314. For minor corrections, see, however, Aspaas, "Review of Moutchnik." Hell already gave notice to the public about Mayer's observations in the summer of 1777, publishing excerpts from a letter to him by the Berlin astronomer Bode, in which they are mentioned. *Realzeitung*, no. 18 (July 29, 1777): 284–85.

36 *WD*, no. 90 (November 8, 1777): 4–5.

37 *Mannheimer Zeitung*, nos. 93 and 94 (November 20 and 24, 1777); *WD*, no. 99 (December 10, 1777): 9–10.

38 Cf. Haberzettl, *Stellung der Exjesuiten*, 31–32.

39 "Astronomische Nachrichten," *Realzeitung*, no. 3 (January 14, 1777): 44–45.

Hell conscientiously published the monthly reports up to November 1777, when he broke with the journal. As he explained early in the following year in the *Wienerisches Diarium*, this was because "the new authors of this journal have chosen a new plan," namely not to publish anything already available in other Viennese publications. He also announced that the same kinds of reports would from then on be published in the *Wienerisches Diarium*,[40] and the first of these indeed followed right upon the heels of the announcement. For their part, the editors of the *Realzeitung* hastened to clarify that Hell's reports had "hardly anything attractive" to offer.[41] Hell's justification of his decision may well have been a polite veil over his discomfort with the editorial line of the journal in a broader sense: during the following years—no doubt thanks to the influence of von Born, who appeared among its authors in the same year as Hell, and writer Alois Blumauer (1755–98), who became its editor in 1782—the *Realzeitung* was taking an ever more radically enlightened turn, with freemasonry becoming its leading source of inspiration.

Before considering the open attack on Hell by von Born a few years later, we should look at the polemics in which the court astronomer was thrown by his ventures into discussing some of the great medical issues of the times. In the 1777 *Realzeitung*, besides the astronomical reports and a brief essay on antidotes against bedbugs, Hell also published an article on the use of sugar as prophylactic medicine against scurvy.[42] While in Vardø, Hell had experienced that several local inhabitants, particularly seafarers, suffered from this disease. Its cause, Hell argued, was the consumption of too much smoked meat, but especially the high salt content of the air. He claims to have recalled from his studies that sugar—"a kind of vegetable-based salt"—has the capacity of neutralizing the effect of salt, therefore he instructed their cook to salt meals very lightly, but use generous quantities of sugar (with which, thanks to the fact that there was a sugar refinery in Trondheim, they were well equipped). As a result, he and his team could avoid the disease without a single exception. For someone as proud as Hell was of his credentials as a scientist with scrupulous standards of verification, he took this perhaps too lightly as a proof of the preventive powers of sugar, yet he even risked a hint that it might be suitable for healing patients already suffering from scurvy, and closed with a passing reference to the possibility of similar benefits from the consumption of horseradish

40 *WD*, no. 3. (January 10, 1778): 10.

41 *Realzeitung*, no. 3 (January 20, 1778): 49.

42 For the discussion of bedbugs, see *Realzeitung*, no. 7 (May 13, 1777): 107–11; on scurvy, *Realzeitung*, no. 8 (February 18, 1777): 122–26.

and sauerkraut.[43] The essay was reissued in 1779, along with a devastating refutation based on the components of sugar set against the (presumed) causes of scurvy, by a certain Dr. von Albertiz.[44]

By far more intriguing and important than Hell's speculation on sugar as an antidote to scurvy was Hell's other foray into the life sciences: his engagement with magnetic healing in general, and specifically the individual primarily associated with this practice during the Enlightenment, Franz Anton Mesmer. Before becoming a celebrity in Paris after his arrival there in 1778,[45] Mesmer had spent nearly two decades of his life in Vienna where, in turn, he had come to study medicine in 1759 after disillusioning experiences at the Jesuit universities of Dillingen and Ingolstadt. Mesmer, a student of the Dutch director of the Viennese general hospital, Anton de Haen (1704–76), who inoculated him with an enthusiasm about British experimental medicine, defended and published his dissertation entitled *De planetarum influxu in corpus humanum* (On the influence of the planets on the human body) in 1766. In substantial parts plagiarized from a 1704 work by the London physician Richard Mead (1673–1754), Mesmer's essay still put forward a new theory: instead of an influence of gravity acting on the body through the mediation of air and cognate fluids as providential agents, it posited an immediate force named "animal gravity," which "intensifies, remits, and agitates cohesion, elasticity, irritability, magnetism, and electricity." While the cosmos, as well as the animal body, is normally

43 Hell demonstrated no awareness of the widespread preoccupation with combating scurvy in his age, including the work of the Edinburgh naval surgeon James Lind (1716–94) a generation earlier, or the highly successful "regiment of cleanliness, fresh air, and diet" implemented on his voyages by James Cook, for which he was awarded a medal of the Royal Society the year before Hell wrote his short essay. Cf. Stephen R. Bown, *Scurvy: How a Surgeon, a Mariner, and a Gentleman Solved the Greatest Medical Mystery of the Age of Sail* (New York: Thomas Dunne/St. Martin's Press, 2003).

44 *Der Zucker, ein neues Präservativmittel wider den Scorbut* (*Scharbock*) *von Herrn Abt Kaiserl. Königl. Hofastronom in Wien, Nebst einer Zuschrift, darinn des Scharbocks Ursachen etc. und auch des Zuckers eigenschaften gründlicher erwogen und widerlegt werden von Herrn* von Albertiz*, der Arzneygelartheit Doktor* (Vienna: Johann Friedrich Jahn, 1779). See also Aspaas, "Hell og Sajnovics," 65.

45 Most of the literature on Mesmer is focused on his Parisian years where "mesmerism" blossomed, discussing the "early years" in Vienna from the perspective of the "denouement." The most compelling treatment from a historical perspective is still Robert Darnton, *Mesmerism and the End of the Enlightenment in France* (Cambridge, MA: Harvard University Press, 1968). More recently, see (despite the error of believing Mesmer to have been a native of Vienna, 199) Jessica Riskin, *Science in the Age of Sensibility: The Sentimental Empiricists of the French Enlightenment* (Chicago: University of Chicago Press, 2002), 189–226. On Mesmer in the context of the "invention of celebrity," see Antoine Lilti, *Figures publiques: L'invention de la célébrité 1750–1850* (Paris: Fayard, 2014), 86, 89.

characterized by harmony among these features, disturbances may arise, which can be counteracted by expert resort to "universal attraction, animal gravity, or animal magnetism [the existence of magnetic fluids in all bodies]," as Mesmer was subsequently to claim.[46]

Even while in Vienna, Mesmer became gradually aware of the public appeal and commercial potential of the implications of these ideas, apparently adumbrating novel ways of resolving the ancient problem of restoring harmony between the cosmos and the human body by resorting to the new science. Though on a lesser scale than in London or Paris, the eighteenth century was the first great age of popular science in Vienna, too, with regular reports in the press—besides those mentioned, only Hell himself contributed many dozens of brief accounts and explanations on a wide range of topics from eclipses through "northern lights" to earthquakes—public lectures, demonstrations, and experiments. Especially captivating was the contemplation of the invisible forces of nature surrounding the inhabitants of the world of Enlightenment: gravity and electricity, fluids and gases, capable of being harnessed to applications from lifting man in the air to curing bodily disorders. Mesmer—characterized as offering a caricature of empiricist natural science by "magnifying [...] the elevation of feeling as the ultimate arbiter of truth"[47]—launched a medical practice in Vienna soon after the publication of his thesis. For several years, however, his approach to medicine seems to have remained "basically orthodox,"[48] and he earned prosperity and social standing mainly thanks to marrying a wealthy widow in 1768. It was in 1774–75 that he first treated a patient—a Miss Franziska Österlin, suffering from hysteria—with magnetized steel attached to her feet and heart, with dubious results. He then managed to obtain testimonials of successful treatment from several prominent individuals, but as these failed to obtain him public recognition among both physicians and academicians (he was even denounced as a fraud by Van Swieten's successor as court physician, Jan Ingenhousz [1730–99]), Mesmer decided on the "therapeutic gamble" of curing a blind pianist, Maria Theresia Paradis (1759–1824).[49] It was the

46 George J. Bloch, ed., *Mesmerism: A Translation of the Original Medical and Scientific Writings of F. A. Mesmer* (Los Altos: W. Kaufmann, 1980), 14–20, cited in Simon Schaffer, "The Astrological Roots of Mesmerism," *Studies in History and Philosophy of Biological and Biomedical Sciences* 41 (2010): 158–68, here 160. Mesmer did not, however, use the term "animal magnetism" until 1775, see below.

47 Riskin, *Science in the Age of Sensibility*, 191.

48 Douglas Lanska and Joseph T. Lanska, "Franz Anton Mesmer and the Rise and Fall of Animal Magnetism," in *Brain, Mind and Medicine*, ed. Harry A. Whitaker, Christopher Upham Murray Smith, and Stanley Finger (New York: Springer-Verlag, 2007), 301–20, here 302.

49 Lanska and Lanska, "Franz Anton Mesmer," 303–5.

failure of this much-publicized venture that discredited Mesmer in Vienna and compelled him to leave for Paris in January 1778.

Hell's point of entry in this story is that—just like he had received the first magnets he used in his experiments in Cluj in the 1750s from a counterpart of his at the Calvinist college—he supplied the magnets that Mesmer used in the attempted treatment of Miss Österlin. We have seen that, on the side of his chief preoccupations, magnetic healing was a lasting interest of Hell, and even in June 1774 he apparently alleviated the suffering of a baroness from severe abdominal pain by lending her magnets. This is related by Hell in a small pamphlet published at the very beginning of 1775, in which he also clarifies that from the patient's account of her feelings he had concluded that the magnets exerted their effect through the nervous system.[50] At the same time, he stressed—at this point, seemingly out of sheer modesty—that while he triggered Mesmer's as yet apparently successful work with Miss Österlin by supplying him with magnets, he himself did not participate in the treatment in either this case or in similar others. Just one day later, on January 5, 1775, Mesmer published his letter to the Altona physician Johann Christoph Unzer (1747–1809), in which he introduced the notion of "animal magnetism," attributing the healing effect not to the steel magnets used but to the magnetism in the physician's body, capable of channeling the invisible magnetic fluids that pervade the universe into the organism of the patient in order to restore its balance. Mesmer also projected this idea back into the 1766 dissertation.[51] "Just as the Sun and the moon, in their various positions vis-à-vis one another and the Earth and its distance, determine the periods of ebb and flow in the sea and the whole atmosphere, I demonstrated that a similar ebb and flow arises from the ordinary causes in the human body."[52]

It was on the basis of such parallels that Mesmer even claimed that "animal magnetism is a reconciliation of two known sciences, astronomy and

50 Maximilian Hell, *Unparteyisher Bericht der in Wien gemachten Entdeckungen der sonderbaren Wirkungen der künstlichen Stahlmagneten in verschiedenen Nervenkrankheiten* (Vienna: n.p., 1775), republished in *Sammlung der gedruckten und geschriebenen Nachrichten von Magnet-Curen, vorzüglich der Mesmerischen* (Leipzig: Hilschern, 1778), 11–12. The same collection begins with a brief, anonymous account of similar healings by Hell (see 1–3).

51 Franz Anton Mesmer, *Schreiben* [*über die Magnetkur von Herrn A. Mesmer, Doktor der Arzneygelahrtheit*], *an einen auswärtigen Arzt* (Vienna: Kurzböck, 1775), republished in *Sammlung der gedruckten und geschriebenen Nachrichten*, 16–25, published in English in Bloch, *Mesmerism*, 23–30.

52 Mesmer, *Schreiben*, 17.

medicine,"[53] which would have been one more reason for him to expect that Hell—whom he continued to mention with gratitude and respect—would be a long-term partner in his ventures. It may have been known to Mesmer that on his celebrated astronomical expedition Hell and his associates also carried out geomagnetic observations and tackled issues like diurnal variation, magnetic storms, and northern lights (though Hell's vigorous refutation of contemporary suggestions of a relatedness between the latter two phenomena was published in the *Ephemerides* of the following year).[54] It is small wonder that he was baffled when Hell, in another quick response, effectively disavowed him—"I could hardly have suspected that in his letter Dr. Mesmer would call me an eyewitness of certain experiments unknown to me"—and went on to elaborate on his firm conviction that the therapies worked because of physical magnetism, not cosmic harmony.[55] In fact, this was more than he was willing to acknowledge earlier. Despite his attempts at the medical use of magnets in both Cluj in the 1750s and Vienna in the 1760s, none of the editions of Hell's treatise on the application of steel magnets contained any mention of such uses, and in a 1765 letter to Weiss he was expressly skeptical about the possible healing power of his magnets:

> I am happy that my Father Colleague [i.e., Weiss] has become a colleague of mine even in medical subjects. For even I have here turned a magnetic doctor and experienced the effect [of magnets] on various persons. However, the effect of this artificial magnet in easing the pain of toothache, I ascribe not to magnetism (which can have no influence on the teeth unless these were made of iron or steel), but to the coldness of the steel. Next time I will test this with a piece of steel that is not magnetized, and I think the effect will be the same; my Honorable Father Colleague can make the same experiment, pretending that the metal that is applied is magnetic, so that the pain of the patient is not disturbed by persuasion.[56]

53 Franz Anton Mesmer, *Mémoire sur la découverte du magnétisme animal* (1779), in *F.-A. Mesmer, Le magnétisme animal*, ed. Robert Amadou (Paris: Payot, 1971), 93. Cf. Schaffer, "Astrological Roots of Mesmerism," 160.

54 Hell, *Theoria nova*. Cf. Aspaas and Lynne Hansen, "Geomagnetism by the North Pole."

55 Maximilian Hell, *Schreiben über die allhier in Wien entdeckte Magnetencur, an einer seiner Freunde* (Vienna, January 12, 1775), in *Sammlung der gedruckten und geschriebenen Nachrichten*, 26 and passim.

56 Hell to Weiss in Trnava, dated Vienna, May 7, 1765. Pinzger, *Hell Miksa*, 2:198. The reference to Weiss's activities as a healer is obscure.

What Hell's unfolding conflict with Mesmer illustrates is that while he was aware of the emergence of vitalistic theories and the related scientific practices, he viewed them with suspicion and remained an inveterate mechanist. He even looked down on Mesmer's experimentations with the same kind of contempt he had toward the lack of "exactitude" he supposed to have diagnosed in Pray's linguistic work. The remarkable blend of bursting into a field of knowledge beyond his own specialization and behaving provocatively—again, just like in the case of language and history, but this time before the eye of the public—may also have been a product of the disaffection, anxiety, and insecurity Hell presumably felt during the immediate post-suppression years, as well as the perceived need to prove himself an all-round scholar worthy of leading an academy of sciences. A final interesting point is Hell's hint to Weiss that in order to attain the desired therapeutic results, it might be sufficient to *pretend* that the metal is magnetized. In a very rudimentary form, this seems to anticipate the position of the experts employed in the famous 1784 investigation of mesmerism in Paris (itself echoing an important strain in eighteenth-century thought): that even in the absence of any alleged "magnetic fluids" (or magnetized metal), the imagination is capable of having dramatic effects on the body—that belief in the curative effect is almost the cure itself.[57]

An astonished Mesmer gave vent to his frustration over Hell's sudden change of heart in writing, to which Hell replied in kind, but in the end he assured the readers that all "misunderstandings" between the two of them had been clarified, and reconciliation had taken place.[58] If this was real, no similar happy end could be expected to conclude the hostility initiated by von Born several years later. At the height of the "flood of pamphlets" in 1783, von Born—a one-time Jesuit for just sixteen months who left the order before his novitiate in 1760, and by this time already the star of the Viennese Enlightenment as the master of Zur wahren Eintracht—published his main work as an anti-clerical satirist. The *Specimen monachologiae, methodo Linnaeano, tabulis tribus aeneis illustratum* (Specimen of the natural history of the various orders of monks, after the manner of the Linnæan system, also published in German, French, and English) by "Joannes Physiophilus" (von Born's pseudonym)[59] is cast as an academic

57 Riskin, *Science in the Age of Sensibility*, 209–25.

58 Mesmer's response was published both separately on January 19, 1775, *Sammlung*, 31–37, and in the *WD*, no. 6. (January 21, 1775): 9–11. For Hell's rejoinder, dated January 29, 1775, see *WD*, no. 10 (February 4, 1775): 9–11.

59 Scholars usually attribute the work to Born; for doubts, see Josef Haubelt, *Studie o Ignaci Bornovi* (Prague: Univ. Karlova, 1973), cf. Evans, *Austria, Hungary, and the Habsburgs*, 46n35.

treatise conceived according to the Linnæan method and using the terminology developed by the famous Swedish botanist. Thus, the *genus* of the monk is in general defined as an "animal" that is "anthropomorphic, hooded, wailing at night, thirsty." Moreover, the body of the monk is "two-footed, erect, with a back that is curved inward, a head that is flattened from above, always hooded and clothed on all sides, except for certain species whose head, feet, ass, and hands are nude."[60] The various monks are then distributed in their *species* (orders)—such as Monachus Benedictinus, Monachus Dominicanus, Monachus Camaldulensis etc.—and described as though they were specimens of natural history. Jesuits were, strictly speaking, not "monks," and the Society of Jesus had in any case ceased to exist by this time, so it was spared description in von Born's merciless satire. Nevertheless, the first German edition of the work was attributed to an "Ignaz Loyola Kuttenpeitscher"—and sold two thousand copies in a mere three weeks.[61] It might be added that the publisher of the Latin original is also spuriously given as "P. Aloys Merz." Alois Merz (1727–92), dean of the cathedral of Augsburg, was another former Jesuit and one of the sharpest Catholic polemicists of the time.

Worse was to come from Hell's point of view, on an *ad hominem* basis. In 1771, as a central figure of the Prague cultural and scientific scene, in the inaugural issue of the review journal *Prager Gelehrte Nachrichten* (Prague learned news), von Born still commended Hell, along with Rieger, Kollár, von Jacquin, Stepling, and others, as an outstanding representative of enlightened science in a "domestic" context.[62] In the same year in the same journal, von Born published a review of Sajnovics's *Demonstratio*, not calling into question its main propositions, but criticizing the author's—according to von Born, a fellow expert of natural knowledge, not sufficiently stringent—notion of "demonstration" (i.e., proof). As an aside, von Born added that he sustained his judgment on the implications of the treatise for the early history of Sajnovics's countrymen until the publication of the "very promising work of the famous father Hell, already announced under the title *Expeditio litteraria ad Polum arcticum*"—but worried that "the undertaking of Mr. Sajnovics to make Hungarians the descendants of Lapps" would create some storms.[63] By a decade later, all the respectful distance was gone. Von Born then published a satire entitled *Telescopium Christiano-Hellianum* (Christian-Hellian telescope), targeting Hell

60 [Ignaz von Born], *Joannis Physiophili Specimen Monachologiæ methodo Linnæana tabulis tribus æneis illustratum, cum adnexis thesibus e Pansophia P.P.P. Fast* [...] (Augsburg: Merz, 1783), [17].

61 Robertson, "Curiosity," 139.

62 "Vorbericht," *Prager Gelehrte Nachrichten* 1, no. 1 (1771): 2.

63 *Prager Gelehrte Nachrichten* 1, no. 13 (1771): 200–6. Cf. Eszter Deák, "Born Ignác ismeretlen recenziója Sajnovics János 'Demonstratió'-járól," *Hungarológia* 2 (1993): 117–21.

directly. Cast as a call for subscriptions modeled upon Hell's advertisement for the *Expeditio litteraria*, it bears the false signature of the court astronomer, who is also styled "historian of the Lappish nation, apostolic missionary of the Roman see."[64] Printed leaflets were circulating in Vienna by the autumn of 1784, and in 1786 the piece was included in von Schlözer's widely disseminated Göttingen journal on public affairs, the *Staats-Anzeigen* (State reports). One thread in the contents is the mockery of Hell's inability to bring his great work to conclusion: von Born put into the astronomer's mouth an account of how "after sweating over this work for ten years," he decided to "say goodbye to all mundane issues" and to "ascend from astronomical matters even higher into the heavens, and henceforth treat nothing but spiritual and divine subjects."[65] In this spurious call for subscriptions, Hell is portrayed as a sworn enemy of the freemasons, with the full title of his work given as *The Christian-Hellian Telescope, or Macro- and Microscopic Observations on the Heresy and Goal of the Freemasons by Honorable Father Maximilian Hell of the Society of Jesus'* [sic], *Made upon His Return and Repentance from Speculations concerning Matters Relating to Venus*.[66] The work was supposed to be brought out by the publisher "of our Society, in three volumes, although not in *folio*, but, as befits Christian modesty, in *octavo*."[67] Furthermore, the volumes were to appear on the day of Saint Xavier in the year 1784, on the day of Saint Aloysius in the year after, and on the day of Saint Ignatius in 1786. Subscriptions were open "in all Catholic cities and provinces, at the Honorable Father Preachers and ex-Jesuit Missionaries."[68]

The reference to Hell as "Honorable Father of the Society of Jesus," the naming of canonized representatives of the same Society (Xavier, Aloysius, and Ignatius Loyola), the supposed existence of a Jesuit press and even of ex-Jesuit missionaries—all was neatly phrased in order to nail the Viennese court astronomer as a spearhead of anti-tolerant schemes against the freemasons. Further attacks on Hell's reputation came in various newspapers and ephemeral publications in the mid-1780s.[69] To at least one of these—an "anecdote illuminating Austrian ex-Jesuitism, or Jesuitism," alleging Hell to be the local

64 In some of the literature, this signature has been taken at face value and the contents of the call have been discussed as though the text had been written by Hell. See Pinzger, *Hell Miksa*, 1:25–26.

65 [Ignaz von Born], "Lectori salutem," *Staats-Anzeigen* 9, nos. 33–36 (1786): 228–31, here 229.

66 [von Born], "Lectori salutem," 230.

67 [von Born], "Lectori salutem."

68 [von Born], "Lectori salutem," 231.

69 According to Steinmayr, "Geschichte der Universitätssternwarte," 271–73, these included the *Oesterreichische Biedermanns-Chronik*, the *Wienerische Kirchenzeitung*, the *Briefe aus dem Himmel*, and the *Phantasten- und Prediger-Almanach.*

intermediary in a surviving Jesuit network who supplies brethren with travel money on their way to the remaining bastions in the Russian Empire (in this particular case, a Dutch fellow en route to Mogilev)—Hell wrote an angry retort, and threatened legal steps against the editors in case the "fabrications" were repeated.[70] Elsewhere, he was even listed as having died—morally speaking—in the year 1773, in the midst of his "struggle for the good cause."[71] Freedom of press took its toll on the ex-Jesuit, who complained to Kästner:

> You will, renowned gentleman, forgive my long silence if you learn that I am not at all enjoying the kind of peace of mind I did just a few years ago. The Viennese scribblers impugn men of all standing with full freedom, so even I, who have not hurt or harmed anyone, and have never written anything apart from astronomical matters, cannot be tranquil […]. I cannot even sleep, and I am forced to refute the slander and the lies of those who want to ruin my reputation […].[72]

A visitor to Vienna in the autumn of 1784, the German-speaking Danish citizen Friedrich Münter (1761–1830) has left a detailed diary that can be compared with the testimony of Hviid from six years earlier. Like Hviid, Münter was on a study trip, transcribing old manuscripts and visiting libraries and archives. Unlike Hviid, however, Münter was a freemason, and on the very day of his arrival in Vienna, he visited von Born. In fact, during his seven weeks in the Austrian capital (from August 30 to October 20, 1784), Münter paid visits to the von Born family virtually every day. He also went to see the papal nuncio, Garampi, whom he appears to have sympathized with, despite the denominational distance. It was through Garampi that Münter was introduced to Hell, "a thin, deteriorated little man, in whom the sly Jesuit is at the same time before one's eyes."[73] Münter met Hell on only three occasions, but heard from various sources enough sensational rumors about this famous ex-Jesuit to fill several pages of his diary.

---

70 "Anekdote zur Beleuchtung des österreichisches ex-Jesuitismus, oder Jesuitismus," *Wienerische Kirchenzeitung*, no. 34 (August 23, 1786): 549–50; "Erinnerung an das Publikum," *Wiener Zeitung*, no. 75 (September 20, 1786): 2246.

71 Steinmayr, "Geschichte der Universitätssternwarte," 272.

72 Hell to Kästner in Göttingen, March 6, 1785. NSUBG; Hungarian translation in Csaba, *Hell Miksa írásaiból*, 57–58.

73 Frederik (Friedrich) Münter, *Frederik Münter: Et mindeskrift II; Aus den Tagebüchern Friedrich Münters; Wander- und Lehrjahre eines Dänischen Gelehrten*, vol. 1, *1772–85*, ed. Øjvind Andersen (Copenhagen: P. Haase & Son, 1937), 62 (entry on September 7, 1784).

According to Münter, the Society of Jesus was never really suppressed. It still prospered not only in Russia but even in the Austrian lands, where there were supposed to exist four large prelatures—in Innsbruck, Lviv, Vienna, and a fourth, unnamed place. The Jesuits were said to hold secret nocturnal meetings in Vienna, over which Hell presided as the superior (*Grosmeister*).[74] Moreover, the court astronomer allegedly cultivated close contacts with the Jesuit order in Russia and profited from support by a network of Jesuit-friendly bishops like the one of Eger in Hungary. Throughout, Münter characterizes Hell as an extremely dishonest man, who complained about "these times of unbelief" (*unglaubigen Zeiten*) and saw little value in the freedom of the press, which he preferred to call "recklessness" (*Zügellosigkeit*).[75] In sum, Hell was one of those

> elected munitions of God, fighting to prevent the creed of the Jesuits from becoming extinct, and he really devotes himself with all his might in this struggle. A substantial part of the pamphlets directed against the emperor passes through his hands. He either writes them himself, or orders others to write them, and thereafter passes them on to his beastly horned [i.e., Satanic] colleague, who immediately submits them to be printed in the press of the order.[76]

It is difficult to judge the exact level of exaggeration in the rumors to which Münter's diary apparently gives full credit. In some of the literature, it is reported—unfortunately, without references—that in the 1780s Hell recruited a team of Catholic polemicists and coordinated their literary efforts to fight the torrent of freethinking unleashed in the tolerant atmosphere of Josephism.[77] He is also said to have personally discussed the spirit of anti-clericalism arising under Joseph II with Pius VI during the pope's visit to Vienna in the spring of 1782, and to have collaborated with Merz in editing and publishing a series of works in Catholic apologetics in Augsburg. All these works, however, are alleged to have been lost.[78] Elsewhere, it is claimed that he supported the

74 Münter, *Frederik Münter*, 83–85 (entries on September 26 and 27, 1784), here 85.

75 Münter, *Frederik Münter*, 77 (entry on September 23, 1784).

76 Münter, *Frederik Münter*, 65–66 (entry on September 11, 1784).

77 Hell had a problem with toleration only when it concerned other denominations, but applauded the policies of Frederick II of Prussia, expressing joy over the protection extended to the Jesuits in Silesia. Hell to Bernoulli in Berlin, dated Vienna, March 1, 1775 (UBB).

78 Kisbán, *Hell Miksa*, 18. The monographer of Merz does not seem to be aware of any meaningful cooperation between him and Hell. Cf. Fred Horstmann, *Alois Merz, Dom- und Kontroversprediger aus Augsburg, als Opponent der Aufklärung* (Frankfurt: Peter Lang, 1996).

unfolding popular piety focused on the adoration of the heart of Christ (*Cordis Jesu*), supporting it with the distribution of leaflets and other material, for which he was even inflicted a fine of five hundred florins.[79] In lack of conclusive evidence, we may presume that as a devout Catholic and devoted ex-Jesuit, Hell did everything he soberly could to resist the tide and preserve his own and his fellow believers' integrity, but also that he was limited in his ability to do so owing to his position as a state servant and his commitment to his vocation. He could hardly have afforded the risk of operating as the hub of a network of plotters.[80] At the same time, Hell had other means, more anchored in his professional life, of holding his own in the face of the adversity newly surrounding him in the metropolis: a resort to the credit he had accumulated in the supra-imperial space of the Republic of Letters, and his connections in the sub-imperial space of the eastern Habsburg provinces.

2 Redefining the Center

It has been mentioned that after the suppression of the Society of Jesus, some former Jesuits continued their career abroad, and Hell as an internationally acclaimed man of science may have had better than ordinary opportunities to do so. In an editorial comment on von Born's mockery of Hell's failure to complete the *Expeditio litteraria*, von Schlözer added: "Mr. Hell was nevertheless elected a fellow of the Royal Society of Sciences in London in the preceding year."[81] Similar and even greater claims are made in some of the historiography, about Hell receiving offers of "honorary pensions much higher than his salary" from both Christian VII of Denmark and George III (1738–1820, r.1760–1820) of Britain,[82] or a "call to England with a considerable salary [...] at the time of the suppression of the Society."[83] Hell is said to have declined these offers, and in lack of source reference, it is hard to establish the facts about them. In any case, Hell's name is missing in the official lists of fellows of the Royal Society of London. The only Jesuits who were elected fellows during the eighteenth century appear to have been Boscovich, Christian Mayer, and Marcin Poczobut

79 Pinzger, *Hell Miksa*, 1:27.

80 Münter's account recalls the topoi of the near-hysterical injunctions of several figures of the contemporary German public scene to avert a conspiratorial offensive of the Catholic Church against Protestantism and the Enlightenment. Cf. Johannes Rogalla von Bieberstein, *Die These von Verschwörung 1776–1945* (Frankfurt: Peter Lang, 1976), 5–32.

81 [von Born], "Lectori salutem," 229.

82 Ferrari d'Occhieppo in Gillispie, *Encyclopedia*, 6:234.

83 Schreiber, "Jesuit Astronomy (Part II)," 111.

(1728–1810), the head of the observatory in Vilnius.[84] Moreover, Hell appears to have had no personal contact in erudite circles in England until 1776, when he finally received an answer from the astronomer royal, Maskelyne, upon repeated requests for help in furnishing the Eger observatory with instruments.[85]

The hint of a Danish offer has a more solid foundation in the sources. In a request submitted to the imperial and royal chamber in July 1781, Hell asked for a higher salary, which he justified as follows:

> Because I, in consideration of the honor of the imperial and royal court, rejected an offer of a yearly personal pension of a thousand *Gülden* as a token of gratitude for my highly strenuous and dangerous journey to the island Vardøhus in the Arctic Ocean, where I observed the transit of Venus in front of the Sun. I refused to receive this pension because I, as imperial and royal court astronomer, deemed that it would be negative for the honor of the imperial and royal court if I benefited from a pension of a foreign court in conducting my work.[86]

There is no mention of any similar offer from England either in this letter or in any other source available for this study. Hell never seems to have seriously contemplated abandoning his position in Vienna, and if he wanted to improve his situation, he used the instruments still in his hands after the dissolution of his order. One of these instruments was the *Ephemerides*. The annual had become an indispensable source of up-to-date astronomical knowledge by virtue of the continent-wide and partially global collection, publication, and interpretation of data. If anything, it could have been a means for Hell to retain or expand his scope of maneuver internationally when it had become narrowed locally.

The profile of the *Ephemerides* underwent some change after 1769, when as a consequence of Hell's departure for the Arctic expedition the editing of the annual was taken over by one of his assistants, Pilgram, who did not publish observation reports until 1771, and relatively few ones both in that year and in 1772.[87] By compensation, the 1771 volume included Hell's account of his 1769 transit observation, and the following one a collection of all the observations

84 Udías, *Searching the Heavens and the Earth*, 5, supplemented by Moutchnik, *Forschung und Lehre*, 349–52.

85 Cf. above, 170n108.

86 Hell to the Kaiserl: Königl: Hofkammer in Vienna, n.d., but according to an administrative note received July 25, 1781 (Akademie der Wissenschaften in Vienna).

87 An earlier version of the argument of the following paragraphs was presented in Kontler, "Uses of Knowledge."

around the world, followed by Hell's treatise on the parallax. The trend continued for the following two years as well. Instead of observation reports, in 1774 we still find supplements to Hell's dissertation on the solar parallax (Lexell's long letter from St. Petersburg, and a shorter treatise by Pilgram on the subject),[88] and in 1775, two treatises by Hell (an article on the diameter of the moon alongside the method of calculation of latitudes).[89]

Reports on astronomical observations appear again in a respectable number in the *Ephemerides* from 1776 onward, but the coverage is conspicuously different from pre-1768 times. It embraces in an apparently haphazard manner a few locations from Central Europe, broadly speaking (besides Vienna, only Kremsmünster, Ingolstadt, and Greifswald), from Copenhagen, and exotic places: Beijing (observations by the Jesuit fathers Augustin von Hallerstein, José da Espinha [1722–88], and José Bernardo de Almeida [1728–1805])[90] and "Western Tartary" (Felix da Rocha [1713–81]). The year 1777 was especially remarkable in the "regional turn" of the *Ephemerides* (that is, the shifting geographic distribution of source locations). In that year, as mentioned, the only university operating in the Kingdom of Hungary was moved from Trnava to Buda, where an astronomical tower was created too, similarly to the town of Eger, where a new observatory was being mounted in the local lyceum. Hell was assigned to supervise and advise the building and equipment of both of these new observatories. In 1776—as reported in great detail in the *Ephemerides* for 1777—Hell completed an astronomical journey in Hungary. From this time on, the yield of observation activity in the metropolitan centers of European science—in France, in England, in Italy (let us remember the comment on the Berlin *Jahrbuch* in the *Journal des Sçavans*) are, by and large, missing from the *Ephemerides*. The space beyond the astronomical tables is quite consistently and overwhelmingly filled, apart from the sporadic appearance of Paris, Milan, and Greenwich in the observation reports, with accounts from the northern, eastern, and central crescent around the European core, as well as contributions of Hell's colleagues (especially Pilgram), and Hell himself.

88 The texts by Hell and Lexell were mentioned and discussed above. The additional item is "De parallaxi Solis ex duobus internis contactibus Veneris, in eodem loco observatis disquisitio. à P. Antonio Pilgram S.J. anno 1772" (140–55). There is also an "Appendicula à P. Hell, itemque solution ultimissimi problematis à R.P. Hallerstein Pekini Sinarum Mandarino" (155–62).

89 "Methodus accurata, ope solius tubi micrometrum instructi, praecisam definire elevationem poli"; "Dissertatio, de vera magnitudine apparente diametri Lunae plenae oculo inermi visae," *Ephemerides* 1775 (1774), 3–41; 42–53.

90 Hell also mentions in their company a certain "Cibolla," whom we have been unable to identify.

Besides this geographic reorientation, there was still an attempt made at coherently organizing the material collected during the Arctic expedition, as already discussed in Chapter 5. As regards the observation data, one conspicuous development is the proliferation of material from Scandinavia: besides Copenhagen, we find Lund, Roskilde, Trondheim, Iceland, and Greenland as new source locations. In addition, astronomical activity in Germany and the Habsburg monarchy was vigorously promoted in the appendices of the *Ephemerides* during the last fifteen years of Hell's life. Besides some German venues, striking presences are—naturally—Vienna, besides Prague and Kremsmünster. Above all, however, Hell was careful to emphasize the achievements of Trnava, Buda, and Eger.

To a considerable extent, the explanation of these shifts of emphasis is quite evident: while some links of the Jesuit chain became broken and Hell had to cook with what he had been left, the new Scandinavian contacts partially made up for the loss. What deserves attention is the surge in the representation of astronomical activity in Hungary, not only and necessarily in the volume of reporting but its hyper-enthusiastic tone. Being confronted with new realities and pressures in the imperial center—still a high-level state servant, but deprived of the institutional (and spiritual) leverage of his order, with certain avenues of government patronage blocked before him, and unprotected against attacks in the arising local public sphere—Hell appealed to the corners of the realm he had learned to love and appreciate during his highly mobile early career, and began extolling their virtues internationally through the *Ephemerides*.

The astronomical journey of 1776 was in a sense a revisiting of these roots in the northern and eastern parts of the Hungarian half of the Habsburg monarchy, combined with the pleasing awareness—amply expressed in the report published in the *Ephemerides*—that the creation of new observatory towers there, together with the already existing ones, might elevate the status of these parts as a power to reckon with in the discipline. On this journey, Hell had a companion: Madarassy, sent in 1774 to study with him in Vienna by Bishop Eszterházy, who had been in contact with Hell for a decade by then.[91] In Eszterházy, perhaps the most erudite churchman of eighteenth-century Hungary while a stout opponent of the Viennese reforms,[92] the court astronomer must

91 See above, 130 and 353.

92 For the bigger picture on the position of Hungarian bishops vis-à-vis Viennese policies throughout the eighteenth century, see Joachim Bahlcke, *Ungarischer Episkopat und österreichische Monarchie: Von einer Partnerschaft zur Konfrontation (1686–1790)* (Stuttgart: Franz Steiner Verlag, 2005).

have recognized a potential champion of Catholic learning who might restore it to its former glory after the suppression of his order.

Hell's detailed report in the *Ephemerides* about the five-week journey he took with Madarassy from Vienna to Eger and back is a remarkable document. Besides recording the data of observations carried out at each station—aimed chiefly at a more accurate determination of the geographic latitude of several locations in Hungary, thus correcting the "grave errors" contained in Ignaz Müller's *Mappa geographica novissima regni Hungariae* (The most recent geographic map of the Kingdom of Hungary [1769])[93]—the account provides a wealth of interesting insights into the cultural environment in which the journey took place. Praises lavished by Hell on the benevolent bishop of Eger, characterized as a munificent patron of learning, are a recurrent theme. Eger is portrayed as a virtual "center of advanced science," and the bishop himself as a devout Christian purportedly with a Jesuitic frame of mind. Looking on as Hell and the rest of his team draws the meridian line of his observatory, Eszterházy is said to be contemplating

> no doubt, in his pious mind those words of David, *the Heavens will tell of the glory of God, and the firmament announce the works of his hands* as well as that holy dictum of Divine Ignatius Loyola, who having observed the stars at night said, *O how dirty the Earth appears, as I look at the sky*.[94]

Even apart from the bishop, the territory is quite densely populated with further men of eminent learning. They include not only old friends and associates, such as Weiss in Trnava and Sajnovics, now professor of mathematics at the university recently moved to Buda, the "metropolis of Hungary." Mention is made of Balajthi, Eszterházy's first protégé to have studied with Hell at the Universitätssternwarte in 1762 (now vicar at the nearby market town of Kunszentmárton), and the former archivist of the episcopal collections, Mátyás Kotuts (dates unknown), who had just succeeded Balajthi as professor of mathematics at the gymnasium of Eger. Further, we meet the illustrious prior of Eger (formerly the erudite librarian of the Collegium Germanicum et Hungaricum in Rome, and later bishop of Alba Iulia [Gyulafehérvár, Weissenburg] in Transylvania), Count Ignác Batthyány (1741–98), and on the backward

93 An army officer, Müller (*c.*1727–1804) was only a namesake of Maria Theresa's abovementioned Jansenist confessor. The map project was supervised by the president of the Viennese military court council (Hofkriegsrat), the famous general count Franz Moritz Lacy (1725–1801), the future initiator of the land survey of Joseph II.

94 Maximilian Hell, "Observationes astronomicae latitudinum geographicarum sive elevationum poli, lep, factae 1776," *Ephemerides* 1777 (1776): 273–89, here 279–80.

journey the prior of the cathedral of Veszprém, Pál Kiss. In this country swarming with men of superior learning (invariably good Catholics, several of them directly emerging from a Jesuit background), even the common man is distinguished by a keen "interest in mathematics"—as in the case of the innkeeper of the village of Szered, for example: this Hungarian counterpart of the Tyrolean farmer Anich, whose mathematical prowess had been used as a proof for the excellence of Catholic education by Hell a decade earlier, was watching in admiration Hell drawing a meridian line with a stick on the floor of his house.[95] At the end of the account, Hell, as it were, sighs in relief: "Thus my tour of Hungary for the improvement of astronomy and geography [...] and for the greater glory of God is completed."[96] That the latter phrase was also the motto of the temporarily defunct Society of Jesus is noteworthy. Decision-makers in the imperial center may have turned hostile to the tradition of science represented by Hell and his attempts to find new institutional bulwarks for it by sponsoring an academy of sciences. But these traditions seemed—or at least were represented by him—to flourish in the province of the realm that he called his "fatherland" (*Patria mea*),[97] with a powerful and generous patron, and a substantial rank-and-file of dedicated scholars. Finally, there is the issue of cross-disciplinary engagement and appropriation. Hell informs his readers about an excursion that he has made, at the request of von Jacquin, to the town of Jászapáti[98] to verify rumors of a special, edible plant. The edible plant did indeed exist; he brought some specimens back to Vienna for further scrutiny by the head of the botanical garden. In a self-assured aside filling more than two pages, he adds that he had known about the plant since his stay in Transylvania, where it proliferated to such an extent that he presumed it to be well known to botanists. Furthermore, he also took the opportunity to gather several other exotic specimens as a service to von Jacquin, thereby placing himself on a par with the famous explorer with respect to the natural kingdom, at least in regard of endemic Hungarian plants.[99]

95 Hell, "Observationes astronomicae latitudinum geographicarum," 167 (flawed pagination: correctly 276). It may be worth noting that the village was located on the estates of the bishop's brother, Count Ferenc Eszterházy (1715–85), head of the Hungarian Court Chancery, another important patron of culture and an enlightened improver of his estates—and an opponent of Josephian centralization. Hell stresses that the "elegantly constructed" inn itself was also built thanks to his support.

96 Hell, "Observationes astronomicae latitudinum geographicarum," 289.

97 Hell, "Observationes astronomicae latitudinum geographicarum," 278.

98 Or "Jasz-Apáthy," as Hell spells it; in contrast to practices earlier established for the *Ephemerides*, the Hungarian name form is highlighted, with the Latin explanation "the town of Jaszigia near the river Tybiscus [Tisza]" added in smaller characters.

99 Hell, "Observationes astronomicae latitudinum geographicarum," 282–84.

Over the subsequent years, we find Hell making efforts to support these provincial initiatives with all the weight of his scientific expertise and the institutional means still available to him. His correspondence is replete with detailed advice and instructions to Weiss concerning the construction of the university observatory in Buda.[100] The 1780 and 1781 volumes of the *Ephemerides* gave generous space to reporting about the astronomical activity carried out at the new observatories of the Kingdom of Hungary, the "most splendid new observatory of Eger" being especially commended.[101] Thus, the reputation of the *Ephemerides*, once established in cosmopolitan contexts and by cosmopolitan means, was put into the service of a patriotic project of promoting scientific knowledge produced in local, Hungarus spaces.

In his correspondence, Hell was quite explicit that this was in direct defiance of unpleasant developments in the metropolitan center. In the letter to Bernoulli already cited, complaining about the increasing narrow-mindedness of the Viennese government in supporting the sciences, he came to the conclusion that "my Hungary (for I am myself an Ungarus) has a more sound attitude to astronomy, which is held in high esteem among the Ungari," adding as a demonstration data from the recently published compendium of statistician Ignaz de Luca (1746–99) on "Austrian" men of learning, *Das gelehrte Österreich* (Learned Austria, 2 vols. [1776, 1778]): "Among these prominent authors, Ungari make up the largest proportion [...]; this demonstrates that Hungary has flourished, and still flourishes, more than the rest of the hereditary kingdoms with respect to the cultivation of all manner of sciences."[102] Hell may have been disturbed by the fact that de Luca categorized him as an "Austrian" on the grounds that his parents were "both born Germans,"[103] and perhaps consoled

100 Hell to Weiss on February 16, 1779; on April 14, 1779 (twice); on June 9, 1780. In Pinzger, *Hell Miksa*, 2:128–34.

101 Maximilian Hell, "Observationes astronomicae Agriae in Ungaria in observatorio novo Excellentissimi, Illustrissimi ac Reverendissimi Episcopi Agriensis D.D. Caroli, e Comitibus Eszterhazi," *Ephemerides* 1780 (1779): 32–33; Hell, "Observationes astronomicae in Novo Observatorio Universitatis Regiae Buda in Ungaria, a Cel. D. Francisco Weiss Astronomo Regio Universitatis," *Ephemerides* 1781 (1780): 28–29. During the last decade of Hell's life, whenever observation reports were published in the *Ephemerides* at all, Buda was included, though Eger less regularly. In this period, the reporting activity was fully confined to the main observatories in the Habsburg monarchy (besides the ones in Hungary, Vienna, Kremsmünster, Prague), with sporadic attention to Scandinavian sites.

102 In the same letter, Hell elaborated in considerable detail on the merits of the bishop of Eger in supporting the cultivation of the sciences, astronomy in particular, in Hungary, as well as the spectacular development of the observatories of Trnava and Buda. Hell to Bernoulli in Berlin, February 15, 1777 (UBB).

103 Ignaz de Luca, *Das gelehrte Österreich: Ein Versuch* (Vienna: Von Ghelen, 1776–78), 1:176.

by his inclusion in a bio-bibliographical encyclopedia of "Hungari and people from the provinces that have made themselves known through published writings," published in the same year as de Luca's first volume.[104] In any case, with the help of the *Ephemerides*, Hell was offering a map of "learned Austria" that recorded the changes explained to his esteemed colleague, another influential voice in the *respublica astronomica*: a shift of the center of gravity to the east.

This representation of the situation was, of course, much too sanguine.[105] While the observatory of Eger indeed performed well, with Madarassy as its astronomer after he had finished his training with Hell in 1778, a full-scale infrastructure of higher learning that a university would have been, proved to be wishful thinking. The medical academy in Eger, opened in 1769, was forced to close in 1775 because of the royal withdrawal of the right of the institution to confer doctoral degrees. By the time the construction of the would-be university building was completed in 1785, clause 14 of the *Ratio educationis* or general law of education for the Kingdom of Hungary (1777) had stipulated that there was to be a single university in the whole of the kingdom: "The one splendidly located in the very midst of the country [in Buda], endowed with rich funds and teaching personnel well trained in all manner of sciences."[106] A second layer of tertiary education was also created, with five *academiae* or *Hochschulen*, in Győr, Oradea (Nagyvárad, Grosswardein), Košice (losing its university status), Zagreb, and Trnava. The school at Eger remained a *lycée*, not even allowed (as Eszterházy requested in 1784) to be a temporary host to the university evacuated from Trnava but not yet possible to accommodate conveniently in the capital of the Hungarian province.

Hell nevertheless remained in close contact with Bishop Eszterházy. Besides matters of science, after the debacle of the university plans the religious and ecclesiastical issues of the day acquired greater prominence in their correspondence. One subject that Hell discussed in two letters in quick succession in 1779 was the forced retraction of the tenets put forward in the famous 1763 treatise *De statu ecclesiae* (On the state of the church; better known as *Febronius*, promoting a return to the conciliar tradition of government in the Catholic Church) by its author, Johann Nikolaus von Hontheim (1701–91), auxiliary

104 Elek Horányi, *Memoria Hungarorum et provincialium scriptis editis notorum* (Vienna: Loew, 1776), 2:81–90.

105 There is no scope here to examine either Hell's judgment of the policies of Vienna with those it actually pursued in the matter, nor the amount of wishful thinking at the bottom of the proposed "shift."

106 Aladár Friml, trans. and ed., *Az 1777-iki Ratio educationis* (Budapest: Katholikus Középiskolai Tanáregyesület, 1913), 50.

bishop of Trier.[107] Hell noted the prominent role of nuncio Garampi in achieving this "real triumph of the Catholic Church," but reported to Eszterházy with disappointment that it is not well received by the "perverted Catholics of this city of ours."[108] Further fulminations concern the "insults" to the Catholic Church constituted by designs to alleviate regulations on fasting and even to abandon priestly celibacy ("after a Lutheran manner").[109] Nevertheless, Hell continued to tackle in his letters scholarly developments as well, never losing the hope that the Eger school, this "most splendid palace of the muses,"[110] might eventually provide a "safe and permanent haven" for the university of Hungary.[111] The latter expectation was made explicit by Hell after the accession of Leopold II early in the year 1790. The seventy-year-old ex-Jesuit at that time became involved in a new edition of the Statutes of the University of Vienna, and made efforts to convince the policy-makers of the need for a purely Catholic university system.[112] As he explained to Eszterházy, he hoped to

> restore the studies at the universities of our hereditary realms, which now lie with their backs broken, to their ancient status and spirit in the same manner as the university studies were restored during the reign of the pious emperor Ferdinand II, at first in Vienna in the year 1623, and thereafter in all the cities of the Austrian hereditary realms.[113]

These hopes were to be frustrated again. Hell's scientific output became also somewhat scaled down during the 1780s. Though even in the very last years of his life, he published two fragments of the *Expeditio litteraria* in the volumes of the *Ephemerides* for 1791 and 1793, the major astronomical contributions to the supplements of the annual in the 1780s were either authored by Hell's serving

107 For a comprehensive overview in English, see Ulrich Lehner, "Johann Nikolaus von Hontheim's *Febronius*: A Censored Bishop and His Ecclesiology," *Church History and Religious Culture* 88, no. 2 (2008): 205–33.

108 Hell to Eszterházy in Eger, dated March 19, 1779. FLE AV 2629. The discussion continues in the letter of April 9, 1779, FLE AV 2629. As for the "perverted Catholics" of Vienna, supporters of Josephist ecclesiastical policies indeed regarded the retraction as one of the most dangerous writings "against worldly regents." Cf. Lehner, "Hontheim's *Febronius*," 226.

109 Hell to Eszterházy in Eger, dated October 15, 1779. FLE AV 2629.

110 Hell to Eszterházy in Eger, dated December 26, 1783. FLE AV 2629.

111 Hell to Eszterházy in Eger, dated October 30, 1790. FLE AV 2629.

112 In an extant copy of the 1791 edition of the Statutes, an autograph letter by Hell was pasted between pages 167 and 168, revealing "his contempt for Protestant education, calling Protestant universities 'pseudo-Universities' that 'corrupt students' minds.'" See Shore, *Jesuits and the Politics of Religious Pluralism*, 105.

113 Hell to Eszterházy in Eger, dated November 1, 1791. FLE AV 2629.

assistant von Triesnecker or by his former assistant Pilgram.[114] However, the volumes for 1788 and 1789 contain a number of pieces that attest to his ability, in his advanced years, to adopt a perspective on major issues in his profession, and to highlight these in a genre that was very different from all of his previous contributions; and he did so in a way that harmonized with the strategy of emphasizing his Jesuit and Hungarus allegiances.

In 1781, Frederick William (Friedrich Wilhelm) Herschel (1738–1822) ascertained that a celestial body he had observed was not a star, but a planet, which at first he named Georgian star (after King George III), but it became universally known as Uranus. This first discovery of a planet in the solar system since antiquity became a sensation, in spite—or precisely because—of the fact that the existence of such a planet had been predicted on purely speculative grounds as an inevitable part of a structurally consistent cosmology by Kant in his *Allgemeine Naturgeschichte und Theorie des Himmels* (Universal natural history and theory of the heavens [1755]). In turn, Kantian speculative cosmology was not dissimilar in its narrative scope and ambition to biblical cosmogony and mythical astrology, which also received significant stimuli from the "new science" of the seventeenth and eighteenth centuries. Together, they have been shown to have supplied a great deal of inspiration for astronomical didactic poetry, a genre that flourished in eighteenth-century Hungary.[115] It was such a piece of poetry, the *Historia Uraniae musae* (History of the muse Urania) by György Alajos Szerdahely (1740–1808), originally published in the previous year, that introduced the appendix of the *Ephemerides* for 1788. This was followed by another poem, by Hell himself, the *Lis astronomorum* (The feud of astronomers—i.e., the controversy on the naming of the new planet). Szerdahely soon composed a companion, *Elegia epidictica, per quam demonstratur Uraniam musam esse primogenitam Urani* (Epideictic elegy demonstrating that the muse Urania was Uranus's first born) and republished along with the *Historia* and the rest of his collected poetical works in 1788 in a volume entitled *Silva Parnassi Pannonii* (Forest of the Pannonian Parnassus).

114 Cf. Sommervogel, "Hell, Maximilien," 244–46. Beginning in the late 1780s, the highly talented, but far less renowned astronomer Johann Tobias Bürg (1766–1834) also took part in observations at the Vienna University Observatory. After Hell's death in 1792, he served as von Triesnecker's adjunct and co-editor of the *Ephemerides*. For a popular account of Bürg's career, see Maria G. Firneis, "Johann Tobias Bürg (1766–1834): Littrows Gegenspieler in Wien," *Die Sterne* 69 (1993): 148–53.

115 Piroska Balogh, "Sic itur ad astra: Változatok a csillagászati tanköltemény műfajára Szerdahely György Alajos és Pálóczi Horváth Ádám műveiből," in *Magyar Arión: Tanulmányok Pálóczi Horváth Ádám műveiről*, ed. Rumen István Csörsz and Béla Hegedüs (Budapest: Rec.iti, 2011), 101–12, here 104.

Excerpts of the *Elegia* were then included by Hell, with lengthy annotations and a celestial map of new constellations named after George III and Herschel, accompanied by their eulogies, in the *Ephemerides* for 1789.[116]

Szerdahely was appointed in 1774 as the first professor of aesthetics at the University of Trnava (then Buda, and finally Pest) before being transferred to the position of director of the university's gymnasium in 1784. He was the author of the first comprehensive work on aesthetics in Hungary (*Aesthetica* [1778])[117] as well as important studies on general poetics (*Ars generalis poetica* [1783]) and genre theory (*Poesis narrativa* and *Poesis dramatica* [1784])—and a fellow ex-Jesuit of Hell's. Like Hell, Szerdahely was a strong devotee of the legacy of his order, often lamenting its demise in his poetry,[118] and also like Hell he suffered denigration from "enlightened" circles.[119] The significance of the two astronomical poems for Szerdahely himself is highlighted in the preface to the *Silva Parnassi Pannoniae*, in which their place is pivotal, and which is dedicated to Hell in recognition of his encouragement to Szerdahely to compose and publish such poetry.[120] "Poetry and astronomy have always been friends, as they have been brothers, too," both of them "dwelling in heaven," where already Plato located the muse of poetry along with her sister Urania. Szerdahely expresses his conviction that Hell, who campaigned to rename the new planet Urania in the debate related in the *Lis astronomorum*, had a "poetic spirit" himself, thanks to his outstanding inquiries into the "eternal worlds" jointly governed by the two muses and the arts they represent.[121] The heavens are portrayed as embracing a physical universe of celestial bodies as well as a cosmos of fiction, accessed and interpreted by human creatures with the means of a dual code: the one by astronomy and the other by poetry. Both of these are in need of resorting to a *spiritus poeticus*, which according to its original Greek

116 The three pieces are found in the *Ephemerides* 1788 (1787): 273–302 and 305–15; and the *Ephemerides* 1789 (1788): 332–56.

117 This work earned Szerdahely considerable international recognition. On this, as well as biographical information and a general reassessment of Szerdahely's fairly neglected and under-appreciated contributions, see István Margócsy, "Szerdahely György művészetelmélete," *Irodalomtörténeti Közlemények* 93, nos. 1–2 (1989): 1–34; and Piroska Balogh, *Teória és medialitás: A latinitás a magyarországi tudásáramlásban 1800 körül* (Budapest: Argumentum Kiadó, 2015), 13–102.

118 László Szörényi, "A latin költészet helyzete Magyarországon a XIX. században," *Irodalomtudományi Közlemények* 89, no. 1 (1985): 1–17, here 6.

119 Margócsy, "Szerdahely művészetelmélete," 5–6.

120 The dedication and the two men's relationship did not escape the attention of the reviewer of the volume for the *Allgemeine Literaturzeitung*, no. 257 (August 21, 1789): 508–9.

121 Cited in Balogh, "Sic itur ad astra," 106.

etymology should be understood not merely as "poetic," but also as "creative." Thus, the narrative offered in the *Historia* of a heavenly coup—at first, the consent of Uranus to her daughter Urania's occupation of a position on the firmament, then her expulsion by the revolt of Saturn, and finally her liberation and restoration thanks to Herschel's discovery—has a "mytho-poetic" character: Urania secures a place for the symbolism of astronomy in poetry, as well as one for poetry in the universe of astronomers.[122] While this narrative serves to sketch a peculiar cosmology, in the *Elegia* this cosmology is shown to have an anthropological base: its claim that Adam, the first and prototypical man, was at the same time "the first astronomer," is the metaphorical formulation of the universal human endeavor of observing and understanding the surrounding cosmos, and thereby achieving ascension and immortality.[123]

While Hell must have been flattered by Szerdahely's appreciation and dedication, his own goals in publishing the Buda professor's poems may have been more down-to-earth. On the one hand, he must have conceived them as striking instruments of canvassing his proposition of the name Urania for the new planet (arguing that Uranus is the progenitor of the heavens, not a part of them). In introducing the *Lis astronomorum*, he styled himself "Uranophilus Austriacus." When sending the *Ephemerides* for 1788 to Kästner, Hell mentioned that he had sent Bernoulli in Berlin "several copies of the *Historia Uraniae*, and he replied that the academy was pleased to receive them," and exclaimed: "What will the renowned Mr. Bode do in his *Ephemerides* with his Uranus?"[124] Hell was eager to learn Kästner's opinion on the name Urania, adding:

> The name Uranophilus covers Hell, who took up his lute, abandoned in the most hidden cave of Parnassus since he was forty years old, and sang the Apotheosis of the Muse Urania, whose name is hardly known by the poets of our time. In the *Historia Uraniae*, which we composed with Mr. Szerdahely, all the ideas are mine, and I have supplied more or less all the notes to it.[125]

While in the sources available for this study no ventures into poetry by the court astronomer around or before 1760 could be identified, his attempt to

122 Balogh, "Sic itur ad astra," 109.

123 Balogh, "Sic itur ad astra," 210.

124 Hell to Kästner in Göttingen, January 26, 1788 (NSUBG; Hungarian translation in Csaba, *Hell Miksa írásaiból*, 59). Bode was the first to suggest the name Uranus for the planet.

125 Hell to Kästner in Göttingen, January 26, 1788 (NSUBG; Hungarian translation in Csaba, *Hell Miksa írásaiból*, 59).

appropriate the work of a collaborator as entirely his own quite closely resembles Hell's redefinition of his role in authoring the *Demonstratio* nearly two decades earlier. The point is not so much the extent to which this was disingenuous—although, had it not been confined to private correspondence, Szerdahely would surely have resented it: after all, the Buda professor himself was quite knowledgeable about astronomy, also shown by his commemoration of Weiss written upon the latter's death in 1785.[126] Rather, Hell's effort to appropriate the poem is noteworthy because it shows his deep identification with the approach to the wider significance of an astronomical discovery adopted in it.

Finally, there is yet another perspective on the publication of Szerdahely's poems in the *Ephemerides*. Like Hell, he was not only a former Jesuit but also a devoted adherent of the Hungarus tradition. He wrote Latin poetry and an *Apologia pro lingua Latina* (Defence of the Latin language [1790]) as a token of his allegiance to the old cultural markers of the country, and at the diets of both 1790 (as a member of the educational committee) and 1807 he spoke out forcefully for the retention of Latin as the official language of Hungary in church and state. This earned Szerdahely violent detractions among the promoters of Hungarian, despite many unquestionable testimonies of his strong attachment to the literature and culture of his *patria*, including the appreciation of the beauties of the Hungarian language.[127] Also like Hell, he was an outstanding scholar, with an increasing international reputation. Especially in conjunction with Hell's correspondence campaign—if Kästner, Bernoulli, and via the latter the Berlin academicians received copies of the *Historia*, quite certainly others in his broad network were not neglected either—the *Ephemerides* was once again, as in the case of the 1776 astronomical journey and the activities of the Eger observatory, a vehicle for the international propagation of Catholic cultural and scientific achievement in the Hungarian half of the Habsburg monarchy.

What were Hell's chances of being taken seriously as a Hungarian patriot?[128] After all, he had also made his name known as an eager, though not formally

126 György Alajos Szerdahely, *Memoria admodum reverendi et Clarissimi Domini Francisci Weiss astronomi celeberrimi* (Buda: Landerer, 1785).

127 Margócsy, "Szerdahely művészetelmélete," 8. For Szerdahely's 1807 statement on Hungarian, see Sándor Domanovszky, ed., *József nádor iratai*, 3 vols. (Budapest: Magyar Történelmi Társulat, 1925–35), 3:74. It must also be added that at the same time he appears to have promoted the spread of Hungarian in education. Cf. *Az Ország-Gyűlésének írásai, Acta Comitiorum* (1807): 270.

128 For a concise version of the argument presented in the following paragraphs, see László Kontler, "Politicians, Patriots, and Plotters: Unlikely Debates Occasioned by Maximilian Hell's Venus Transit Expedition of 1769," in Sterken and Aspaas, *Meeting Venus*, 83–93.

qualified student of themes in Hungarian history and language, emerging as crucial to contemporary discourses of identity. During his lifetime, "language became ideology" in the Kingdom of Hungary—or at least firmly on its track toward achieving such a status[129]—and the historical study of language was generally consolidating its authority as an indispensable branch of the "sciences of man," whose emergence itself was central to the reorientation of the map of knowledge in the eighteenth century. From this point of view, he may be perceived as responding to developments in the sciences and in the public domain with special sensitivity, but in lack of explicit evidence, one could only speculate as to the extent to which he saw these changes happening. If he did, he may also have realized that there could be political benefits for him in going along. In the post-1773 status quo, when changing circumstances favored the amplification of Hell's Hungarus commitments, his studies devoted to central issues of the genesis of the Hungarian "patria" could have served to consolidate his credentials as a "patriot," and smoothly dovetailed with his efforts to promote the progress of science in the realm.

This would seem like a highly ingenious and potentially promising combination of flexibility in intellectual endeavors (based on open-mindedness and curiosity), and adaptability in social brokerage. Still, in the end Hell was fighting an uphill battle. It is true that in strictly academic circles the theory advanced in the *Demonstratio* was almost invariably welcomed in Hungary too. As we saw, even Pray felt compelled to modify his earlier views on the subject. It must also be added that the only linguist to champion the alternative concept in Sajnovics's and Hell's lifetime, the eccentric itinerant scholar György Kalmár (1726–*c*.1782), published his relevant work nearly simultaneously with the *Demonstratio*, so it could not have been a response to it.[130] In other words, the issue here was not (yet) that of an academic debate,[131] the more so as contemporary scholars used the terms "linguistic family" or "linguistic kinship," if

129 István Margócsy, "When Language Became Ideology: Hungary and the Eighteenth Century," in Almási and Šubarić, *Latin at the Crossroads*, 25–34.

130 György Kalmár, *Prodromus idiomatis Schytico-Mogorico-Chuno-*(*seu Hunno-*) *Avarici, sive adparatus criticus ad linguam Hungaricam* (Bratislava, 1770). Cf. Zoltán Éder, "Újabb szempontok a *Demonstratio* hazai fogadtatásának kérdéséhez," in Éder, *Túl a Duna-tájon: Fejezetek a magyar művelődéstörténet európai kapcsolatai köréből* (Budapest: Mundus, 1999), 47–61, here 49.

131 This somewhat revisionist view of Hungarian scholarship on the subject is summarized, with references to the now extensive literature, in Réka Lőrinczi, "Megjegyzések és adalékok a finnugor nyelvrokonítás fogadtatásához," *Nyelvtudományi Közlemények* 97 (2000): 261–72. During the subsequent century, however, a veritable "Ugrian-Turkic war" gradually unfolded and culminated in the 1860–70s, among linguists and ethnographers, in which the notions of linguistic, cultural, and genetic affinity and kinship became increasingly confounded.

ever, metaphorically at best, and without any clear-cut frontlines between a "Scytho-Hungarian" and a "Finno-Ugrian" "school."[132]

At this point, it is worth recalling other texts of an academic nature, those mentioned in Chapter 5, published in Hungary about Sámi and "Scythian" ethnology, and the attempts Hell and Sajnovics made to attenuate the predictable consternation among increasingly zealous Magyar patriots over the theory advanced in the *Demonstratio*. These attempts were mostly in vain. The repudiation of the Sámi kinship of the Hungarian language proposed by Hell and Sajnovics, framed in derogatory discussions of the Sámi, was especially prominent among the "bodyguard writers." Given the intellectual and cultural sensibilities of this group, briefly described above, the implications of "Lappianism"—understood by them as not only linguistic but also ethnic kinship—seemed to them highly disturbing. Ábrahám Barcsay's (1742–1806) poetry abounds in rebuffs addressed to Sajnovics whose "yoke" was perceived by him as a vital threat to ancient liberties, established on the cornerstone of the idea that Hungarians are "the valiant grandsons of Scythians."[133] Similarly, in Lőrinc Orczy's (1718–89) "The Errors of Star-Watcher Sajnovits and Hell Being Refuted" (1773), the author points out the absurdity of the allegation that the progeny of Alexander the Great's brave opponents should be related to mere "Lapps," munching on dried fish. Orczy is profoundly ironic. Referring to the preface of the *Demonstratio*, he recalls that it was Hell who "forced" the strange idea on Sajnovics—but "I know you rejoiced in this kinship / with a noble nation like this / Lapps have always been so famous / just like eminent Tóts [Slovaks] among us."[134] The reference to "Tóts" is not accidental: Orczy concludes by recommending that "the astronomer" return to *his* "kind relatives," an inaccurate hint at Sajnovics's Slavic (though in his case Croat) ethnic background.

It is, however, not merely an ethnic hint. "You could once be the lord of this people / leading it to the shore of the icy sea / raising it to glory / good Svatopluk having lost it shamefully." Svatopluk (*c.*840–94, r.871–94) had been the Slav

132 Béla Hegedűs, "Kalmár György a magyar nyelv származásáról," in *Historia litteraria a XVIII. században*, ed. Rumen István Csörsz, Béla Hegedűs, and Gábor Tüskés (Budapest: Universitas, 2006), 294–306, here 300.

133 László Vajthó, ed., *Barcsay Ábrahám költeményei* (Budapest: Királyi Magyar Egyetemi Nyomda, 1933), 50–51.

134 Miklós Révai, ed., *Két nagyságos elmének költeményes szüleményei* (Bratislava: Antal Loewe, 1789); http://mek.oszk.hu/03300/03368/03368.htm#77 (accessed April 19, 2019). It has been claimed that Barcsay may have been the author of this poem, too. Cf. Emese Egyed, *Levevék fejemről Múzsák sisakomat: Barcsay Ábrahám költészete* (Kolozsvár: Erdélyi Múzeum-Egyesület, 1998), 101. See, however, Piroska Balogh, "'Scytha vagyok, nem Lappon': Adalékok Csokonai *Halotti versek* című művének tudománytörténeti hátteréhez egy történész és egy poéta diskurzusából," in Balogh, *Teória és medialitás*, 180–203, here 182.

prince of Moravia ruling substantial parts of the western Carpathian Basin before the late ninth-century Magyar conquest. It was as a result of his demise that they ("Tóts") are now regarded, according to Orczy, as "diligent serfs." He gave Sajnovics a further piece of advice: "You see, if servitude no longer pleases you / [...] / lordship may be your lot over there / as freedom does not accrue to serfs over here."[135] While Sajnovics himself possessed a patent of nobility, his embracing—at Hell's instigation—the Sámi theory amounted to a disavowal of this status on his part, and a general assault on the entire system of social exclusiveness forming the basis of the ancient Hungarian polity. This leads us to the political context. As mentioned above, just a few years earlier, the diet of 1764–65 ended in bitter estrangement between the Hungarian nobility and the Viennese government because of the latter's pursuit of measures circumscribing the former's privileges. During the debates of the diet and afterward, court propaganda in support of the proposed policies received a boost from a treatise by Kollár, *De originibus et usu perpetuo potestatis legislatoriae circa sacra apostolicorum regum Ungariae* (The origin and the perpetual use of legislative power among the apostolic kings of Hungary [1764]).

In this treatise, the commoner[136] and ethnic Slovak Hungarus Kollár called into question many of the political and social privileges of the Hungarian ecclesiastical and secular elites, criticizing Werbőczy in especially sharp terms, and causing great consternation among the clergy and the nobility.[137] Characteristically, Kollár's anti-feudal polemics was readily associated by this constituency with anti-Hungarian sentiment, identified in his commentary on *Hungaria et Atila, sive de originibus gentis Hungariae*, a work by the sixteenth-century humanist Miklós Oláh (Nicolaus Olahus [1493–1568]), which Kollár edited and published in 1763.[138] These comments, which refer to the statistical minority of Hungarians in the Kingdom of Hungary and predict the gradual demise of the language as well as the nation itself, became European currency through being quoted in von Schlözer's *Allgemeine nordische Geschichte*, which in turn seems to have inspired Johann Gottfried Herder's (1744–1803) famous "prophecy" to the same effect. The latter's prediction that the Hungarian nation, amid the "ocean" of Slavic peoples, will inevitably perish, was underpinned by his theory (available in publication for the first time in the late 1760s

135 Révai, *Két nagyságos*.

136 Until his ennoblement in recognition of his services by Maria Theresa in 1776.

137 Andor Csizmadia, "Egy kétszáz év előtti országgyűlés évfordulójára: 'Kollár contra Status et Ordines,'" *Jogtudományi Közlöny* 19, no. 4 (1964): 214–27.

138 Cf. Dezső Dümmerth, "Herder jóslata és forrásai," *Filológiai Közlöny* 9, nos. 1–2 (1963): 181–83; Dümmerth, "Kollár Ádám problémája," *Filológiai Közlöny* 13, nos. 3–4 (1967): 442–44.

and early 1770s) on the crucial role of language in the formation of human identities. Herder claimed that "all conditions of awareness in [man] are linguistic"—thus, as language acquisition took place in communities, reason and the capacity of thinking, the very distinguishing feature of the human animal, was bound to have as many modes as there were human communities.[139]

Members of the Hungarian intellectual elite had good reasons for being attentive to such views, and also for taking them as an alarm bell. These developments only added to von Schlözer's notoriety as an "anti-Hungarian." Indeed, even three decades later Mihály Csokonai Vitéz (1773–1805), the greatest of Hungarian lyricists of the time, still identified the German scholar—whose views as a political writer and expert of the state sciences, diametrically opposed to systems based on the distinction of estates, were also regarded as having contaminated not a few young Hungarians studying with him in Göttingen—as a chief national enemy:

> I believe that Atila is not needed for the augmentation of the glory of my noble nation: but I also believe that after Schlötzer [*sic*], who (at least to my mind) is one of the most nationally biased writers, we are insulted by some of the newer, and novelty seeking German authors when they want to call into question in one way or another that the Huns and the Hungarians derive from the same nation.[140]

Kollár was cast in the same role in the eyes of the Hungarian elite after 1764. A parliamentary committee assigned with the task of "investigating" the *De originibus* found it to be "the shame of living Hungarians" and achieved its inclusion in the Index of prohibited books; this, and a torrent of pamphlets and libels critical of Kollár, forced him to issue an *apologia*.[141] Despite the fact that Kollár was a distinguished scholar who as late as in 1763 drafted a plan of a *societas litteraria* or *societas Hungarica* (learned, or Hungarian society) for the promotion of the sciences in Hungary, and maintained intense correspondence about its establishment, he now lost his credit even in a part of the

139 Johann Gottfried Herder, *Treatise on the Origin of Language* [1772], in *Philosophical Writings*, trans. and ed. Michael N. Forster (Cambridge: Cambridge University Press, 2002), 65–164, here 131, 150. See also *Fragments on Recent German Literature* [1767–68], in Herder, *Philosophical Writings*, 33–64, here 49.

140 Mihály Csokonai Vitéz to István Kultsár, 1802 [?], in Mihály Csokonai Vitéz, *Összes művei két kötetben*, ed. Cyrill Horváth (Budapest: Magyar Könyvkiadó Intézet, 1901), 2:907.

141 Tibenský, *A királynő könyvtárosa*, 60–61.

learned public.[142] As we have seen, Kollár later on welcomed the position advanced in the *Demonstratio* in his review of it, which—had it not been anonymous—would have made him, if possible at all, even more suspect. Together with him, by championing the "Lappish cause," for an influential segment of the contemporary Hungarian public scene Sajnovics and his mentor Hell seemed to be (ex-)Jesuit hirelings of a hostile court, employed in a plot that also involved willing collaborators from the camps of old and new national enemies, Germans and Slavs.

An increasingly influential voice in the chorus determining the climate of opinion in which Hell was attempting to assert his credentials as a "Hungarian patriot" belonged to Bessenyei, already introduced as a key figure of the Hungarian Enlightenment and national awakening.[143] Most of Bessenyei's contributions to philosophical history, the idiom for him to discuss the problem of linguistic kinship and ethnic origins, appeared in the 1770s. It is true that his direct engagement of the "Lappish" theory—significantly enough, contained in a work entitled *Magyarországnak törvényes állása* (The legal status of Hungary [1802])—derives from the time of his retirement to his estate, but the ideas advanced in it must have been generated by the debates several decades earlier. Bessenyei's criticism is developed in considerable detail. He recalls that a "writer has voiced the opinion that the Hungarian nation derives from Lapponia, for the reason that their language contains words that mean the same as in Hungarian." This is asserted to be methodologically wrong: "But it is impossible to displace something of such a great consequence, on the basis of so little a circumstance [as language], and set it on a different footing. Instead of words, one should consider moral character and manners."[144]

142 Cf. Csizmadia, "Egy kétszáz év előtti országgyűlés," 224. For instance, Kollár suspected that the author of one of the attacks was the Jesuit fellow historian Kaprinai, mentioned above as a correspondent also of Hell's. Kollár to Maria Theresa, May 22, 1765. Soós, *Kollár levelezése*, 179.

143 Given Kollár's situation vis-à-vis the court on the one hand and the Hungarian elite on the other, it is noteworthy that in the early 1770s, Kollár—upon the request of Theresia Grass (1721–after 1780), a lady-in-waiting at Maria Theresa's court—enthusiastically supported the young Bessenyei and recommended him for patronage to the empress. In one of his letters to his sovereign in this matter, Kollár praised the Hungarus "national character." Theresia Grass to Kollár, December 4, 1772, April 16, and October 11, 1773, January 14, 1774; Kollár to Maria Theresa, April 16 and 18, 1773. Soós, *Kollár levelezése*, 336, 341–46, 349–50. In 1779, Bessenyei became a custodian of the library of which Kollár was the director.

144 György Bessenyei, *Összes művei: Prózai munkák, 1802–1804*, ed. György Kókay (Budapest: Akadémiai Kiadó, 1986), 232.

Bessenyei was in fact by no means alone and not even the first in objecting to Sajnovics's (and Hell's) neglect of the tools fundamental to the approach of the eighteenth-century sciences of man. In commentaries to his own poem on the "star-watchers," Orczy also gibed:

> I cannot comprehend why your Reverend [...] makes no reference at all to the morals of the Lapps in order to underpin his opinion. [...] Morals are of their nature inscribed in us, and indelible marks of the customs inherited from our forefathers. [...] It is imperative to target the original source of morals. [...] The sounds of language follow history, they sometimes soften and sometimes harden according to the needs of the heart [...].[145]

It has been pointed out that Orczy wrote his poem in close collaboration with the learned Piarist history professor Károly Koppi (1744–1801) of Košice (later Oradea, and finally Pest), who in his own comments also stressed that "manners, mental disposition, domestic discipline, the pursuit of dominance and submission," and so on take precedence in the study of national character over linguistic evidence based on word matches.[146] It must be noted that in these objections, the standard contemporary argument from manners is turned upside down. In mainstream stadial history, the study of manners throws light on the dynamics of historical change in a society, whereas in the Hungarian writers' account they are indicative of a nation's permanent spirit—contrary to language, which is more malleable, and therefore not regarded by them as a reliable test of kinship. Nevertheless, there is a meta-level to their critique. As has been mentioned, in his exchanges with Pray Hell somewhat arrogantly claimed the superiority of his method, imported from the "exact" sciences for application in the study of linguistic kinship. The opposite happens here: the approach of Sajnovics and Hell is pointed out to be rigid and reductionist, lacking the sensitivity to incorporate a multiplicity of perspectives on the subject, and failing to consider contradictory evidence. In this regard, Hell's ambition to follow the shifts of emphasis in the sciences of his day by an *entrée* in those of the human and the social was futile because he was unwilling or unable to align his methodological priorities.

145 Extant only among Orczy's manuscripts, published in Balogh, "'Scytha vagyok, nem Lappon,'" 193–96.

146 Balogh, "'Scytha vagyok, nem Lappon,'" 185–86, 202. The full text of Koppi's commentary is published with Balogh's article, 200–3.

However, especially for Orczy, this was not the only guilt of the astronomers, and generally representatives of the natural sciences. While "measuring unknown corners of the world," "descending in the bowels of the earth, searching in its crust for its beginnings," and so forth, they "besiege the Gods once again":[147] they were trespassing in the territory of metaphysics, where their sciences lacked authority. "Such is, my dear Reverend Father, the lunatic error of the human mind, if no limits are set to its dazzling conceit and sinful pride," Orczy wrote in his commentary, resembling the distinction of Francis Bacon, in a much earlier phase of the "new science," between "pure knowledge" and "proud knowledge" in the *Advancement of Learning*.[148] The ascription of universalistic aims and potentials, in the novel Kantian mode, to disciplines like astronomy, geology and mineralogy, evolutionary botany and anthropology, was becoming a trade mark of the scientific milieu in Göttingen, where Hell was elected a member of the academy, and where "Lappianism" was appreciated and promoted by men like von Schlözer. The aversion evoked by the social- and political-ideological implications of the theory of the *Demonstratio* became voiced in terms of a discrepancy between scientific paradigms, too.[149]

Returning to Bessenyei's argument, in the subsequent explicit comparison the lens of manners shows the "Scythian" and the "Lapp" to be separated by a yawning gap:

> The Lapp, when standing erect, is barely three elbows tall: he has a ghastly wide mouth, always kept open; his head is like a pigeon-house on his short body; his eyes are tiny and sunk deep in the head; his thorax is thick and swollen; his nose is short and flat; his long, protruding chin has no hair. Besides this ugliness of form, the Lapp is vile and fearful, it is such a subterranean mole nation, which loathes the fight; for the same reason, it never wages war. The desire for secular fame and glory has never occurred to them. But the extraordinary coldness of the country creates and

147 Révai, *Két nagyságos*.

148 Balogh, "'Scytha vagyok, nem Lappon,'" 196. Cf. "It was not the pure knowledge of nature and universality, a knowledge by the light whereof man did give names to other creatures of the Paradise […] but it was the proud knowledge of good and evil, with an intent in man to give law unto himself, and to depend no more on God's commandments, which was the form of the temptation." Francis Bacon, *The Advancement of Learning and New Atlantis*, ed. Arthur Johnstone (Oxford: Clarendon Press, 1981), 6.

149 For the Göttingen approach to the disciplines, see Luigi Marino, *Praeceptores Germaniae: Göttingen 1770–1820* (Göttingen: Vandenhoeck & Ruprecht, 1995 [Italian original: Turin: Einaudi, 1975]). For Orczy's criticism, see Balogh, "'Scytha vagyok, nem Lappon,'" 188.

> nurtures the Lapp with a nature that cannot keep him alive under any, more pliant climate. In Hungary, Lapps would all die. If the writer was so familiar with the language that he formed a judgment about it, it is a pity that he forgot about these features of the nations, which could have placed the matter in a clearer light.[150]

It has been pointed out that Bessenyei closely follows Vaissète in his description of the Sámi.[151] But the vocabulary employed by him ("ghastly," "ugly," "subterranean mole") replaces rather passionate disparagement for the attempted scholarly detachment of Enlightenment philosophical-scientific texts: the element of "othering" one regularly finds in such texts about Sámi as a primitive nation (similarly to other "savage" societies) becomes radicalized under the impact of the politically inspired vantage point of the Hungarian nobleman. Unlike in the case of the steppe barbarians, where "savagery" is developed and accentuated as a condition of a propensity to freedom, any potential of Sámi savages to be recognized as "noble" is relentlessly suppressed by Bessenyei.[152]

Questioning the Hun–Scythian ancestry of Hungarians, the cornerstone of both national dignity and old liberties, with reference to the Hungarian–Sámi linguistic kinship almost inevitably invited passionate rejection—ironically, even from figures who, like Bessenyei, otherwise demonstrated an awareness

150 Bessenyei, *Prózai munkák, 1802–1804*, 233.

151 Penke, *Filozofikus világtörténetek*, 65

152 This is not the place to delve into the further intricacies of the reception of the *Demonstratio*. Several scholars have emphasized that outright hostility to "Finno-(Lappo)-Ugrianism" was confined to a minority, and the dominant feeling was perplexity (resulting in strange hybrid theories). See László Szörényi, "Nyelvrokonság, őstörténet és epika a 18. századi magyarországi jezsuita latin irodalomban," *Irodalomtörténeti Közlemények* 101, nos. 1–2 (1997): 16–24; István Margócsy, "A tiszta magyar: Nemzetkarakterológia és nemzeti történelem összefüggései Bessenyei és kortársai nyelvrokonság-felfogásában," in *A szétszórt rendszer Tanulmányok Bessenyei György életművéről*, ed. Csaba Csorba and Klára Margócsy (Nyíregyháza: Bessenyei Kiadó, 1998), 131–40.The fluctuation of the Habsburg–Hungarian relationship is a factor to consider in this regard. The retorts of Barcsay and Orczy date from a period in which the initial perplexity over Sajnovics's theory spilled over into consternation under the impact of the post-1765 disaffection with Vienna. True, there were more neutral voices already in the Josephian period, when relations were altogether also far from cordial, culminating in the conflation of Sámi, Finns, Huns, Scythians, and Hungarians—locating them all in the "empire of Karelia"—in the novels and plays of András Dugonics (1740–1818). But it is noteworthy that Bessenyei's most relevant statement on the subject was conceived in a period when the 1794 Hungarian "Jacobin conspiracy" had resulted in several executions and a wave of imprisonments (Bessenyei himself was also suspect), and the new, unenlightened absolutism of Francis I understandably provoked retrenchment.

of the largely bogus character of those liberties. Hell's old-new Hungarus patriotism, expressed by his adulation of the recent achievements of scientific progress in the country and his immersion in the labyrinthine paths of ancient Magyar history, sounded insincere to many in his potential audience. Kinship with the "fish-smelly Lappians," as proposed, with Hell's increasing sponsorship, in Sajnovics's *Demonstratio*, was from their perspective not merely methodologically problematic, but undignified and unwholesome, even treacherous and hostile. Many believed that such a denigration of the Magyar stock received intellectual ammunition from German academic circles, where ideas of enlightened bureaucratic centralization were also promoted, and encouragement from the Habsburg government, where such ideas were on the way of being implemented to the detriment of the ancient privileges of Hungary.

After support for him in the imperial center had become lukewarm, whatever hopes Hell entertained of re-constituting himself as a moving spirit of a scientifically thriving, Hungarus counterweight to Vienna, the alienation of this group of the nobility limited his scope of action to seeking the favors of conservative Catholic lords like Eszterházy. While the latter possessed the means of lavishly investing into the development of the infrastructure of learning, this was still insufficient leverage to negotiate the recognition of the Eger *lycée* as a university, which was a political matter. However, this would have been an indispensable step, in Hell's eyes, of his own repositioning on the map of learning in the Habsburg monarchy as well as the redrawing of that map by the resuscitation of Catholic knowledge in its old Jesuit style. On April 14, 1792, Hell passed away as a result of a deteriorating lung fever he had caught a few weeks earlier, without ever really coming close to attaining the ingeniously contrived end.

CONCLUSION

Borders and Crossings

Eighteenth-century societies in the Habsburg lands, as elsewhere in Europe, were marked by distances and borders, socially, spatially, and otherwise. The cultural experience belonging to the life worlds that they separated differed significantly. The traversability of the distances and the porosity of the borders were varied and changeable, subject to diverse influences from political interest and stratagem through economic growth or decline to the development of patterns and means of communication, and more. So were the opportunities for transgressing the borders and connecting the life worlds.

Maximilian Hell was born and raised among circumstances that, despite some appearances, equipped him well for such transgressions. Apart from his university years, the scenes of his life before his appointment as imperial and royal astronomer were "borderlands": relatively recently captured and consolidated possessions of the Habsburg crown whose value for it derived from its newly conceived geopolitical interests and stakes in the region east of the River Leitha. In some sense thus peripheral, yet these scenes were by no means marginal. Hell's birthplace was home to, and several of his family members were key figures in, a branch of industry that assumed strategic importance in the great power aspirations of the Habsburgs. The Society of Jesus, which offered unique opportunities for mobility and which by family decision Hell joined as a young adult, was firmly established there, while in Transylvania, where he was active as a much more mature but still early career scholar, the order was assigned a central role in the monarchy's "civilizing mission"—thus an excellent learning ground for developing skills of creative adjustment to varying, even contradictory, constraints and requirements.

Between these two stations, Hell could already ascertain how promising the combination of his descent and his Jesuit affiliation was during the years of his university studies in the imperial metropolis, where—naturally also thanks to his obvious mathematical and more broadly scientific talents—he first began integration in the intertwining patronage networks of aristocratic–governmental circles and the Society of Jesus during the 1740s. The firmness of this integration and intertwining is further underscored by his appointment, a few years later, as the first director of the new Imperial and Royal Observatory, the creation of which was central to the larger endeavor of the Habsburg government to raise the imperial seat once and for all to the status of a European scientific capital. Accepting this position was a major "crossing" for the

© PER PIPPIN ASPAAS AND LÁSZLÓ KONTLER, 2020 | DOI:10.1163/9789004416833_011
This is an open access chapter distributed under the terms of the CC-BY-NC-ND 4.0 License.

ambitious Jesuit from Banská Štiavnica, also holding out the possibility of more of the kind. Far from severing the ties binding him to the life worlds in which he was active until then, he made strenuous efforts to channel whatever worthy scientific work he saw being pursued there into the broader circulations that now opened to him. Nevertheless, at the same time he was thrown into one far grander in scale, especially as regards access to the various strands of the contemporary ferment in cultural sensibility, intellectual orientation, political program, and patterns of communication: the European Enlightenment.

It is important to re-emphasize how unproblematic it was for the Viennese administration to enlist in the service of its reform agenda a member of the Society of Jesus in 1755, just a few years before the demise or "end" of the order began with its expurgation from the Catholic states of the West, and not a full two decades before its general suppression by the pope. The analysis of the circumstances and the extant documents of the appointment, as well as the new state servant's subsequent manner of procedure, demonstrates that in this period the unity of purpose between him and the promoters of enlightened policies and institutions could hardly have been fuller. The pursuit of anti-superstitious and utilitarian ends via the production and dissemination of new knowledge, prescribed to Hell in the instructions given to him, was consonant with age-old Jesuit priorities and practices, and he proved to be highly ingenious and creative in exploiting the avenues and methods of knowledge circulation characteristic of the Republic of Letters at home and abroad in order to earn the much-desired recognition for his patrons as well as for himself, his faith, and his order. By the 1760s, his status as a truly cross-border character, constituting himself at the intersection of domestic and cosmopolitan scenes and shrinking the distances between them, had become sealed. The 1767 invitation of the Danish–Norwegian court to lead the Arctic Venus transit expedition was both an acknowledgment of this fact, and stretched it to its limits.

Borders and distances are relevant notions to the interpretation of Hell's figure in regard of the substance of his scientific contributions, too. Two of the most memorable among these were his calculation of the solar parallax (i.e., his preoccupation with inquiry into the fundamental unit of measurement of distance in the solar system), and determining the virtual proximity of human communities separated by physical distance in his studies of Sámi–Hungarian linguistic kinship. Together with his work in fields of knowledge as widely divergent as northern lights, electricity, meteorology, and magnetic healing, after the famed expedition of 1768–70 these were supposed to establish his credentials as a universal man of science with an encompassing vision who, thanks to his firm attachment to the solid methods and principles characteristic of

mathematics and mechanics (as against new-fangled approaches informed by the humanities and vitalism), is capable of bringing the study of all these fields to a shared platform. Fashioning himself in this role, Hell was self-assured, even self-conceited and occasionally arrogant, resorting to steps of dubious honesty like attributing to himself scientific achievements that at the very best originated from collaborative effort. As regards dishonesty, the allegations that he manipulated his Venus transit observation data were patently false. But it is small wonder that the cross-disciplinary pretensions of Hell were met with some perplexity and evoked a mixed response among fellow scholars. The latter continued to recognize his outstanding merits as a practical and theoretical astronomer, but also the limits of his larger claims as well as the eccentricity and unpleasantness of some of his reactions.

In this situation, Hell, more than any time before, was in need of support from other centers of knowledge, such as the Royal Danish Society of Sciences, of which he had become a member during the Arctic expedition, or the Parisian Académie des Sciences, whose *membre correspondant* he had become far earlier. However, the ideological underpinnings of such support had either vanished altogether or became corroded. In Denmark, the coup by Struensee in late 1770, which wiped away the mighty ministers who had facilitated Hell's recruitment as a savant in service of their monarch, was less than a year and a half later followed by a nationally oriented, "anti-German" government reluctant to lend support to cosmopolitan and multinational scientific endeavors of the kind represented by Hell and his expedition. From the French side, the reasons for the lack of support and ultimately indifference from former allies such as Lalande were apparently more complex. The continuing support for Boscovich and the lack thereof vis-à-vis Hell at least goes to show that anti-Jesuit sentiments around the climax of the suppression of the order did not trump prestige based on scientific merits and good conduct according to the long-established informal rules of the Republic of Letters. Hell's late publication and over-aggressive support of his Venus transit observations from Vardø in the ensuing controversy over the solar parallax were an infringement of the latter.

The uneasiness, anxiety, impatience, and frustration that filters through not a few of Hell's utterances in his later life, however, arose not only from the apparent futility of some of his scholarly endeavors but from changing tides on the Central European public scene. Hell's personal trajectory as a Jesuit man of science and state servant under successive Habsburg reform administrations in the mid- to late eighteenth century puts the chronology of the Enlightenment in Central Europe into relief. If there was one border that Hell was consistently unwilling to cross, it was the boundary of the Enlightenment in the

guise it arrived in the Habsburg realm during the later years of Maria Theresa and especially under Joseph II. Hell is a significant figure of science in the Age of Enlightenment, and the European Enlightenment is crucial to understanding Hell, while he remained peripheral to the Enlightenment—not geographically, as "periphery" is most often understood in Enlightenment studies, but in the sense of Enlightenment as a "system," a notion sketched in the introduction. In this "Wallersteinian" perspective, Hell *accessed* the Enlightenment and both benefited from it and enriched it as a highly proficient user and improver of the mechanisms, institutions, networks, and practices that its ideas fostered and sustained, without meaningfully *participating* in its intellectual and moral universe. In fact, he cultivated a principled hostility to some core values of the Enlightenment—for instance, religious toleration. The Enlightenment of the late 1740s to the 1760s was still congenial to an ambitious Jesuit man of science with its emphasis on the improvement of the infrastructures of (especially higher) learning, besides a beginning of the overhaul of the economic foundations and administrative organization of the state. Hell does not even seem to have been bothered much by the step that underlined the unity of these three aspects of the incipient transformations: the establishment of Viennese *Polizeywissenschaft*, whose logic and the governmental *modus operandi* that it promoted were pointing toward a program of eroding estate distinctions, including the ecclesiastical estate, of the kind implemented—gradually, with varying intensity and consistency—from about the time of Hell's northern adventure.

Despite the shock of *Dominus ac redemptor noster*, neither was the change abrupt, nor did it represent an existential threat to Hell and his personal status. Though he complained about the practical implications of the suppression of his order to the work routine of the observatory, his resentment was also based on hardly explicit, nevertheless unmistakable grounds of principle. Happiness in this world, even pursued by the means of modern knowledge practices, remained to him inseparable from happiness in the next one—indeed, he regarded the achievement of scientific goals, while in the strict sense subject to its own procedural rules, still ultimately dependent on the perpetual manifestations of divine benevolence. If "happiness" was to be attained, it therefore seemed to him indispensable to preserve the constitution of God's servants exactly as it existed in the Catholic Church, including its scientifically most distinguished arm, the Society of Jesus. The lukewarm, non-committal disposition of the Habsburg leadership vis-à-vis the matter of the suppression and its reconciliation with the papal verdict signaled to Hell a lack of commitment on the part of the government to the principle on which the services he was performing to it were founded.

For the first time in Hell's career, the boundaries of the "life worlds" in which he had negotiated his existence simultaneously became stiffened: what had been possible for a Jesuit until quite recently, was no longer feasible for an ex-Jesuit—a new type in need of new strategies of accommodation. To make matters still worse, confirming in Hell the sense of abandonment by his superiors, the developments on the Viennese scene also nurtured an Enlightenment "from below," exposing him to personal attacks in his character as a former Jesuit, now left to his own resources in fighting the battles that ensued. Hell took up the challenge, not only in the ordinary and simple sense of undertaking the necessary combats before the public eye but more generally and impressively by re-inventing the spaces around him, and relocating himself across the newly conceived borders. The would-be Viennese academy of sciences was envisioned as such a space—a virtual refuge for "ex-Jesuit science," more than just a consolation but perhaps a genuine compensation for the loss of the bastions of Jesuit learning. The eventual failure of this project, pursued by Hell with much vigor, must have made him all the more embittered in a few years' time upon witnessing the—true, ephemeral—flowering of institutions of academic sociability under the auspices of his most fervent critics, the Viennese freemasons. Even more striking was Hell's alternative to rekindling Jesuit science in the imperial center, now hopelessly submerged in heartless, calculative enlightened rationality: a Hungary dedicated to the rejuvenation of Catholic learning, with himself in a leading role and the bridge—physically still situated in the Viennese hub of astronomical activity in the Habsburg lands, but in a capacity not derived from his official position—between this space and the wider world. Eventually, he faltered because of the largely imaginary character of this space, and because he miscalculated the chances of re-fashioning (rediscovering) himself as a patriotic Hungarus savant, the reason being his blindness to the powerful survival of an archaic—but by no means obsolete—set of ideas about national identity in a freshly conceived Hungarian Enlightenment (or, Magyar national awakening).

The figure of Hell connected local, imperial, and cosmopolitan spaces—real as well as symbolic ones—of producing scientific knowledge in eighteenth-century Europe. He moved with facility in and between life worlds of different scales, from the small town environments of the Central European periphery, through the Catholic-Jesuit hierarchy, the courtly and government circles of imperial and royal capital cities, and the international Republic of Learning, to the hostile climate of the colonial north. At each of these scenes, he made strenuous efforts, and managed to a remarkable extent to exploit the range of opportunities they presented for becoming "successful." When the apparent continuity established through his person among these life worlds

became fragmented, it seemed a realistic hope that he would be able to resort to the credit raised in some of them against the ones where a deficit had suddenly been accumulated. In the interest of maintaining his positions, he might even be said to have been working across the boundaries of distinct scientific fields. Eventually, what appears to be his attempt to maintain the continuity of his ends by "de-centering" the realm that had once bred him but then abandoned him, turns out to have failed. Yet, his story is not less instructive for the fact that it was a failure: it reveals something about what men of science operating on multiple scales in early modern Europe may—or may not—have achieved by "negotiating knowledge" at times of imperial consolidation.

Appendix 1: Map of the Austrian Province of the Society of Jesus

© PER PIPPIN ASPAAS AND LÁSZLÓ KONTLER, 2020 | DOI:10.1163/9789004416833_012
This is an open access chapter distributed under the terms of the CC-BY-NC-ND 4.0 License.

MAP 1 Map of the Austrian province of the Society of Jesus
Map made by Johann Baptist Mayr (Augsburg: Matthäus Seutter, n.d. [*c.*1727–30]). Digitized by the Moravian Library in Brno

The map gives an overview of the houses of the so-called "Austrian province" of the Society of Jesus, to which Maximilian Hell belonged. The Latin place names are in alphabetical order (with Hell's stay in parenthesis when applicable). Names in regional vernaculars (at first in the language of the country of present location) and, when applicable, in English, are provided.

Agria = Eger, Erlau (*observatory construction*, late 1770s)
Alba Carolina = Alba Julia, Gyulafehérvár, Karlsburg
Alba Graeca = Beograd, Belgrád, Griechisch Weißenburg, Belgrade
Alba Regalis = Székesfehérvár, Stuhlweißenburg
Buda = the western part of Budapest, Ofen
Cassovia = Košice, Kassa, Kaschau
Cibinium = Sibiu, Nagyszeben, Hermannopolis, Hermannstadt
Clagenfurtum = Klagenfurt
Claudiopolis = Cluj, Kolozsvár, Klausenburg (*mathematics professor*, 1752–55)
Comaromium = Komárom, Komárno, Komorn
Corona = Braşov, Brassó, Kronstadt
Crembsium = Krems an der Donau
Eperiesinum = Prešov, Eperjes, Preschau
Essekinum = Osijek, Eszék, Mursa, Essegg
Flumen = Rijeka, Fiume, Vitopolis, Szentvit, Sankt Veit am Flaum
Ginsium = Kőszeg, Güns, Kiseg
Goritia = Gorizia, Görz
Graecium = Graz, Gräz
Gyöngyösinum = Gyöngyös, Gengeß
Jaurinum = Győr, Raab
Judenburgum = Judenburg
Labacum = Ljubljana, Laibach
Leobium = Leoben
Leopoldop[olis] = Leopoldov, Lipótvár, Leopoldstadt
Leuscovia/Leutschovia = Levoča, Lőcse, Leutschau (*gymnasium teacher*, 1745–47)
Lincium = Linz
Millestadium = Millstatt am See
Nagybania = Baia Mare, Nagybánya, Frauenbach, Groß-Neustadt
Neosolium = Banská Bystrica, Besztercebánya, Neusohl (*gymnasium pupil*, 1736–38; *tertianship*, 1751–52)
Passavium = Passau
Patakinum = Sárospatak, Šarišský Potok, Blatný Potok, Patak am Bodrog
Petrovaradinum = Petrovaradin, Pétervárad, Peterwardein
Posonium = Bratislava, Pozsony, Pressburg

Possega = Požega, Pozsega, Poschegg
Quinque Ecclesiae = Pécs, Pečuh, Fünfkirchen
Rosnavia = Rožňava, Rozsnyó, Rosenau
Scepusium = Spiš, Szepes, Zips
Schemnic(z)ium = Banská Štiavnica, Selmecbánya, Schemnitz (*elementary school pupil* [–1736])
Schurzium = Žireč, Schurz, part of Dvůr Králové nad Labem, Königinhof an der Elbe
Sopronium = Sopron, Ödenburg, Šopron
Strigonium = Esztergom, Gran
Styra = Steyr
Szakolcza = Skalica, Szakolca, Skalitz
Szat(t)marinum = Satu Mare, Szatmár, Sathmar
Szolna/Zolna = Žilina, Zsolna, Solna, Sillein
Temesvarinum = Timișoara, Temesvár, Temeswar
Tergestum = Trieste, Trst, Triest
Traunkirchium = Traunkirch
Trenchinium = Trenčín, Trencsén, Trentschin (*novice*, 1738–40)
Turoczium = Kláštor pod Znievom, Znióváralja, Zniev
Tyrnavia = Trnava, Nagyszombat, Tyrnau (*observatory construction consultant*, early 1750s)
Udvarhelynum = Odorheiu Secuiesc, Székelyudvarhely, Oderhellen
Ungvar = Uzhhorod, Ugohrad, Ungvár, Ungwar
Vallis Dominorum = Špania Dolina, Úrvölgy, Herrengrund
Varadinum = Oradea, Nagyvárad, Grosswardein
Varasdinum = Varaždin, Varasd, Warasdin
Vasarhelinum = Târgu Mureș, Marosvásárhely, Neumarkt am Mieresch
Vienna = Wien, Viedeň, Bécs, Vindobona (*university studies*, 1740–45 and 1747–51, *court astronomer*, 1755–92)
Zagrabia = Zagreb, Zágráb

Appendix 2: Instruction for the Imperial and Royal Astronomer Maximilian Hell, S.J.

1. The imperial and royal astronomer is to set in place a perfect arrangement for all the instruments pertaining to this study and make sure they are calibrated when necessary and well taken care of.[1]
2. It will be his responsibility to make daily observations of the trajectories of the planets, thereby taking heed of the journals of observations that were begun by, and continued through many years by the Gentleman de Marinoni, and to enter his observations meticulously in suitable notebooks.
3. The populace is to be urged and invited by way of published announcements or posters placed on gates to make observations of eclipses, occultations of stars, comets, and other unusual astronomical phenomena.
4. In order to promote the honor of this capital and its university, and to steer it toward the common good, the imperial and royal astronomer shall entertain a perpetual scientific correspondence with all the famous observatories abroad, and in so doing make sure that all observations that are necessary for the advancement of geography be communicated to this observatory by the foreign ones, and that no observations of the kind that other astronomers are eager to receive, shall be neglected by him.
5. All supervision of the calendars is bestowed and laid upon him. This responsibility will not only consist in making sure that everything that may originate from the superstition of the ancients and the multitude, or from the unfounded astrology, on weather, medications, bloodletting, growth of plants, or human coincidences, shall be completely avoided: he is also to edit an astronomical calendar every year and to publish it in time.
6. The above-mentioned is given responsibility, besides mechanical, practical, and calculatory astronomy, also for the courses in mechanics, which he shall deliver in the German vernacular at a suitable time every Sunday in the philosophical

1 This 7-point list is the formal job instruction Hell received on his appointment as court astronomer, in September 1755. Ernennung Maximilian Hells zum k.k. Astronomen. Beilage: Instruction. Für dem Kaiser. Königl. Astronomen Maximilianum Hell S.J. UAW, Universitätskonsistorium, CA 1.2.102 (translated from the German). On this document, see the discussion in Chapter 2 above.

© PER PIPPIN ASPAAS AND LÁSZLÓ KONTLER, 2020 | DOI:10.1163/9789004416833_013
This is an open access chapter distributed under the terms of the CC-BY-NC-ND 4.0 License.

lecture hall, and illustrate by means of mechanical experiments, and he is to announce these courses by way of posters of invitation in advance.

7. He shall report every week to the director of philosophy about all his observations and scientific correspondence, and he shall inform the director, to whom he is responsible in all matters relating to his office, about his further activities, on what subject matters are to be included in his calendars and mechanics courses, and what works he is going to publish.

Bibliography

Archival Sources

Archives nationales (Paris)
MAR/2JJ/66
Archives de l'Académie des sciences (Paris)
Protocol des séances and Lettre de nomination, 23 Décembre 1758
Archivio Segreto Vaticano (Vatican See)
Archivio della Nunziatura Apostolica in Vienna, 136:fol. 45^{r}
Centrum för vetenskapshistoria, Kungl. Vetenskapsakademien (Center for History of Science, Royal Swedish Academy of Sciences, Stockholm; CVH)
Correspondence of Pehr Wilhelm Wargentin
Eötvös Loránd Tudományegyetem, Egyetemi Könyvtár (Loránd Eötvös University, University Library, Budapest; ELTE EK)
Collectio Kaprinayana. Vol. 66.
Collectio Prayana. Vol. 18.
G 119
Főegyházmegyei Levéltár, Eger (Archiepiscopal Archives, Eger; FLE)
Archivum vetus 2629
Kansalliskirjasto, Helsinki (National Library of Finland)
Anders Planman's Correspondence
Det Kongelige Danske Videnskabers Selskab (Royal Society of Sciences, Copenhagen; DKDVS)
Protocoll 1742–70 and Correspondence of Henrik Hielmstierne
Konkoly Thege Miklós Csillagászati Intézet (Miklós Konkoly Thege Institute of Astronomy, Budapest)
Private Collection of Documents of the Late Magda Vargha (Vargha priv.)
Magyar Nemzeti Levéltár (Hungarian National Archives, Budapest; MOL)
Acta jesuitica E 152
Coll. Trench., Coll. Leucsov., Coll. Neosol., Coll. Schemn.
Magyar Tudományos Akadémia Könyvtára (Library of the Hungarian Academy of Sciences, Budapest; MTAK)
Irodalmi levelezés (IL) 2-r, 13. sz.
Niedersächsische Staats- und Universitätsbibliothek Göttingen (NSUBG)
Cod. MS philos. 182 (Letters from Hell to Abraham Gotthelf Kästner)
NTNU Trondheim, University Library
Gunnerus XA Qv. 281

Österreichisches Staatsarchiv (Vienna; ÖstA)
Finanz- und Hofkammerarchiv
Neue Hofkammer, Akten Altes Münz- und Bergwesen, Chronologische Reihe, 1747–56.
Haus-, Hof- und Staatsarchiv (HHStA)
Allgemeines Verwaltungsarchiv (AVA)
Studienhofkommission
75: Wien Akademie der Wissenschaften
132: Protokolle der Studienhofkommission
Gesandtschaftsberichte, fasc. 63.
Pannonhalmi Főapátsági Levéltár (Archives of the Abbey of Pannonhalma)
Hell's MSS "Opera à P. Hell. S.J. edita." June 9, 1773, and "Elenchus operum editorum à P. Maximiliano Hell," 1791.
Rigsarkivet (Royal Archives, Copenhagen; RA)
Privatarkiv no. 1846. Andreas Schumacher
Stattholderembetet 1572–1771, C VI Kopibøker, no. 7
Tyske Kancelli
Udenrigske Afdeling, Kejseren, Gesandtskabsrelationer 1767–68
Kopibogen
Rossiiskaia Akademiia Nauk (Russian Academy of Sciences; RAN)
Johann Albrecht Euler's correspondence
Spišský archív v Levoči (Archives of Spiš in Levoča)
21:40–42. Protocollum Regiae ac Liberae Civitatis Leuchoviensis pro Anni 1740–50
Štátny archív v Banskej Bystrici, Banská Štiavnica (State Archives in Banská Bystrica, Banská Štiavnica)
Protocollum Liberae Regiae Civitatis Montana Schemnitziensis de Anni 1725–35
Štátny archív v Trenčíne (State Archives in Trenčín)
KN/I 58–65, Protocollum Liberae ac Regiae Civitatis Trenchiniensis, Actorum Politicorum 1738–43
MGTN Contractus 1560–1755
Štátny ústredný banský archív v Banskej Štiavnici (State Archives, Central Mining Archives, Banská Štiavnica; ŠÚBA BŠ)
HKG 2617
Szent Mihály plébánia levéltára (Archives of the Parish of St. Michael, Cluj)
36:99–107.
Universitätsarchiv Wien (UAW)
Universitätskonsistorium, CA 1.0.195; CA 1.2.102; CA 1.3.117; CA 1.3.140; CA 1.3.405; CA 1.4.158.
Universitätsbibliothek Basel (UBB)
LIa964 and LIa701 (Letters from Hell and Lalande to Johann III Bernoulli)

Universitätssternwarte Wien (WUS)
Manuscripte von Hell, Chr. 90. 4 Vols.

Journals and Newspapers

Diarium Viennense. Vienna.
Gazette de Vienne. Vienna.
Göttingische Anzeigen von gelehrten Sachen. Göttingen.
Journal des Sçavans. Paris.
Kaiserlich-königlich allergnädigst privilegirte Realzeitung der Wissenschaften, Künste und Kommerzien. Vienna.
Kiøbenhavnske Nye Tidender om lærde Sager. Copenhagen.
Mannheimer Zeitung. Mannheim.
Prager gelehrte Nachrichten. Prague.
Wiener Zeitung. Vienna.
Wienerische Kirchenzeitung. Vienna.
Wienerisches Diarium. Vienna.

Printed Primary Sources

Anonymus, and Master Roger. *Anonymi Bele Regis Notarii Gesta Hungarorum/Anonymus, Notary of King Béla, the Deeds of the Hungarians*. Translated and edited by Martyn Rady and László Veszprémy; *Magistri Rogerii epistola in miserabile carmen super destructione Regni Hungarie per Tartaros facta/Master Roger's Epistle to the Sorrowful Lament upon the Destruction of the Kingdom of Hungary by the Tatars*. Translated and edited by János M. Bak and Martyn Rady. Budapest and New York: Central European University Press, 2010.

Audiffredi, Joannes Baptista [Giovanni Battista]. *De Solis parallaxi ad V. Cl. Grandjean de Fouchy* [...] *Commentarius*. Rome, 1766.

Authentic Memoirs of the Life and Reign of Catherine II: Empress of all the Russias; Collected from Authentic MS's [...]. London: B. Crosby, 1797.

Bacon, Francis. *The Advancement of Learning and New Atlantis*. Edited by Arthur Johnstone. Oxford: Clarendon Press, 1981.

[Baranyi, László]. *Rövid magyar geographia*. Pest: Trattner, 1796.

Bernoulli, Jean [Johann III]. *Lettres astronomiques où l'on donne une idée de l'état actuel de l'astronomie pratique dans plusieurs villes de l'Europe*. Berlin: l'Auteur, 1771.

Bernoulli, Jean [Johann III]. *Lettres sur différens sujets, écrites pendant le cours d'un voyage par l'Allemagne, la Suisse, la France méridionale et l'Italie, en 1774 et 1775* [...]. Vols. 1–3. Berlin: G.J. Decker, 1777–79.

Bernoulli, Jean [Johann III]. *Nouvelles litteraires des divers pays* [...]. Vols. 1–6. Berlin: l'Auteur and Hande & Spencer, 1776–79.

Bernoulli, Jean [Johann III]. *Receuil pour les astronomes*. Vols. 1–3. Berlin: l'Auteur, 1771–76.

[Bertalanffi, Pál]. *Világnak Két-rendbéli ismerete: Először A' mint Istentől teremtetett; Másodszor A' mint az Istennek, és a' természetnek Vezérléséből az emberektől külömbb-külömbbféle részekre, Országokra, Tartományokra, és kösségekre osztatott* [...]. Trnava: Academia, 1757.

Bessenyei, György. *A Holmi*. Edited by Ferenc Bíró, György Kókay, and Andor Tarnai. Budapest: Akadémiai Kiadó, 1983.

Bessenyei, György. *Magyarság; A Magyar Néző*. Magyar irodalmi ritkaságok 16. Budapest: Királyi Magyar Egyetemi Nyomda, 1932.

Bessenyei, György. *Összes művei: Prózai munkák, 1802–1804*. Edited by György Kókay. Budapest: Akadémiai Kiadó, 1986.

Bessenyei, György. *Összes művei: Társadalombölcseleti írások 1771–1778*. Edited by Péter Kulcsár. Budapest: Argumentum-Akadémiai Kiadó, 1992.

[Bessenyei, György]. "A Benevolent Plan for a Hungarian Society." In *Learned Societies, Freemasonry, Sciences, and Literature in 18th-Century Hungary*, edited by Réka Lengyel and Gábor Tüskés, 80–89. Budapest: MTA Bölcsészettudományi Kutatóközpont, 2017.

Boscovich, Roger. *De Aurora Boreali dissertatio habita in Collegio Romano*. Rome, 1738.

Boscovich, Roger. *Caroli Noceti e Societate Jesu: De Iride et Aurora Boreali carmina illustrissimo ac reverendissimo Praesuli Bernardino Giruadio dicata; Cum Notis Josephi Rogerii Boscovich ex eadem Societate*. Rome, 1747.

Boscovich, Roger. "Dialoghi sull'aurora boreale del P. Ruggiero Boscovich della Compagnia di Gesù lettore di Matematica nel Collegio Romano." *Giornale de' Letterati per l'Anno 1748* (1748): 192–202, 264–75, 293–302, 239–336, 363–68.

Boscovich, Roger. *Philosophiae recentioris a Benedicto Stay in Rom*[*ano*] *Archigymn*[*asio*] *Eloquentiae Profess*[*ore*] *versibus traditae Libri X, ad Sylvium Valentium Cardinalem amplissimum, cum adnotationibus, et Supplementis P. Rogerii Josephi Boscovich S.J. in Collegio Rom*[*ano*] *Publ*[*ico*] *Matheseos Professore Tomus II*. Rome, 1760.

Buffon, Georges-Louis Leclerc. *Histoire naturelle, générale et particulière*. Vol. 1. Paris: Imprimerie Royale, 1749.

Büsching, Anton Friedrich. *Neue Erdbeschreibung*. Vol. 1. Hamburg: Bohn, 1764.

Chappe d'Auteroche, Jean-Baptiste. *Voyage en Sibérie fait par ordre du Roi en 1761*. Edited by Madeleine Pinault Sørensen and Michel Mervaud. 2 Vols. Studies on Voltaire and the Eighteenth Century 3. Oxford: Voltaire Foundation, 2004.

Cook, James. "Observations Made [...] at King George's Island in the South Sea [...]." *PTRSL* 62, no. 1 (1771; published 1772): 397–421.

A Copper Plate and Discourse of the Transit of Venus, on the 3d of June 1769: Most Humbly Inscribed to His Royal Highness George Prince of Wales. n.p.: n.p., 1769.

[Crivelli, Giovanni Francesco]. *Elementa arithmeticae numericae et litteralis exposita a Joanne Cribello*. Venice: Lazzaroni, 1740.

[Crivelli, Giovanni Francesco]. *Elementa arithmeticae numericae et litteralis exposita a Joanne Crivellio, C.R.S. Academiae Bononiensis Academico Honorario, et Regiae Societatis Londinensis Socio: Editio tertia, prioribus correctior*. Vienna: Kaliwoda, 1745.

Csokonai Vitéz, Mihály. *Összes művei két kötetben*. Edited by Cyrill Horváth. Budapest: Magyar Könyvkiadó Intézet, 1901.

[Däzel, Georg Anton]. *Freymüthige Gedanken über die Witterungslehre des Herrn Hells*. Salzburg: Waisenhausbuchhandlung, 1786.

De Lagrange, Joseph Louis. "Mémoire sur le passage de Vénus du 3 juin 1769." *Histoire de l'Académie Royale des Sciences et des Belles-Lettres de Berlin* (1766; published 1768): 265–301.

De Luca, Ignaz. *Das gelehrte Österreich: Ein Versuch*. 2 vols. Vienna: von Ghelen, 1776–78.

Cassini de Thury, César-François. "Observation du passage de Vénus sur le Soleil, faite à Vienne en Autriche." *HARS* (1761; published 1763): 409–12.

Cassini de Thury, *César-François. Relation de deux voyages faits en Allemagne par ordre du Roi: Par rapport à la figure de la Terre* [...] *Par rapport à la geographie* [...] *Par rapport à l'astronomie* [...]. Paris: Durand, 1763.

Cassini de Thury, César-François. "Remarques sur la conjonction de Vénus avec le Soleil, qui doit arriver le 6 juin de l'année prochaine 1761." *HARS* (1757; published 1762): 326–35.

Döbrentei, Gábor. "Gróf Batthyány Ignác." *Erdélyi Muzéum* 2 (1815): 3–18.

Döbrentei, Gábor. "Hell Maximilián élete." *Erdélyi Muzéum* 8 (1817): 88–104.

Domanovszky, Sándor, ed. *József nádor iratai*. 3 Vols. Budapest: Magyar Történelmi Társulat, 1925–35.

Encke, Johann Franz. *Die Entfernung der Sonne von der Erde aus dem Venusdurchgänge von 1761 hergeleitet*. Gotha: Bercker, 1822.

Encke, Johann Franz. "Über den Venusdurchgang von 1769." *Abhandlungen der Königlichen Akademie der Wissenschaften zu Berlin: Mathematische Klasse* (1835; published 1837): 295–309.

Encke, Johann Franz. *Der Venusdurchgang von 1769 als Fortsetzung der Abhandlung über die Entfernung der Sonne von der Erde*. Gotha: Becker, 1822.

Ephemerides Anni [*1757–93*] *ad meridianum Vindobonensem jussu Augustorum calculis definitae a Maximiliano Hell, è S.J. caesaro-regio astronomo, et mechanices experiment: Prof. public. et ordin*. Vienna: Trattner, 1757–92.

[Fejér, György]. *Anthropologia vagy is az embe'r esmértetése*. Buda: Királyi Magyar Universitás, 1807.

[Ferenczy, János]. *Közönséges geographia, mellyben a' Földnek mathematikai, természeti, és leg inkább politikai állapotja a' leg ujabb változások után elő adatik*. Pest: Eggenberger József, 1809.

Ferguson, James. "A Delineation of the Transit of *Venus* Expected in the Year *1769* [...], Read Feb. 10, 1763." *PTRSL* 53 (1763; published 1764): 30.

Ferguson, James. *A Plain Method of Determining the Parallax of Venus by her Transit over the Sun*. 2nd ed. London: The Author, 1761.

Ferrner [Ferner], Bengt. "An Account of the Observations on the Same Transit Made in and near Paris: In a Letter from Mr. Benedict Ferner [...] to the Rev. Thomas Birch [...] Translated from the French. Read Nov. 19, 1761." *PTRSL* 52, no. 1 (1761; published 1762): 221–25.

Ferrner [Ferner], Bengt. *Resa i Europa: En astronom, industrispion och teaterhabitué genom Danmark, Tyskland, Holland, England, Frankrike och Italien 1758–1760*. Edited by Sten G. Lindberg. Uppsala: Almqvist & Wiksells, 1956.

Fixlmillner, Placidus. "Kurze Geschichte und Beschreibung der Sternwarte zu Kremsmünster (nebst drey Kupferplatten)." In Johann III Bernoulli, *Sammlung kurzer Reisebeschreibungen und anderer zur Erweiterung der Länder- und Menschenkenntniß dienender Nachrichten*. Vol. 4. Berlin and Altenburg: Bey dem Herausgeber and Richter, 1784.

Friis, Aage, ed. *Bernstorffske Papirer: Udvalgte Breve og Optegnelser vedrørende Familien Bernstorff i Tiden fra 1732 til 1835*. 3 Vols. Copenhagen/Christiania: Gyldendalske Boghandel, 1904–13.

Friml, Aladár, ed. *Az 1777-iki Ratio educationis*. Budapest: Katholikus Középiskolai Tanáregyesület, 1913.

Gunnerus, Johan Ernst. *Flora Norvegica: Observationibus praesertim oeconomicis panosque Norvegici locupletata*. 2 Vols. Trondheim: Typis Vindingianis, 1766–72.

Gunnerus, Johan Ernst, and Carl von Linné. *Brevveksling 1761–1772*. Edited by Leiv Amundsen. Oslo: Universitetsforlaget, 1976.

Halley, Edmond. "Methodus singularis quâ Solis Parallaxis sive distantia à Terra, ope Veneris intra Solem conspiciendæ, tuto determinari poterit." *PTRSL* 29 (1714/16; printed 1717): 454–64.

Hatvani, István. *Bevezetés a szilárdabb filozófia alapelveibe*. Debrecen: Debreceni Akadémiai Bizottság, 1990.

Hatvani, István. *Introductio ad principia philosophiae Solidioris cui accedit observatio elevationis poli Debrecinensis*. Debrecen: Kállai, 1757.

Heinsius, Gothofredus [Gottfried]. "De refractionibus in oris septentrionalibus." *NcASIP* (1758/59; published 1761): 412–44.

[Hell, Maximilian]. *Adjumentum memoriae chronologico-genealogico-historicum*. Vienna: Ghelen, 1750.

Hell, Maximilian. *Anleitung zum nützlichen Gebrauch der künstlichen Stahl-Magneten*. Vienna: Ghelen, 1762.

Hell, Maximilian. "Aurorae borealis theoria nova […]: Anno 1770 Mense Martio illustrissimae Academiae Regiae Scientiarum Hafniensi praelecta Pars I." *Ephemerides* 1777 (1776): 1–119.

Hell, Maximilian. *Beyträge zur Praktischen Astronomie, in verschiedenen Beobachtungen, Abhandlungen, Methoden aus den astronomischen Ephemeriden der Herrn Abbe' Maximilian Hell*. Translated and edited by Longinus Anton Jungnitz. 4 Vols. Breslau and Hirschberg: Korn, 1790–93.

Hell, Maximilian. *Elementa arithmeticae numericae, et literalis seu algebrae ad prefixam in scholis nostris normam concinnata*. Vienna: Trattner, 1761 [1755].

Hell, Maximilian. *Maximiliani Hell S.J. der Oesterreichischen Provinz Priestern Ihro beyder Kaiserl. Königl. Majest. Astronomi bey der uralten hohen Wienerischen Universität Kurzer Unterricht der Oster-Feyer für den gemeinen Mann samt der gründlichen Wiederlegung einer Schrift, welche Herr Christoph Sigismund Schumacher, Calender-Schreiber in Dreßden unter der Innschrift Untersuchung der Oster-Feyer von Anno 1700. bis 2500. verfasset und Anno 1760. in Druk gegeben hat*. Vienna: Trattner, 1760.

Hell, Maximilian. "Methodus astronomica Sine usu quadrantis, vel sectoris, aut alterius cujusvis instrumenti, in gradus circuli divisi, item sine notitia refractionis, ope solius tubi instructi micrometro filari, singula secunda indicante, et in apto ad hunc usum fulcro mobili applicati, elevationem poli cujusvis loci, in continente siti, accuratissimam definire." *Ephemerides* 1775 (1774): 3–41.

Hell, Maximilian. "Nogle Steders Geographiske Breder i Finmarken, Nordlandene, Norge og Sverrige bestemmede ved astronomiske Observationer […] og overgivet det Kongelige Videnskabernes Selskab i Kiøbenhavn den 18 May 1770. af det Latinske Sprog oversat paa Dansk af Henrich Hövinghoff." *Skrifter Kiøb*. 10 (1770): 619–52.

Hell, Maximilian. "Observatio litteraria." *Ephemerides* 1765 (1764): 364–68.

Hell, Maximilian. *Observatio transitus Veneris ante discum Solis die 3 junii anno 1769*. Copenhagen: Giese, 1770.

Hell, Maximilian. "Observation over Veneris Gang forbi Soelens Skive den 3 Junii 1769. anstillet i Wardøhuus efter den Stormægtigste og Allernaadigste Konge til Dannemark og Norge &c. &c. Kong Christian den Syvendes Befalning, og forelæst det Kongelige Videnskabernes Selskab i Kiøbenhavn den 24 November 1769. […] Oversat af det Latinske i det Danske Sprog af Henrich Hövinghoff." *Skrifter Kiøb.* 10 (1770): 537–618.

Hell, Maximilian. "Observationes astronomicae agriae in Ungaria in Observatorio Novo Excellentissimi, Illustrissimi ac Reverendissimi Episcopi Agriensis D.D. Caroli, e Comitibus Eszterhazi." *Ephemerides* 1780 (1779): 32–33.

Hell, Maximilian. "Observationes astronomicae in novo observatorio Universitatis Regiae Budae in Ungaria, a Cel. D. Francisco Weiss Astronomo Regio Universitatis." *Ephemerides* 1781 (1780): 28–35.

Hell, Maximilian. "Observationes astronomicae latitudinum geographicarum sive elevationum poli, locorum quorundam Ungariae, factae 1776." *Ephemerides* 1777 (1776): 273–89.

Hell, Maximilian. "Observationes astronomicae latitudinum, & longitudinum locorum Borealium Daniae, Sueciae, Norvegiae, & Finnmarchiae Lapponicae per iter arcticum Annis 1768, 1769, & 1770 factae." *Ephemerides* 1791 (1790): 300–86.

Hell, Maximilian. "De parallaxi Solis ex observationibus transitus Veneris anni 1769." *Ephemerides* 1773 (1772): 1–116.

Hell, Maximilian. *De satellite Veneris*. Vienna: Trattner, 1765.

Hell, Maximilian. *Transitus Veneris per discum Solis anni 1761: Die Astronom. 5. Junii calculis definitus et methodis observandi illustratus*. Vienna: Trattner, 1760.

Hell, Maximilian. *Unparteyisher Bericht der in Wien gemachten Entdeckungen der sonderbaren Wirkungen der künstlichen Stahlmagneten in verschiedenen Nervenkrankheiten*. Vienna: n.p., 1775.

Hell, Maximilian. *Der Zucker, ein neues Präservativmittel wider den Scorbut* (*Scharbock*) *von Herrn Abt Hell, Kaiserl. Königl. Hofastronom in Wien, Nebst einer Zuschrift, darinn des Scharbocks Ursachen etc. und auch des Zuckers eigenschaften gründlicher erwogen und widerlegt werden von Herrn von Albertiz, der Arzneygelartheit Doktor*. Vienna and Leipzig: Johann Friedrich Jahn, 1779.

Hell, Maximilian, and János Sajnovics. "Observationes meteorologicae in insula Maris Glacialis Wardoehus dicta." *Ephemerides* 1793 (1792): 352–93.

Hell, Maximilian, and Ignaz Weinhart. *Elogium rustici Tyrolensis celeberrimi Petri Anich Oberperfussensis coloni, tornatoris, chalcographi, mechanicarum artium magistri, geodetæ, geographi, et astrophili ad prodigium excellentis* [...]. Innsbruck: Trattner, 1768.

Hellant, Anders. "Venus i Solen, Observerad i Torne Den 6 Junii 1761." *KVAH* 23 (July–September 1761): 180–84.

Herder, Johann Gottfried. "Fragments on Recent German Literature [1767–68]." In Johann Gottfried Herder, *Philosophical Writings*. Translated and edited by Michael N. Forster, 33–64. Cambridge: Cambridge University Press, 2002.

Herder, Johann Gottfried. "Treatise on the Origin of Language [1772]." In Johann Gottfried Herder, *Philosophical Writings*. Translated and edited by Michael N. Forster, 65–164. Cambridge: Cambridge University Press, 2002.

Horrebow, Christianus [Christian]. *Dissertatio de semita, qvam in Sole descripsit Venus per eundem transeundo die 6 junii Ao. 1761* [...]. Copenhagen: Nicolai Christian Höpffner, 1761.

Horrebow, Christianus [Christian]. "Tidens Bestemmelse i Henseende til de Observationer, som skeede i Solen og Venere, da Venus Anno 1761. den 6te Junii passerede igiennem Solen." *Skrifter Kiøb.* 9 (1765): 373–88.

Horrebow, Petrus [Peter], and Olaus Andreae [Oluf Andersen] Borrebye. *Dissertatio de transitu Veneris per discum Solis, quam publico opponentium examini submittet* [...]. Copenhagen: Nicolai Christian Höpffner, 1761.

[Hübner, Johann]. *Geographica globi terraquei synopsis: A multis praesertim quod Hungariam attinet, erroribus, qui in celeberrimo alias Geographo Hübnero, aliisque circumferuntur, expurgata; In qua omnium mundi regionum, & locorum situs pro mapparum geographicarum usu exactissime describuntur*. Trnava: Acad. Societ. Jesu, 1755.

Hviid, Andreas Christian. *Andreas Christian Hviids Europa: Udtog af en Dagbog holden i Aarene 1777–1780 paa en Reise igennem Tyskland, Italien, Frankrige og Holland*. Edited by Michael Harbsmeier, Claus Mechlenborg, and Morten Petersen. Copenhagen: Forlaget Vandkunsten, 2005 [1788].

Jaszlinszky, Andreas. *Institutiones physicae*. Trnava: Academia Societatis Jesu, 1756.

Kalmár, György. *Prodromus idiomatis Schytico-Mogorico-Chuno-(seu Hunno-) Avarici, sive adparatus criticus ad linguam Hungaricam*. Bratislava: n.p., 1770.

Kant, Immanuel. "Answer to the Question: What Is Enlightenment? [1784]." In *What Is Enlightenment? Eighteenth-Century Answers and Twentieth-Century Questions*, edited by James Schmidt, 58–64. Berkeley: University of California Press, 1996.

[Katona, Mihály]. *Közönséges természeti Föld-leirás*. Pest: Trattner, 1824.

[Kollár, Ádám Ferenc (Adam Franz/Adam František)]. "Joannis Sajnovics S.J. Ungari Tordasiensis & c. *Demonstratio Idioma Ungarorum et Laponum idem esse*." *Realzeitung der Wissenschaften, Künste und Commerzien* (December 1770): 18–23.

Kollár, Ádám Ferenc. *Kollár Ádám Ferenc levelezése*. Edited by István Soós. Budapest: Universitas Kiadó, 2000.

Kratzenstein, Christian Gottlieb. "Afhandling Om Veneris Gang igiennem Solen aar 1761. med En Beskrivelse af nye og bequæmme Maader at betragte samme." *Skrifter Kiøb*. 9 (1765): 520–40.

Krünitz, J.G. "Verzeichniß der vornehmsten Schriften von der Venus und dem Merkur, und dem Durchgange dieser Planeten durch die Sonnenscheibe." *Neues Hamburgisches Magazin* 6, no. 37 (1769): 114–56.

Lalande, Joseph Jérôme Lalanade de. *Astronomie*. 1st ed. Paris: Desaint & Saillant, 1764.

Lalande, Joseph Jérôme Lalanade de. *Astronomie*. 2nd ed. Vols. 1–2. Paris: Veuve Desaint, 1771.

Lalande, Joseph Jérôme Lalanade de. *Astronomie*. 3rd ed. Vols. 1–3. Paris: Veuve Desaint, 1792.

Lalande, Joseph Jérôme Lalanade de. *Bibliographie astronomique avec l'histoire de l'astronomie depuis 1781 jusqu'à 1802*. Paris: Imprimerie de la République, 1803.

Lalande, Joseph Jérôme Lalanade de. *Explication de la figure du passage de Venus sur le disque du Soleil, qui s'observera le 3 juin 1769; Avec les résultats du passage observé en 1761*. Paris: Jean-Thomas Hérissante, 1764.

Lalande, Joseph Jérôme Lalanade de. "Remarques sur les observations du passage de Vénus, faites à Copenhague & à Drontheim en Norwège, par ordre du Roi de Dannemarck." *HARS* (1761; published 1763): 113–14.

Lambert, Johann Heinrich. "Essai d'une théorie du satellite de Vénus." *Nouveaux mémoires de l'Académie Royale des Sciences et Belles-Lettres* (1773; published 1775): 222–50.

Lambert, Johann Heinrich. *Joh. Heinrich Lamberts* [...] *deutscher gelehrter Briefwechsel*. Edited by Johann III Bernoulli. 5 Vols. Berlin and Dessau: Der Herausgeber and Buchhandlung der Gelehrten, 1781–87.

Leem, Knud [Canutus]. *Beskrivelse over Finmarkens Lapper 1767* [Facsimile edition of *Knud Leems, Professor i det Lappiske Sprog, Beskrivelse over Finmarkens Lapper, deres Tungemaal, Levemaade og forrige Afgudsdyrkelse, oplyst ved mange Kaaberstykker: Med J.E. Gunneri* [...] *Anmærkninger; Og E.J. Jessen-S.* [...] *Afhandling om de Norske Finners og Lappers Hedenske Religion/Canuti Leemii, professoris lingvæ Lapponicæ, de Lapponibus Finmarchiæ, Eorumqve lingva, vita et religione pristina commentatio, multis tabulis æneis illustrata: una cum J.E. Gunneri* [...]; *Notis; & E.J. Jessen-S.* [...] *Tractatu Singulari de Finnorum Lapponumqve Norvegic. religione pagana*]. Copenhagen: Rosenkilde og Bagger International Boghandel, 1975.

Leibniz, Gottfried Wilhelm. "Brevis designatio meditationum de Originibus Gentium, ductis potissimum ex indicio linguarum." *Miscellanea Berolinensia ad incrementum scientiarum, ex scriptis Societati Regiae Scientiarum exhibitis edita* 1 (1710): 1–16.

Lexell, Andreas Iohannes [Anders Johan]. "Determinatio accuratior verae parallaxis Solis et reliquorum elementorum." In *Collectio omnium observationum quae occasione transitus Veneris per Solem A. MDCCLXIX iussu Augustae per Imperium Russicum institutae fuerunt una cum theoria indeque deductis conclusionibus*, edited by [Johann Albrecht Euler], 533–74. St. Petersburg: Academia Imperialis Scientiarum, 1770.

Lexell, Andreas Iohannes [Anders Johan]. *Disqvisitio de investiganda vera qvantitate parallaxeos Solis, ex transitu Veneris ante discum Solis anno 1769: Cui accedunt animadversiones in tractatum Rev. Pat. Hell de Parallaxi Solis*. St. Petersburg: Academia Imperialis Scientiarum, 1772.

Liesganig, Joseph. *Tabulae memoriales praecipua arithmeticae tum numericae tum literalis, geometriae, etiam curvarum, et trigonometriae, atque utriusque architecturae elementa complexae, in usum auditorum*. Vienna: Trattner, 1754.

Ludewig, Johann. *Der gelehrte Bauer: Mit Christian Gotthold Hoffmanns Vorbericht nebst Kupffern*. Edited by Holger Böning and Reinhart Siegert. Stuttgart-Bad Cannstatt: Frommann-Holzboog, 1992 [1756].

Maire, Christopher, and Ruggiero Giuseppe Boscovich. *De litteraria expeditione per pontificiam ditionem ad dimetiendos duosmeridiani gradus et corrigendam mappam geographicam*. Rome: Palladis, 1755.

Mallet, Fredric. "Berättelse om det som kunnat observeras uti Pello, vid Veneris gang förbi Solen, den 3 och 4 junii 1769." *KVAH* 31 (July–September 1769): 218–23.

Marinoni, Johann Jakob. *De astronomica specula domestica et organico apparatu astronomico libri duo*. Vienna: Kaliwoda, 1745.

Martin, Benjamin. *Venus in the Sun: Being an Explanation of the Rationale of That Great Phœnomenon; Of the Several Methods Used by Astronomers for Computing the Quantity and Phases Thereof; And of the Manner of Applying a Transit of Venus over the Solar Disk, for the Discovery of the Parallax of the Sun, Settling the Theory of That Planet's Motion, and Ascertaining the Dimensions of the Solar System*. London: W. Owen, 1761.

Maskelyne, Nevil. *Instructions Relative to the Observation of the Ensuing Transit of Venus over the Sun's Disk, on the 3rd of June 1769*. London: Richardson and Clark, 1768.

Maskelyne, Nevil. "An Account of the Observations Made on the Transit of *Venus, June 6, 1761, in the Island of St. Helena*: In a Letter to [...] *George* Earl of *Macclesfield*, President of the Royal Society, from the Rev. *Nevil Maskelyne* [...]. Read Nov. 5, 1761." *PTRSL* (1762), 196–201.

[Mayer, Andreas Ulrich]. *Abhandlung des Daseyns der Gespenster, nebst einem Anhange vom Vampyrismus*. Augsburg: n.p., 1768.

Mayer, Christian. *Ad Augustissimam Russiarum omnium Catharinam II Alexiewnam Imperatricem expositio de transitu Veneris ante discum Solis d. 23 Maii, 1769* [...]. St. Petersburg: Academia Scientiarum, 1769.

Mayer, Christian. "Expositio utriusque observationis et Veneris et eclipsis Solaris factae Petropoli in specula astronomica." *NcASIP* 13 (1768; published 1769): 541–60.

Melander [Melanderhielm], Daniel. "Uttydning på de Phænomener, hvilka åtfölja Planeten Veneris Passage genom Solen." *KVAH* (April-June 1769): 161–73.

Mesmer, Franz Anton. "Mémoire sur la découverte du magnétisme animal [1779]." In *F.-A. Mesmer, Le magnétisme animal*, edited by Robert Amadou. Paris: Payot, 1971.

Mesmer, Franz Anton. *Schreiben* [*über die Magnetkur von Herrn A. Mesmer, Doktor der Arzneygelahrtheit*], *an einen auswärtigen Arzt*. Vienna: Kurzböck, 1775.

Montesquieu, Charles-Louis Secondat. *The Spirit of the Laws*. Translated and edited by Anne M. Cohler, Basia Carolyn Miller, and Harold Samuel Stone. Cambridge: Cambridge University Press, 1989.

Mueller, Joh. Heinricus [Müller, Johann Heinrich]. *Collegium experimentale; in quo ars experimentandi, praemissa brevi eius delineatione, potioribus aevi recentioris inventis ac speciminibus, de aere, aqua, igne ac terrestribus, explanatur ac illustratur, & ad genuinum scopum usumque accommodatur*. Nuremberg: Endterus, 1731.

Münter, Frederik [Friedrich]. *Frederik Münter: Et mindeskrift II; Aus den Tagebüchern Friedrich Münters; Wander- und Lehrjahre eines Dänischen Gelehrten*, vol. 1, *1772–85*.

Edited by Øjvind Andersen. Copenhagen and Leipzig: P. Haase & Son and Harrassowitz, 1937.

Niebuhr, Carsten. *Reisebeschreibung nach Arabien und andern umliegenden Ländern*. 3 Vols. Graz: Akademische Druck- und Verlagsanstalt, 1968 [1774–78].

Niegowiecki, Jacobus [Jakub]. *Transitus Veneris per discum Solis post peractas revolutiones tam synodicas quàm periodicas intrà annos circiter 122. iterum anno domini 1761. die 6. Junii. celebratus et per mathematicos universitatis Cracoviensis sub elevatione poli gr. 50. min. 12. observatus*. Kraków: n.p., 1761.

Pavur, Claude, ed. *The* Ratio studiorum: *The Official Plan for Jesuit Education*. St. Louis, MO: Institute of Jesuit Sources, 2005.

Pictet, Jean-Louis, and Jacques-André Mallet. *Deux astronomes genevois dans la Russie de Catherine II: Journaux de voyage en Laponie russe* [...] *pour observer le passage de Vénus devant le disque solaire 1768–1769*. Edited by Jean-Daniel Candaux, Sophie Capdeville, Michel Grenon, René Sigrist, and Vladimir Somov. Ferney-Voltaire: Centre international d'étude du XVIIIe siècle, 2005.

Pilgram, Anton. *Untersuchungen über das Wahrscheinliche der Wetterkunde*. Vienna: Kurzboeck, 1788.

Pingré, Alexandre Guy. *Mémoire sur le choix et l'état des lieux; Où le passage de Vénus du 3. Juin 1769 pourra être observé avec le plus d'avantage; Et principalement sur la position géographique des isles de la mer du Sud* [...] *Lu à l'Académie des Sciences, le 23 Décembre 1766 & en Janvier & Février 1767* [...]. Paris: P.G. Cavelier, 1767.

Pingré, Alexandre Guy. "Mémoire sur la parallaxe du Soleil, déduite des meilleurs observations de la durée du passage de Vénus sur son disque le 3 juin 1769." *HARS* (1772; published 1775): 398–420.

Pingré, Alexandre Guy. "Nouvelle recherche sur la determination de la Parallaxe du Soleil par le passage de Vénus du 6 juin 1761." *HARS* (1765; published 1768): 1–34.

Planman, Andrew [Anders]. "A Determination of the Solar Parallax Attempted, by a Peculiar Method, from the Observation of the Last Transit of Venus: By Andrew Planman [...] Together with a Letter from Him to Mr. James Short [...]." *PTRSL* 58 (1768; published 1769): 107–27.

Planman, Anders. "Förklaring På de Formler, at uträkna Parallaxens verkan, för observerade in- och utgångs-momenter vid en Planets gång under Solen, som anfördes uit Handlingarne för år 1771." *KVAH* 36 (October–December 1774): 306–19.

Planman, Anders. "Formuler, At Uträkna Parallaxens verkan för observerade in- och utgångs momenter, vid en Planets gång under Solen." *KVAH* (January–March 1771): 66–74.

Planman, Anders. "Om Solens Parallaxis, i anledning af observationer öfver Venus i Solen, år 1769." *KVAH* (April–June 1772): 183–91.

Planman, Andreas [Anders], and Johannes [Johan] Kreander. *Animadversiones subitaneæ in appendicem Hellianam ad Ephemerides anni MDCCLXXIII, de parallaxi Solis* [...]. Åbo: Johannes Christoph Frenckell, 1772.

Planman, Andreas [Anders], and Carolus Gebhardus [Karl Gebhard] Widqvist. *Expositio observationum transitus Veneris per Solem, Cajaneburgi A:o 1769, D. 3 Junii factarum* [...]. Åbo: Joh. Christopher Frenckell, [1770].

Poda, Nikolaus. *Kurzgefaßte Beschreibung der, bey dem Bergbau zu Schemnitz in Nieder-Hungarn, errichteten Maschinen*. Prague: Walther, 1771.

Pontoppidan, Erich. *The Natural History of Norway*. London: A. Linde, 1755.

Pontoppidan, Erich. *Norges Naturlige Historie 1752–53* [Facsimilie edition of *Det første Forsøg paa Norges Naturlige Historie, forestillende Dette Kongeriges Luft, Grund, Fielde, Vande, Vœxter, Metaller, Mineralier, Steen-Arter, Dyr, Fugle, Fiske og omsider Indbyggernes Naturel, samt Sædvaner og Levemaade*]. 2 Vols. Copenhagen: Rosenkilde og Bagger, 1977.

Pray, György. *Epistola ad Benedictum Cetto e piis scholis in qua novae huius in rebus sinicis imposturae deteguntur: Accedit historia controversiarum de ritibus sinicis* [...]. Buda: Strohmayer, 1789.

Pray, György. *Imposturae ccxvii in dissertatione R.P. Benedicti Cetto Clerici Regularis e Scholii Piis, de Sinensium impostoris detectae, & convulsae*. Buda: n.p., 1781.

Prosperin, Eric. "Utdrag af observationerna på Veneris inträde i Solen, d. 3 Jun. 1769, som blifvit gjorda på observatorium i Upsala." *KVAH* 31 (April–June 1769): 158–61.

Raff, György. *Geografiája a' gyengébbek elméjekhez alkalmaztatott, és magyarúl ki-adattatott*. Vác: Ambro Ferenc, 1791.

[Raff, Georg Christian]. *Természethistoria a' gyermekeknek*. Veszprém: Számmer Mihály, 1799.

Report from the Select Committee Appointed to Report the Nature and Substance of the Laws and Ordinances Existing in Foreign States, Respecting the Regulation of Their Roman Catholic Subjects [...]. [London]: House of Commons, 1816.

Révai, Miklós, ed. *Két nagyságos elménck költeményes szüleményei*. Bratislava: Antal Loewe, 1789.

Röhl, Lambert Heinrich. *Merkwürdigkeiten von der Durchgängen der Venus durch die Sonne*. Greifswald: Röse, 1768.

Rumovskii, Stepan. "Investigatio parallaxeos Solis ex observatione transitus Veneris per discum Solis Selenginski habita, collata cum observationibus alibi institutis." *NcASIP* 11 (1765; published 1767): 487–538.

Rumovskii, Stepan. *Nabliudeniia iavleniia venery v solntse v rossiiskoi imperii v 1769 godu uchinennyia s istoricheskim preduvedomleniem*. St. Petersburg: Imperatorskaia Akademia Nauk, 1771.

Sajnovics, Johannes [János]. *Beweis, das die Sprache der Ungarn und Lappen dieselbe ist*. Translated by Monika Ehlers, edited by Gyula Decsy and Wolfgang Veenker. Wiesbaden: Harrassowitz, 1972.

Sainovics, Joannes [Sajnovics, János]. "Beviis, at Ungarernes og Lappernes Sprog er det samme: Oversat af det Latinske ved M.R. Fleischer," *Skrifter Kiøb.* 10 (1770): 653–732.

Sajnovics, Joannes [János]. *Demonstratio: Bizonyítás; A magyar és a lapp nyelv azonos*. Translated by Zsuzsa C. Vladár, edited by Enikő Szíj. Budapest: ELTE, 1994.

Sajnovics, Joannes [János]. *Demonstratio: Idioma Ungarorum et Lapponum idem esse*. Copenhagen and Trnava: Salicath and Collegium Academicum Societatis Jesu, 1770 and 1771.

Sajnovics, Joannes [János]. *Demonstratio: Idioma Ungarorum et Lapponum idem esse* [Facsimile of Trnava edition]. Edited by Thomas A. Sebeők. The Hague: Mouton, 1968.

Sajnovics, Joannes [János]. *Idea astronomiae, honoribus regiae universitatis Budensis dicata*. Buda: Landerer, 1778.

Schefferus, Johannes. *Lapponia, id est Regionis Lapponum et gentis nova et verissima descriptio*. Frankfurt: Ex officina Christiani Wolffii, 1673.

Scherffer, Carolus [Karl]. *Institutiones astronomiae theoreticae*. Vienna: Trattner, 1777.

Scherffer, Karl, Maximilian Hell, Paul Mako, Anton Pilgram, Siegfried von Storchenau, Joseph Benedict Heyrenbach, Joseph von Herbert, and Franz Weiss. *Beyträge zu verschiedenen Wissenschaften von einigen Oesterreichischen Gelehrten*. Vienna: Augustin Bernhardi, 1775.

Schlichtegroll, Friedrich. "Maximilian Hell." In *Nekrolog auf das Jahr 1792: Erhaltend Nachrichten von dem Leben merkwürdiger in diesem Jahre verstorbener Personen*, edited by Friedrich Schlichtegroll, 1:282–303. Gotha: Justus Perthes, 1793.

Schytte, Erik Gerhard. "Verschiedene Anmerkungen an den Bischoff in Drontheim." *Der Drontheimischen Gesellschaft Schriften* 1 (1765): 242–49.

Scriptores ordinis S. Benedicti qui 1750–1880 fuerunt in Imperio Austriaco-Hungarico. Vienna: Leon, 1881.

Short, James. "Second Paper concerning the Parallax of the Sun Determined from the Observations of the Late Transit of Venus [...]." *PTRSL* 53 (1763; published 1764): 300–45.

Smith, Adam. *An Inquiry into the Nature and Causes of the Wealth of Nations*. Edited by R.H. [Roy Hutcheson] Campbell and A.S. [Andrew Stewart] Skinner. Vol. 1. Indianapolis: Liberty Classics, 1981.

Smith, Adam. *The Theory of Moral Sentiments*. Edited by D.D. [David Daiches] Raphael and A.L. [Alec Lawrence] Macfie. Indianapolis: Liberty Classics, 1982.

Szerdahely, György Alajos. *Memoria admodum reverendi et Clarissimi Domini Francisci Weiss astronomi celeberrimi*. Buda: Landerer, 1785.

Tolomeo, Rita, ed. *Ruggiero Giuseppe Boscovich: Lettere per una storia della scienza (1763–1786)*. Accademia Nazionale delle Scienze detta dei XL: Scritti e documenti IX, Documenti Boscovichiani 3. Rome: Accademia Nazionale delle Scienze detta dei XL, 1992.

Trébuchet, [Claude-Etienne]. *Lettre à Messieurs les auteurs du* Journal des Sçavans *sur le passage de Vénus*. Bouillon: Société Typographique, 1770.

Vaissète, Dom [Jean-]Joseph]. *Geographie historique, ecclesiastique et civile, ou description de toutes les Parties du Globe Terrestre, enrichie de cartes géographiques*. Paris: Desaint & Saillant, Jean-Thomas Hérissante, Jacques Barois, 1755.

Van Swieten, Gerard. "Vampyrismus." In [Andreas Ulrich Mayer], *Abhandlung des Daseyns der Gespenster, nebst einem Anhange von Vampyrismus*, Appendix. Augsburg: n.p., 1768.

Vargha, Magda, ed. *Correspondence de Ferenc Weiss: Astronome hongrois du xviiie siècle*. Budapest: Bibliothèque de l'Université Budapest, 1990.

Vetsei, István P. [Pataki]. *Magyar Geografiája. Az Az: Ez egész világ négy részeinek, ugymint Európának, Asiának, Afrikának és Amerikának; 's bennek levő sokféle országok nemzetségek; azok eredetek, természetek, 's nevezetesebb szokásainak, vallásainak, imperátorinak, királyinak, s több egyéb elmét vidámito hasznos dolgainak méltó és rövid le-irása* [...]. Carei: Károlyi Ferentz Typographiája, 1757.

[Von Born, Ignaz]. *Joannis Physiophili specimen monachologiæ methodo Linnæana tabulis tribus æneis illustratum, cum adnexis thesibus e Pansophia P.P.P. Fast* [...]. Augsburg: Merz, 1783.

Von Littrow, Karl Ludwig. *P. Hell's Reise nach Wardoe bei Lappland und seine Beobachtung des Venus-Durchganges im Jahre 1769: Aus den aufgefundenen Tagebüchern geschöpft und mit Erläuterungen begleitet*. Vienna: Gerold, 1835.

Von Arneth, Alfred Ritter. "Zwei Denkschriften der Kaiserin Maria Theresias." *Archiv für österreichische Geschichte* 47 (1871): 267–354.

Von Strahlenberg, Philipp Johann. *Das Nord- und Ostliche Theil von Europa und Asia, Jn so weit solches Das gantze Rußische Reich mit Siberien und der grossen Tatarey in sich begreiffet, Jn einer Historisch-Geographischen Beschreibung der alten und neuern Zeiten, und vielen andern unbekannten Nachrichten vorgestellet, Nebst einer noch niemahls ans Licht gegebenen Tabula Polyglotta von zwey und dreyßigerley Arten Tatarischer Völcker Sprachen und einem Kalmuckischen Vocabulario, Sonderlich aber Einer grossen richtigen Land-Charte von den benannten Ländern und andern verschiedenen Kupfferstichen, so die Asiatisch-Scythische Antiqvität betreffen; Bey Gelegenheit der Schwedischen Kriegs-Gefangenschafft in Rußland, aus eigener sorgfältigen Erkundigung, auf denen verstatteten weiten Reisen zusammen gebracht und ausgefertiget*. Stockholm: In Verlegung des Autoris, 1730.

Von Zach, Franz Xaver. "Über Längen-Beobachungen im Orient u.s.w. Aus einem Schreiben des königl. Dänischen geheimen Justiz-Raths Carsten Niebuhr." *Monatliche Correspondenz zur Beförderung der Erd- und Himmelskunde* 4 (September 1801): 240–53.

Von Zach, Franz Xaver. "Über die Sternwarte in Lemberg: Aus einem Schreiben aus Lemberg in Galizien." *Monatliche Correspondenz zur Beförderung der Erd- und Himmelskunde* 4 (November 1801): 547–57.

Wargentin, Pehr Wilhelm. "Anmärkningar öfver Planeten Veneris gång genom Solens discus." *KVAH* 23 (July–September 1761): 167–79.

Wargentin, Pehr Wilhelm. "A Letter from Mr. Wargentin, F.R.S. and Secretary at the Royal Academy of Sciences at Stockholm, to the Rev. Mr. Maskelyne, M.A. F.R.S. and Royal Astronomer at Greenwich Containing an Essay of a New Method of Determining the Longitude of Places, from Observations of the Eclipses of Jupiter's Satellites." *PTRSL* 56 (1766; published 1767): 278–86.

Wargentin, Pehr Wilhelm. "Observationer på planeten Veneris gång genom Solens discus, d. 6 Junii 1761." *KVAH* 23 (April–June 1761): 143–66.

Zakarjás, János, and Dávid Fáy. "Zakarjás János és Fáy Dávid délamerikai jezsuita misszionáriusok uti levelei (1749–1756)." *Földrajzi Közlemények* 38 (1910): 115–28, 215–36.

Zanotti, Eustachio. *De Veneris ac Solis congressu observatio habita in astronomico specula Bononiensis Scientiarum Instituti die 5 Junii MDCCLXI*. Bologna: Laelii e Vulpe, 1761.

Secondary Sources

Aase, Monica, and Mikael Hård. "'Det norska Athen': Trondheim som lärdomsstad under 1700-talets andra hälft." *Lychnos* (1998): 37–74.

Abafi, Ludwig [Lajos]. *Geschichte der Freimaurerei in Österreich-Ungarn*. 5 Vols. Budapest: L. Aigner, 1890–99.

Ács, Tivadar. *Akik elvándoroltak*. Budapest: n.p., 1940.

Ács, Tivadar. "Délamerikai magyar utazók a XVII. és XVIII. században." *A Földgömb* 9 (1938): 67–74, 113–17, 150–53.

Adorno, Theodor, and Max Horkheimer. *Dialectic of Enlightenment*. Stanford: Stanford University Press, 2002 [1944/47].

Almási, Gábor. "Latin and the Language Question in Hungary (1700–1844): A Survey of Hungarian Secondary Literature (Parts 1 and 2)." *Das achtzehnte Jahrhundert und Österreich* 28 (2014): 211–319; 30 (2016): 237–90.

Alt, Peter André. "Mode ohne Methode? Überlegungen zu einer Theorie der literaturwissenschaftlichen Biographik." In *Grundlagen der Biographik: Theorie und Praxis des biographischen Schreibens*, edited by Christian Klein, 23–40. Stuttgart: Metzler, 2002.

Andersen, Håkon, with Brita Brenna, Magne Njåstad and Astrid Wale. *Aemula Lauri: The Royal Norwegian Society of Sciences and Letters, 1760–2010*. Sagamore Beach, MA: Science History Publications, 2009.

Anderson, Mark. *The Day the World Discovered the Sun: An Extraordinary Story of Scientific Adventure and the Race to Track the Transit of Venus*. Cambridge, MA: Da Capo Press, 2012.

Apynevich, A., O. Lohvynenko, B. Novosyadlyj, and M. Kovalchuk. "First Astronomical Observatory in Lviv." *Kinematics and Physics of Celestial Bodies* 27, no. 5 (2011): 265–72.

Arens, Hans. *Sprachwissenschaft: Der Gang ihrer Entwicklung von der Antike bis zur Gegenwart*. Freiburg: K. Alber, 1969.

Arlot, Jean-Eudes, ed. *Les rendez-vous de Vénus/Venus's rendez-vous*. CD-ROM. Les Ulis: EDP Sciences, 2004.

Arlot, Jean Eudes, and Jean-Pierre Luminet. *Le passage de Vénus*. Les Ulis: EDP Sciences Editions, 2004.

Armenteros, Carolina. *The French Idea of History: Joseph de Maistre and His Heirs, 1794–1854*. Ithaca: Cornell University Press, 2011.

Armitage, Angus. "Chappe d'Auteroche: A Pathfinder for Astronomy." *Annals of Science* 10 (1954): 277–93.

Ashworth, William B. Jr. "Catholicism and Early Modern Science." In *God and Nature: Historical Essays on the Encounter between Christianity and Science*, edited by David C. Lindberg and Ronald L. Numbers, 133–66. Berkeley: University of California Press, 1986.

Aspaas, Per Pippin. "Astronomy, Latinity, Enlightenment: Niels Krog Bredal's Poems Commemorating the Transits of Venus, 1761 and 1769." *Symbolae Osloenses* 90 (2016): 205–34.

Aspaas, Per Pippin. "The Auroral Zone versus the Zone of Learning: A Brief History of Early Modern Theories on the Aurora Borealis." In *Travels in the North*, edited by Silje Gaupseth, Marie-Theres Federhofer, and Per Pippin Aspaas, 113–35. Hannover: Wehrhahn Verlag, 2013.

Aspaas, Per Pippin. "Biographical Introduction, Summary of Contents (Manuscript Version), Summary of Contents (Latin Edition), and Summary of Contents (German Edition)." In *Maximilianus Hell: Lucis Boreæ Theoria nova (MS, c. 1770)/Aurorae borealis theoria nova (1776)/Neue Theorie des Nordlichtes (1792)*, edited by Per Pippin Aspaas, 1–17. Aurorae Borealis Studia Classica 4. Tromsø: Septentrio Academic Publishing, 2016. http://septentrio.uit.no/index.php/aurora/issue/view/334 (accessed May 29, 2019).

Aspaas, Per Pippin. "Denmark–Norway 1761–1769: Two Missed Opportunities?" *Journal of Astronomical Data*, Special Issue, "Meeting Venus: A Collection of Papers Presented at the Venus Transit Conference in Tromsø 2012," edited by Christiaan Sterken and Per Pippin Aspaas, 19, no. 1. (Brussels and Tromsø: C. Sterken and University of Tromsø, 2013): 39–48.

Aspaas, Per Pippin. "Maximilian Hell's Invitation to Norway." In *Konferenzbeiträge/Proceedings: Festkolloquium und Fachtagung 250 Jahre Universitätssternwarte Wien*, edited by Maria G. Firneis and Franz Kerschbaum, 10–20. Communications in Asteroseismology 149. Vienna: Austrian Academy of Science Press, 2008.

Aspaas, Per Pippin. "Maximilian Hell og Johannes Sajnovics om folkeliv og natur i Øst-Finnmark anno 1769." In *Forpost mot øst: Fra Vardø og Finnmarks historie 1307–2007; Rapport fra det XXXII nordnorske historieseminar Vardø 21.–23. september 2007*,

edited by Randi Rønning Balsvik and Jens Petter Nielsen, 61–72. Stamsund: Orkana forlag, 2008.

Aspaas, Per Pippin. "Maximilian Hellin ja Johannes Sajnovicsin 'Expeditio litteraria ad Polum arcticum' ja suomalais-ugrilaisen kielentutkimuksen synty." In *Lapin tuhat tarinaa*, edited by Osmo Pekonen and Johan Stén, 65–86. Ranua: Mäntykustannus, 2012.

Aspaas, Per Pippin. "Maximilianus Hell (1720–1792) and the Eighteenth-Century Transits of Venus: A Study of Jesuit Science in Nordic and Central European Contexts." PhD diss., University of Tromsø, 2012. http://hdl.handle.net/10037/4178 (accessed November 26, 2018).

Aspaas, Per Pippin. "Nordiske amatørastronomers bidrag i forbindelse med venuspassasjene 1761 og 1769." In *Mellom pasjon og profesjonalisme: Dilettantkulturer i skandinavisk kunst og vitenskap*, edited by Marie-Theres Federhofer and Hanna Hodacs, 103–27. Trondheim: Tapir, 2011.

Aspaas, Per Pippin. "Le Père Jésuite Maximilien Hell et ses relations avec Lalande." In *Jérôme Lalande (1732–1807): Une trajectoire scientifique*, edited by Guy Boistel, Jérôme Lamy, and Colette LeLay, 129–48. Rennes: Presses universitaires de Rennes, 2010.

Aspaas, Per Pippin, Thomas Posch, Isolde Müller, and Ákos Bazsó. "Astronomische Observatorien der Jesuiten in der 'Provincia Austriae' im 18. Jahrhundert." *Acta historica astronomiae* 52 (2014): 89–110.

Aspaas, Per Pippin, and Truls Lynne Hansen. "Geomagnetism by the North Pole, Anno 1769: The Magnetic Observations of Maximilian Hell during His Venus Transit Expedition." *Centaurus: An International Journal of the History of Science and Its Cultural Aspects* 49 (2007): 138–64.

Aspaas, Per Pippin, and Truls Lynne Hansen. *Maximilian Hell's Geomagnetic Observations in Norway 1769*. Tromsø Geophysical Observatory Reports no. 2. Tromsø: University of Tromsø, 2005.

Aspaas, Per Pippin, and Nils Voje Johansen. "Astronomen Maximilian Hell: Fra Wien til Vardø for å se Venus." *Ottar: Populærvitenskapelig tidsskrift fra Tromsø Museum* 249, no. 1 (2004): 3–11.

Aspaas, Per Pippin, and László Kontler. "Before and After 1773: Central European Jesuits, the Politics of Language and Discourses of Identity in the Late Eighteenth Century Habsburg Monarchy." In *Latin at the Crossroads of Identity: The Evolution of Linguistic Nationalism in the Kingdom of Hungary*, edited by Gábor Almási and Lav Subarić, 95–118. Leiden: Brill, 2015.

Aspaas, Per Pippin, and Katalin Pataki. "Did Astronomy Constitute a Denominationally Neutral Space within the Republic of Letters? An Outline for the Use of Visualization Tools in the Study of Astronomical Correspondence." *Das Achtzehnte Jahrhundert und Österreich* 34 (2019): 65–89.

Aubin, David, ed. *L'événement astronomique du siècle? Histoire sociale des passages de Vénus, 1874–1882*. Cahiers François Viète 11–12. Nantes: Cahiers François Viète, 2007.

Aughton, Peter. *Endeavour: The Story of Captain Cook's First Great Epic Voyage*. Moreton-in-Marsh: Windrush, 1999.

Aughton, Peter. *The Transit of Venus: The Brief, Brilliant Life of Jeremiah Horrocks, Father of British Astronomy*. London: Windrush, 2004.

Baack, Lawrence J. *Undying Curiosity: Carsten Niebuhr and the Royal Danish Expedition to Arabia 1761–1767*. Stuttgart: Franz Steiner, 2014.

Baasner, Rainer. *Abraham Gotthelf Kästner, Aufklärer (1719–1800)*. Tübingen: Niemeyer, 1991.

Babarczi, Dóra. "Magyar jezsuiták Brazíliában a 18. század közepén." PhD diss., University of Szeged, 2011.

Bachleitner, Norbert. *Die literarische Zensur in Österreich von 1751 bis 1848*. Vienna: Böhlau, 2017.

Bahlcke, Joachim. *Ungarischer Episkopat und österreichische Monarchie: Von einer Partnerschaft zur Konfrontation (1686–1790)*. Stuttgart: Franz Steiner Verlag, 2005.

Balázs, Éva H. *Hungary and the Habsburgs: An Experiment in Enlightened Absolutism 1765–1800*. Budapest: Central European University Press, 1997.

Balázs, Lajos G., Peter Brosche, Hilmar Duerbeck, and Endre Zsoldos, eds. *The European Scientist: Symposium on the Era and Work of Franz Xaver von Zach (1754–1832)*. Acta Historica Astronomiae 24. Frankfurt am Main: Verlag Harri Deutsch, 2005.

Balázs, Péter. *Biblia, história és bölcselet a felvilágosodás korában*. Budapest: L'Harmattan, 2013.

Balázs, Péter, and Olga Penke. "Montesquieu műveinek és gondolatainak fogadtatása a 18. század végétől napjainkig Magyarországon." *Irodalomtudományi Közlemények* 116, no. 1 (2012): 3–21.

Balogh, Piroska. "Sic itur ad astra: Változatok a csillagászati tanköltemény műfajára Szerdahely György Alajos és Pálóczi Horváth Ádám műveiből." In *Magyar Arión: Tanulmányok Pálóczi Horváth Ádám műveiről*, edited by Rumen István Csörsz and Béla Hegedüs, 101–12. Budapest: Reciti, 2011.

Balogh, Piroska. *Teória és medialitás: A latinitás a magyarországi tudásáramlásban 1800 körül*. Budapest: Argumentum Kiadó, 2015.

Balsvik, Randi Rønning. "Pomorbyen Vardø og Russland." In *Pomor: Nord-Norge og Nord-Russland gjennom tusen år*, edited by Einar Niemi, 96–116. Oslo: Gyldendal, 1992.

Bartha, Lajos. "Hell Miksa légkörtani munkássága." *Légkör* 49, no. 4 (2004): 20–25.

Bartha, Lajos. "Magyar tudósok mágneses megfigyelései a sarkkörön túl 1769-ben." *Földrajzi Múzeumi Tanulmányok* 13 (2004): 49–55.

Bartha, Lajos. "A nagyszombati egyetem csillagvizsgálójának kezdetei." *Padeu* 16 (2006): 8–38.

Bartha, Lajos. "Sajnovics János, Hell Miksa és a 'magyar őstörténet.'" *Nyelvtudományi Közlemények* 85 (1983): 297–304.

Barthes, Roland. "The Death of the Author." In Roland Barthes, *Image, Music, Text*, 142–48. New York: Hill and Wang, 1977.

Bartusz-Dobosi, László. "Magyar missziósok az 'Indiákon.'" In *A magyar jezsuiták küldetése a kezdetektől napjainkig*, edited by Antal Molnár, 200–16. Piliscsaba: Pázmány Péter Katolikus Egyetem, 2006.

Beales, Derek. *Joseph II*, vol. 1, *In the Shadow of Maria Theresa 1741–1780*. Cambridge: Cambridge University Press, 1987.

Beales, Derek. *Joseph II*, vol. 2, *Against the World 1780–1790*. Cambridge: Cambridge University Press, 2009.

Beales, Derek. "Joseph II and the Monasteries of Austria and Hungary." In Derek Beales, *Enlightenment and Reform in Eighteenth-Century Europe*, 227–55, London: Tauris, 2005.

Beales, Derek. "Philosophical Kingship and Enlightened Despotism." In Derek Beales, *Enlightenment and Reform in Eighteenth-Century Europe*, 28–59. London: Tauris, 2005.

Beales, Derek. "Religion and Culture." In *The Eighteenth Century: Europe 1688–1815*, edited by Tim C.W. Blanning, 131–77. Oxford: Oxford University Press, 2000.

Beauvois, Daniel. "Les jésuites dans l'Empire Russe 1772–1820." *Dix-huitième siècle* 8 (1976): 257–72.

Bedini, Silvio A. "The Transit in the Tower: English Astronomical Instruments in Colonial America." *Annals of Science* 54 (1997): 161–96.

Berg, Gunhild, Marcus Twellmann, and Borbála Zsuzsanna Török, eds. *Berechnen/Beschreiben: Praktiken statistischen (Nicht-)Wissens 1750–1850*. Berlin: Duncker & Humblot, 2015.

Berlász, Jenő. *Dernschwam János könyvtára*. Budapest: Akadémiai Kiadó, 1964.

Bernard, Paul B. *From the Enlightenment to the Police State: The Public Life of Johann Anton Pergen*. Urbana and Chicago: University of Illinois Press, 1991.

Biagioli, Mario. *Galileo Courtier: The Practice of Science in the Culture of Absolutism*. Chicago and London: University of Chicago Press, 1993.

Bieńkowska, Barbara. "From Negation to Acceptance: The Reception of the Heliocentric Theory in Polish Schools in the 17th and 18th Centuries." In *The Reception of Copernicus' Heliocentric Theory*, edited by Jerzy Dobrzycki, 79–116. Dordrecht: Reidel, 1972.

Birkeland, B.J. "Ältere meteorologische Beobachtungen in Vardö." *Geofysiske publikasjoner* 10, no. 9 (1935): 1–52.

Bíró, Ferenc. *A felvilágosodás korának magyar irodalma*. Budapest: Balassi Kiadó, 1994.

Bíró, Vencel. *A kolozsvári jezsuita egyetem szervezete és építkezései a XVIII. században*. Kolozsvár [Cluj]: Erdélyi Múzeum Egyesület, 1945.

Bitskey, István. "'Püspökünk, példánk és tükörünk volt': Eszterházy Károly életpályája és egyénisége." In *Eszterházy Károly emlékkönyv*, edited by Béla Kovács, 7–22. Eger: Érseki Gyűjteményi Központ, 1999.

Bloch, George J., ed. *Mesmerism: A Translation of the Original Medical and Scientific Writings of F.A. Mesmer*. Los Altos: W. Kaufmann, 1980.

Bödeker, Hans Erich. "Biographie: Annäherungen an die gegenwärtigen Forschungs- und Diskussionsstand." In *Biographie schreiben*, edited by Hans Erich Bödeker, 9–64. Göttingen: Wallstein Verlag, 2003.

Bödeker, Hans Erich. ed. *Biographie schreiben*. Göttingen: Wallstein Verlag, 2003.

Bödeker, Hans Erich, Philippe Büttgen, and Michel Espagne, eds. *Die Wissenschaft vom Menschen in Göttingen um 1800*. Göttingen: Vandenhoeck & Ruprecht, 2008.

Bodi, Leslie. *Tauwetter in Wien: Zur Prosa der österreichischen Aufklärung 1781–1795*. Frankfurt: Fischer Verlag, 1977.

Boglár, Lajos. "The Ethnographic Legacy of Eighteenth-Century Hungarian Travellers in South-America." *Acta ethnographica* 4, nos. 1–4 (1955): 313–59.

Boistel, Guy. "Un 'bréviaire' pour les astronomes et les marins: *La connaisance* [sic] *des temps* et les calculateurs de Bureau des longitudes, de Lalande à Loewy (1772–1907)." *Archives internationales d'histoire des sciences* 64 (2014): 462–80.

Boistel, Guy. "Nicole-Reine Lepaute et l'*Hortensia*." *Les Cahiers Clairaut* 108 (2004): 13–17.

Borián, Elréd. "A történetíró jezsuita testvérek: Kazy Ferenc és Kazy János újraértékelése." *Az Egyetemi Könyvtár Évkönyvei* 9 (1999): 45–64.

Bossy, John. "Editor's Postscript." In H. Outram Everett, *The Spirit of the Counter-Reformation*. Edited by John Bossy, 126–45. Cambridge: Cambridge University Press, 1968.

Bourdieu, Pierre. "The Biographical Illusion [1986]." In *Identity: A Reader*, edited by Paul de Gay, Jessica Evans, and Peter Redman, 299–305. London: Sage, 2000.

Bourguet, Marie-Noëlle, Christian Licoppe, and H. Otto Sibum, eds. *Instruments, Travel and Science: Itineraries of Precision from the Seventeenth to the Twentieth Century*. London and New York: Routledge, 2002.

Bown, Stephen R. *Scurvy: How a Surgeon, a Mariner and a Gentleman Solved the Greatest Medical Mystery of the Age of Sail*. New York: Thomas Dunne, 2003.

Bray, R.J. "Australia and the Transit of Venus." *Proceedings of the Astronomical Society of Australia* 4 (1980): 114–20.

Breznyik, János. *A selmecbányai ágost. hitv. evang. egyház és lyceum története.* I. *A XVI. századi események*. Selmecbánya [Banská Štiavnica]: Joerges Ágost, 1883.

Briggs, J. Morton. "Aurora and Enlightenment: Eighteenth-Century Explanations of the Aurora borealis." *Isis* 58, no. 4 (1967): 491–503.

Brittan, Gordon G. "The Role of the Law of Continuity in Boscovich's Theory of Matter." In *R.J. Boscovich: Vita e attività scientifica; His Life and Scientific Work*, edited by Piers Bursill-Hall, 211–24. Rome: Istituto della Enciclopedia Italiana, 1993.

Brizzi, Gian Paolo. *La formazione della classe dirigente nel Sei-Settecento: I seminaria nobilium centro-settentrionale*. Bologna: Il Mulino, 1976.

Brochmann, Grete, and Knut Kjeldstadli. *A History of Immigration: The Case of Norway 900–2000*. Oslo: Universitetsforlaget, 2008.

Brosche, Peter. *Der Astronom der Herzogin: Leben und Werk von Franz Xaver von Zach (1754–1832)*. 2nd ed. Acta Historica Astronomiae 12. Frankfurt am Main: Verlag Harri Deutsch, 2009.

Brosche, Peter. "Korrespondierende Beobachtungen." In *Wissenschaftskommunikation in Europa im 18. und 19. Jahrhundert: Beiträge der Tagung vom 5. und 6. Dezember 2008 an der Akademie gemeinnütziger Wissenschaften zu Erfurt*, edited by Ingrid Kästner, 95–99. Aachen: Shaker Verlag, 2009.

Brosche, Peter. "Küstner's Observations of 1884–85: The Turning Point in the Empirical Establishment of Polar Motion." *International Astronomical Union Colloquium* 208 (2000): 101–108.

Brosche, Peter, and Klaralinda Ma-Kircher. "Elisabeth von Matt (1762–1814), an Enlightened Practitioner of Astronomy in Vienna." *Journal of Astronomical History and Heritage* 13 (2010): 187–93.

Brosche, Peter, Wolfgang R. Dick, Oliver Schwarz, and Roland Wielen, eds. *The Message of the Angles: Astrometry from 1798 to 1998*. Acta Historica Astronomiae 3. Frankfurt: Harri Deutsch, 1998.

Bruckner, Joseph. *La Compagnie de Jésus: Esquisse de son institute et son histoire*. Paris: Gabriel Beauchesne, 1919.

Bryson, Gladys. *Man and Society: The Scottish Inquiry of the Eighteenth Century*. Princeton: Princeton University Press, 1945.

Burke, Peter. *Languages and Communities in Early Modern Europe*. Cambridge: Cambridge University Press, 2004.

Bursill-Hall, Piers. "Introduction." In *R.J. Boscovich:* Vita e attività scientifica; *His Life and Scientific Work*, edited by Piers Bursill-Hall, v–xxii. Rome: Istituto della Enciclopedia Italiana, 1993.

Burson, Jeffrey D. "Between Power and Enlightenment: The Cultural and Intellectual Context of the Jesuit Suppression in France." In *The Jesuit Suppression in Global Context: Causes, Events, and Consequences*, edited by Jeffrey D. Burson and Jonathan Wright, 40–63. Cambridge: Cambridge University Press, 2015.

Burson, Jeffrey D. "The Catholic Enlightenment in France from the *Fin de siècle* Crisis of Consciousness to the Revolution." In *A Companion to the Catholic Enlightenment in Europe*, edited by Ulrich L. Lehner and Michael Printy, 63–125. Leiden: Brill, 2010.

Burson, Jeffrey D. "Introduction." In *Enlightenment and Catholicism in Europe: A Transnational History*, edited by Jeffrey D. Burson and Ulrich Lehner, 1–37. Notre Dame: University of Notre Dame Press, 2014.

Burson, Jeffrey D. "Refracting the Century of Light: Alternative Genealogies of the Enlightenment in Eighteenth-Century Culture." In *Let There Be Enlightenment: The Religious and Mystical Sources of Rationality*, edited by Anton M. Matytsin and Dan Edelstein, 227–46. Baltimore: Johns Hopkins University Press, 2018.

Burson, Jeffrey D. *The Rise and Fall of the Theological Enlightenment: Jean-Martin de Prades and Ideological Polarization in Eighteenth-Century France*. Notre Dame: University of Notre Dame Press, 2010.

Butler, C. John. "Observations of Planetary Transits Made in Ireland in the 18th Century and the Development of Astronomy in Ireland." *Proceedings of the International Astronomical Union*, Special Issue, "Transits of Venus: New Views on the Solar System and Galaxy, Proceedings IAU Colloquium," edited by Don W. Kurtz, 196 (2004): 87–99.

Butterfield, Herbert. *The Origins of Modern Science, 1300–1800*. London: G. Bell and Sons, 1950.

Butterwick, Richard. "Between Anti-Enlightenment and Enlightened Catholicism: Provincial Preachers in Late-Eighteenth-Century Poland–Lithuania." In *Peripheries of the Enlightenment*, edited by Richard Butterwick, Simon Davies, and Gabriel Sánchez-Espinosa, 201–28. Oxford: Voltaire Foundation, 2008.

Caine, Barbara. *Biography and History*. Basingstoke: Palgrave Macmillan, 2010.

Capra, Carlo. "The State of Milan's 'New Census.'" *Catastro* (December 2002): 129–33.

Carcreff, Alessandra Orlandini. *Au pays des vendeurs de vent: Voyages et voyageurs en Laponie et Finlande du XVe au XIXe siècle*. Aix and Marseille: Presses universitaires de Provence, 2017.

Carter, William, and Merri Sue Carter. "Simon Newcomb, America's First Great Astronomer." *Physics Today* 62 (2009): 46–51.

Cerman, Ivo, Rita Krueger, and Susan Reynolds, eds. *The Enlightenment in Bohemia: Religion, Morality, and Multiculturalism*. Oxford: Voltaire Foundation, 2011.

Chadwick, Owen. *The Popes and the European Revolution*. Oxford: Clarendon Press, 1981.

Chapman, Allan. "Jeremiah Horrocks, William Crabtree, and the Lancashire Observations of the Transit of Venus of 1639." *Proceedings of the International Astronomical Union*, Special Issue, "Transits of Venus: New Views on the Solar System and Galaxy, Proceedings IAU Colloquium," edited by Don W. Kurtz, 196 (2004): 3–26.

Čičaj, Viliam. *Bányavárosi könyvkultúra a XVII–XVIII. században* (*Besztercebánya, Körmöcbánya, Selmecbánya*). Szeged: n.p., 1993.

Čičaj, Viliam. "Stredoslovenské meštianstvo a výtvarné umenie v období neskorého feudalizmu." In *Banské mestá na Slovensku*, edited by Marsina, Richard, 249–60. Žiar nad Hronom: Okresný národný výbor, 1990.

Clark, William, Jan Golinski, and Simon Schaffer. "Introduction." In *The Sciences in Enlightened Europe*, edited by William Clark, Jan Golinski, and Simon Schaffer, 3–31. Chicago and London: University of Chicago Press, 1999.

Clark, William, Jan Golinski, and Simon Schaffer. eds. *The Sciences in Enlightened Europe*. Chicago and London: University of Chicago Press, 1999.

Cobern [née Fröhlich], Andrea. "Negotiating the Reformation in Habsburg Hungary, *c.*1520–*c.*1620: A Case Study of Seven Mining Cities." PhD diss., University of Cambridge, 2014.

Cohen, H. Floris. *The Scientific Revolution: A Historiographical Inquiry*. Chicago: University of Chicago Press, 1994.

Cohen, I. Bernard. *Introduction to Newton's* Principia. Cambridge, MA: Harvard University Press, 1978.

Constantine VII Porphyrogenitus. *De administrando imperio*. Greek text edited by Gyula Moravcsik, English translation by R.J.H. [Romilly James Heald] Jenkins, commentary by F. [Francis] Dvornik. Washington, DC, and London: Dumbarton Oaks and Athlone Press, 1962–67.

Csaba, György Gábor, ed. *A csillagász Hell Miksa írásaiból*. Budapest: Magyar Csillagászati Egyesület, 1997.

Csáky, Moritz. "Die Hungarus-Konzeption." In *Ungarn und Österreich unter Maria Theresia und Joseph II: Neue Aspekte im Verhältnis der beiden Länder*, edited by Anna Maria Drabek, Richard G. Plaschka, and Adam Wandruszka, 71–89. Vienna: Verlag der Österreichischen Akademie der Wissenschaften, 1982.

Csáky, Moritz. *Von der Aufklärung zum Liberalismus: Studien zum Frühliberalismus in Ungarn*. Vienna: Verlag der Österreichischen Akademie der Wissenschaften, 1981.

Csapodi, Csaba. "Két világ határán: Fejezet a magyar felvilágosodás történetéből." Századok 79–80, no. 1 (1945–56): 85–137.

Csapodi, Csaba. "Newtonianizmus a nagyszombati jezsuita egyetemen." *Regnum* 6 (1944–46): 59–68.

Csepregi, Zoltán. "Die Anfänge der Reformation im Königreich Ungarn bis 1548." In *Die Reformation im Mitteleuropa/Reformacija v srednji Evropi*, edited by Vincenc Rajšp, Karl W. Schwarz, Bogusław Dybaś, and Christian Gastgeber, 127–47. Ljubljana and Vienna: Založba ZRC and Österreichische Akademie der Wissenschaften, 2011.

Csizmadia, Andor. "Egy kétszáz év előtti országgyűlés évfordulójára: 'Kollár contra Status et Ordines.'" *Jogtudományi Közlöny* 19, no. 4 (1964): 214–27.

D'Occhieppo, Konradin Ferrari. "Hell, Maximilian." In *Dictionary of Scientific Biography*, edited by Charles Coulston Gillispie, 6:234. New York: Charles Scribner's Sons, 1972.

D'Occhieppo, Konradin Ferrari. "Maximilian Hell und Placidus Fixlmillner: Die Begründer der neueren Astronomie in Österreich." In *Österreichische Naturforscher, Ärzte und Techniker*, edited by Fritz Knoll, 27–31. Vienna: Verlag der Gesellschaft für Natur und Technik, 1957.

Dahl, Ove. *Biskop Gunnerus's virksomhed fornemmelig som botaniker, tilligemed en oversigt over botanikens tilstand i Danmark og Norge indtil hans død*. Trondheim: Aktietrykkeriet, 1899.

Darnton, Robert. *Mesmerism and the End of the Enlightenment in France*. Cambridge, MA: Harvard University Press, 1968.

Daston, Lorraine. "Afterword: The Ethos of Enlightenment." In *The Sciences in Enlightened Europe*, edited by William Clark, Jan Golinski, and Simon Schaffer, 495–504. Chicago and London: University of Chicago Press, 1999.

Daston, Lorraine. "The Ideal and Reality of the Republic of Letters in the Enlightenment." *Science in Context* 4 (1991): 367–86.

Daston, Lorraine, and H. Otto Sibum. "Introduction: Scientific Personae and Their Histories." *Science in Context* 16, nos. 1–2 (2003): 1–8.

Davis, A.E.L. "Kepler's Angular Measure of Uniformity: How It Provided a Potential Proof of His Third Law." In *Miscellanea Kepleriana: Festschrift für Volker Bialas*, edited by Friederike Boockmann, Daniel A. Di Liscia, and Hella Kothmann, 157–73. Augsburg: Erwin Rauner Verlag, 2005.

Davis, Natalie Zemon. *The Return of Martin Guerre*. Cambridge, MA: Harvard University Press, 1983.

Davis, Natalie Zemon. *Trickster Travels: A Sixteenth-Century Muslim between Worlds*. New York: Hill and Wang, 2006.

De Lucca, Denis. *Jesuits and Fortifications: The Contribution of Jesuits to Military Architecture in the Baroque Age*. Leiden: Brill, 2012.

Deák, Eszter. "Born Ignác ismeretlen recenziója Sajnovics János 'Demonstratió'-járól." *Hungarológia* 2 (1993): 117–21.

Dear, Peter. *Discipline and Experience: The Mathematical Way in the Scientific Revolution*. Chicago: University of Chicago Press, 1995.

Dear, Peter. *Revolutionizing the Sciences: European Knowledge and Its Ambitions, 1500–1700*. Princeton: Princeton University Press, 2009.

Débarbat, Suzanne. "Venus Transits: A French View." *Proceedings of the International Astronomical Union*, Special Issue, "Transits of Venus: New Views on the Solar System and Galaxy, Proceedings IAU Colloquium," edited by Don W. Kurtz, 196 (2004): 41–51.

Deme, László. "Maria Theresa's Noble Lifeguards and the Rise of the Hungarian Enlightenment and Nationalism." In *The East Central European Officer Corps, 1740–1920s: Social Origins, Selection, Education, and Training*, edited by Béla Király and Walter Scott Dillard, 197–212. Boulder, CO: Columbia University Press, 1988.

Demkó, Kálmán. *A felső-magyarországi városok életéről a XV–XVII. században*. Budapest: Magyar Tudományos Akadémia, 1890.

Desmond, Adrian, and James Moore. *Darwin*. Harmondsworth: Penguin, 1992.

Desmond, Adrian, and James Moore. *Darwin's Sacred Cause: Race, Slavery, and the Quest for Human Origins*. Chicago: University of Chicago Press, 2011.

Domokos, Péter. *Szkítiától Lappóniáig: A nyelvrokonság és az őstörténet kérdéskörének visszhangja*. Budapest: Universitas, 1998.

Dompnier, Bernard. "Die Fortdauer der katholischen Reform." In *Die Geschichte des Christentums*, vol. 9, *Das Zeitalter des Vernunfts* (*1620/30–1750*), edited by Bernard Plongeron, 211–300. Freiburg im Breisgau: Herder, 1998.

Donnert, Erich. *Russia in the Age of Enlightenment*. Leipzig: Edition Leipzig, 1986 [1983].

Duchet, Michèle. *Anthropologie et histoire au siècle des lumières*. Paris: Albin Michel, 1971.

Duerbeck, Hilmar W. "Zach, Gotha and the Venus Transits of the 18th and 19th Centuries." In *The European Scientist: Symposium on the Era and Work of Franz Xaver von Zach* (*1754–1832*), edited by Lajos G. Balázs, Peter Brosche, Hilmar Duerbeck, and Endre Zsoldos. Acta Historica Astronomiae 24. Frankfurt am Main: Verlag Harri Deutsch, 2005.

Duhr, Bernhard. *Jesuiten-Fabeln: Ein Beitrag zur Culturgeschichte*. Freiburg: Herder, 1892.

Dümmerth, Dezső. "Herder jóslata és forrásai." *Filológiai Közlöny* 9, nos. 1–2 (1963): 181–83.

Dümmerth, Dezső. "Kollár Ádám problémája." *Filológiai Közlöny* 13, nos. 3–4 (1967): 442–44.

Dumont, Simone. *Un astronome des Lumières: Jérôme Lalande*. With a foreword by Jean-Claude Pecker. Paris: Vuibert and Observatoire de Paris, 2007.

Dumont, Simone, and Suzanne Débarbat. "Delisle: Cassini iii; Deux pèlerins de la cartographie scientifique en Europe centrale et orientale." *Revue XYZ* 18, no. 67 (1996): 70–76.

Dumont, Simone, and Jean-Claude Pecker, eds. *Mission à Berlin: Jérôme Lalande, lettres à Jean III Bernoulli et à Elert Bode*. Paris: Vrin, 2014.

Duyker, Edward. *Nature's Argonaut: Daniel Solander 1733–1782; Naturalist and Voyager with Cook and Banks*. Melbourne: Melbourne University Press, 1998.

Ebneth, Bernhard. "Schlichtegroll, Friedrich von." *Neue Deutsche Biographie* 23 (2007): 72–73. https://www.deutsche-biographie.de/pnd117327077.html#ndbcontent (accessed November 26, 2018).

Éder, Zoltán. "Sajnovics Demonstratiójának első recenziója: 'Viennensis Recensitor opusculi mei Hafniae editi.'" *Magyar Nyelv* 110 (2014): 85–94.

Éder, Zoltán. "Újabb szempontok a *Demonstratio* hazai fogadtatásának kérdéséhez." In Zoltán Éder, *Túl a Duna-tájon: Fejezetek a magyar művelődéstörténet európai kapcsolatai köréből*, 47–61. Budapest: Mundus, 1999.

Egyed, Emese. *Levevék fejemről Múzsák sisakomat: Barcsay Ábrahám költészete*. Kolozsvár: Erdélyi Múzeum-Egyesület, 1998. http://mek.oszk.hu/02800/02816/02816.pdf (accessed December 3, 2018).

Ehlers, Monika, trans. *Johann Sajnovics: Beweis, das die Sprache der Ungarn und Lappen dieselbe ist*. Edited by Gyula Decsy and Wolfgang Veenker. Wiesbaden: Harrassowitz, 1972.

Engstrand, Iris H.W. "The Transit of Venus in 1769: Launching Pad for European Exploration in the Pacific during the Late Eighteenth Century." *Boletin: Journal of the California Mission Studies Association* 21 (2004): 36–48.

Erdődi, József. "Sajnovics, der Mensch und der Gelehrte." *Acta linguistica Academiae Hungaricae* 20 (1970): 291–322.

Eriksen, Trond Berg, and Øystein Sørensen, eds. *Norsk Idéhistorie*, vol. 2, Nils Gilje and Tarald Rasmussen, *Tankeliv i den lutherske stat*, 376–96. Oslo: Aschehoug, 2002.

Evans, R.J.W. [Robert John Weston]. *Austria, Hungary, and the Habsburgs: Central Europe, c.1683–1867*. Oxford: Oxford University Press, 2006.

Evans, R.J.W. [Robert John Weston]. *The Making of the Habsburg Monarchy, 1550–1700: An Interpretation*. Oxford: Oxford University Press, 1979.

Evans, R.J.W. [Robert John Weston]. "Maria Theresa and Hungary." In *Enlightened Absolutism: Reform and Reformers in Eighteenth-Century*, edited by H.M. [Hamish Marshall] Scott, 189–207. London: Macmillan, 1990.

Fabre, Pierre Antoine, and Patrick Goujon. *Suppression et rétablissement de la Compagnie de Jésus* (*1773–1814*). Paris: Lessius, 2014.

Faller, Jenő. *A magyar bányagépesítés úttörői a XVIII. században: Hell Máté Kornél és Hell József Károly főgépmesterek élete és munkássága*. Budapest: Akadémiai Kiadó, 1953.

Farkas Wellmann, Éva. *Irodalom és közönsége a XVIII. században: Verestói György munkássága*. Budapest: Gondolat Kiadó, 2013.

Fauque, Danielle M.E. "La correspondance Jérôme Lalande et Nevil Maskelyne: Un exemple de collaboration internationale au XVIIIe siècle." In *Jérôme Lalande* (*1732–1807*)*: Une trajectoire scientifique*, edited by Guy Boistel, Jérôme Lamy, and Colette LeLay, 109–28. Rennes: Presses universitaires de Rennes, 2010.

Faustmann, Cornelia. "'In parte physicae theoretica Newtonum eiusque commentatores secutus sum': Leopold Gottlieb Biwald's *Physica generalis* as a Compendium Propagating Newtonian Physics in Europe." In *The Circulation of Science and Technology: Proceedings of the 4th International Conference of the ESHS in Barcelona, 18–20 November 2010*, edited by Antoni Roca-Rosell, 349–54. Barcelona: SCHCTIEC, 2012.

Faustmann, Cornelia. "Physik des 18. Jahrhunderts im Spiegel der Quellen." PhD diss., University of Vienna, 2010.

Faustmann, Cornelia, Gottfried Glassner, and Thomas Wallnig, eds. *Melk in der barocken Gelehrtenrepublik: Die Brüder Pez, ihre Netzwerke und Forschungen*. Melk: Stift Melk, 2014.

Faye, Hervé Auguste Étienne Albans. "Examen critique des idées et des observations du P. Hell sur le passage de Venus de 1769." *Comptes rendus hebdomadaires des séances de l'Académie des Sciences* 68 (1869): 282–90.

Faye, Hervé Auguste Étienne Albans. "Sur les passages de Vénus et la parallaxe du Soleil." Parts 1–2. *Comptes rendus hebdomadaires des séances de l'Académie des Sciences* 68 (1869): 42–50, 69–73.

Febvre, Lucien. *Un destin: Martin Luther*. Paris: PUF, 1968.

Febvre, Lucien. *Le problème de l'incroyance au 16e siècle: La religion de Rabelais.* Paris: Albin Michel, 1947.

Fehér, Katalin. *Hatvani István és tanítványai*. Budapest: Országos Pedagógiai Könyvtár és Múzeum, 2002.

Feil, Joseph. *Versuche zur Gründung einer Akademie der Wissenschaften unter Maria Theresia*. Vienna: Gerold, 1860.

Feingold, Mordechai, ed. *Jesuit Science and the Republic of Letters*. Cambridge, MA: MIT Press, 2003.

Feldhay, Rivka. "The Cultural Field of Jesuit Science." In *The Jesuits: Cultures, Sciences, and the Arts 1540–1773*, edited by John W. O'Malley, Gauvin Alexander Bailey, Steven J. Harris, and T. Frank Kennedy, 1:107–30. Toronto: University of Toronto Press,1999.

Feldhay, Rivka. *Galileo and the Church: Political Inquisition or Critical Dialogue?* Cambridge: Cambridge University Press, 1995.

Ferencová, Elena. *Maximilián Hell významná osobnosť slovenskej vedy a techniky*. Bratislava: Asklepios, 1995.

Ferrone, Vincenzo. *The Intellectual Roots of the Italian Enlightenment: Newtonian Science, Religion, Politics in the Early Eighteenth Century*. Atlantic Highlands: Humanities Press, 1995.

Fettweis, Günter B., and Günther Hamann, eds. *Über Ignaz von Born und die Societät der Bergbaukunde: Vorträge einer Gedenkveranstaltung zur 200; Wiederkehr des Gründungstages im September 1786 der ältesten internationalen wissenschaftlichen Gesellschaft*. Vienna: Verlag der Österreichischen Akademie der Wissenschaften, 1989.

Fillafer, Franz Leander. "Whose Enlightenment?" *Austrian History Yearbook* 48 (2017): 111–25.

Findlen, Paula, ed. *Athanasius Kircher: The Last Man Who Knew Everything*. New York and London: Routledge, 2004.

Findlen, Paula, ed. *Possessing Nature: Museums, Collecting, and Scientific Culture in Early Modern Italy*. Berkeley: University of California Press, 1994.

Fiocca, Alessandra. "Ferrara e i gesuiti in materia d'acque." In *Gesuiti e università in Europa* (*secoli XVI–XVIII*), edited by Gian Paolo Brizzi and Roberto Greci, 339–59. Bologna: CLUEB, 2002.

Fiocca, Alessandra. "I gesuiti e il governo delle acque del basso Po nel secolo XVII." In *Giambattista Riccioli e il merito scientifico dei gesuiti nell'età Barocca*, edited by Maria Teresa Borgato, 319–70. Florence: Olschki, 2002.

Firneis, Maria G. "Johann Tobias Bürg (1766–1834): Littrows Gegenspieler in Wien." *Die Sterne* 69 (1993): 148–53.

Fischer, Karl Adolf-Franz. "Jesuiten-Mathematiker in der Deutschen Assistenz bis 1773." *Archivum historicum Societatis Iesu* 47 (1978): 159–224.

Fischer, Karl Adolf-Franz. "Die Jesuiten-Mathematiker des Nordostdeutschen Kulturgebietes," *Archives internationales d'histoire des sciences* 34 (1984): 124–62.

Flóra, Ágnes. "Rekatolizáció és provokáció? A kolozsvári jezsuita kollégium alapítása és a városi tanács." In *Szentírás, hagyomány, reformáció: Teológia- és egyháztörténeti tanulmányok*, edited by Beatrix F. Romhányi and Gábor Kendeffy, 287–96. Budapest: Gondolat, 2008.

Flügel, Helmut W. "Nikolaus Poda und die mineralogisch-paläontologische Sammlung der Jesuitenuniversität Graz von 1766." *Joannea mineralogie* 3 (2006): 25–61.

Forbes, Eric, and Jacques Gapaillard. "La correspondance astronomique entre l'abbé Nicolas-Louis de Lacaille et Tobias Mayer." *Revue d'histoire des sciences* 49 (1996): 483–541.

Frängsmyr, Tore, ed. *Linnaeus: The Man and His Work*. Berkeley: University of California Press, 1985.

Frank, Peter R., and Johannes Frimmel. *Buchwesen in Wien 1750–1850: Kommentiertes Verzeichnis der Buchdrucker, Buchhändler und Verleger*. Wiesbaden: Harrassowitz Verlag, 2008.

Fried, István. "A hungarus-tudat kérdőjelei." In István Fried, *A közép-európai szöveguniverzum*, 47–68. Budapest: Lucidus, 2002.

Friedrich, Markus. *Der lange Arm Roms: Globale Verwaltung und Kommunikation im Jesuitenorden 1540–1773*. Frankfurt and New York: Campus Verlag, 2011.

Frijhoff, Willem. "Experience and Agency at the Crossroads of Culture, Mentality, and Contextualization: The Biography of Everhardus Bogardus (*c*.1607–1647)." In *Biographie schreiben*, edited by Hans Erich Bödeker, 65–105. Göttingen: Wallstein Verlag, 2003.

Frijhoff, Willem. *Fulfilling God's Mission: The Two Worlds of Dominie Everardus Bogardus 1607–1647*. Leiden and Boston: Brill, 2007 [1995].

Fröhlich, Andrea. "The *Confessio montana*, 1559: Composition and Aftermath/*Confessio montana*, 1559; Zostavenie a následky." *Montánna história* 3 (2010): 8–24.

Gaukroger, Stephen. "Biography as a Route to Understanding Early Modern Natural Philosophy." In *The History and Poetics of Scientific Biography*, edited by Thomas Söderqvist, 37–50. Aldershot: Ashgate, 2007.

Gaukroger, Stephen. *Descartes: An Intellectual Biography*. Oxford: Oxford University Press, 1995.

Gaukroger, Stephen. *Francis Bacon and the Transformation of Early Modern Philosophy*. Cambridge: Cambridge University Press, 2001.

Gay, Peter. *The Enlightenment: An Interpretation*. 2 Vols. New York: Knopf, 1967–69.

Gerbi, Antonello. *The Dispute of the New World: The History of a Polemic 1750–1900*. Pittsburgh: University of Pittsburgh Press, 1973.

Gheno, Danilo. "Sajnovics e la *Demonstratio*: Problemi e caratteri dell'edizione di Trnava." *Atti e memorie, Accademia Patavina di scienze lettere ed arti* 87 (1975): 45–59.

Ginzburg, Carlo. *The Cheese and the Worms: The Cosmos of a Sixteenth-Century Miller. Baltimore: Johns Hopkins University Press,* 1980 [*1976*].

Glaβner, Gottfried, and Christina Preiner. "'[…] Physica autem sine omni experimento sicca sit et sterilis': Warum im Jahr 1771 trotz guter Argumente der Plan, in Melk eine Sternwarte zu errichten, nicht zur Ausführung kam." In "[…] *Und das Firmament kündet vom Werk Seiner Hände" (Ps. 19, 2): Faszination Astronomie: eine Spurensuche in der Melker Stiftsbibliothek*, edited by Gottfried Glaβner, 123–31. Thesaurus Mellicensis 1. Melk: Stift Melk, 2009.

Godsey, William D. *The Sinews of Habsburg Power: Lower Austria in a Fiscal-Military State 1650–1820*. Oxford: Oxford University Press, 2018.

Goodrick-Clarke, Nicholas. *The Western Esoteric Traditions: A Historical Introduction*. Oxford: Oxford University Press, 2010.

Grendler, Paul F. "The Culture of the Jesuit Teacher 1548–1773." *Journal of Jesuit Studies* 3, no. 1 (2016): 17–41.

Grendler, Paul F. "Jesuit Schools in Europe: A Historiographical Essay." *Journal of Jesuit Studies* 1, no. 1 (2014): 7–25.

Guillemain, Hervé, and Nathalie Richard. "Towards a Contemporary Historiography of Amateurs in Science (18th–20th Century)." *Gesnerus: Swiss Journal for the History of Medicine and Sciences* 73, no. 2 (2016): 201–37.

Gutkas, Karl. *Kaiser Joseph II: Eine Biographie*. Vienna: Paul Zsolnay Verlag, 1989.

Gyenis, András. *A jezsuita rend hazánkban*. Budapest: Szalézi Művek, 1941.

Gyenis, András. *Régi jezsuita rendházak: Központi kormányzat*. Vác: n.p., 1941.

György, Lajos. *A kolozsvári római katolikus Lyceum-könyvtár története 1579–1948*. Budapest: Argumentum Kiadó, 1994.

Göderle, Wolfgang. "Modernisierung durch Vermessung? Das Wissen des modernen Staats in Zentraleuropa, circa 1760–1890." *Archiv für Sozialgeschichte* 57 (2017): 155–86.

Haakonssen, Knud. *Natural Law and Moral Philosophy: From Grotius to the Scottish Enlightenment*. Cambridge: Cambridge University Press, 1996.

Habermas, Jürgen. *The Structural Transformation of the Public Sphere: An Inquiry into a Category of Bourgeois Society*. Cambridge, MA: MIT Press, 1989 [1962].

Haberzettl, Hermann. *Die Stellung der Exjesuiten in Politik und Kulturleben Österreichs zu Ende des 18. Jahrhunderts*. Dissertationen der Universität Wien 94. Vienna: Verband der wissenschaftlichen Gesellschaften Österreichs, 1973.

Hadobás, Sándor. *Hell Miksa és Sajnovics János bibliográfiája*. Rudabánya: Érc- és Ásványbányászati Múzeum Alapítvány, 2008.

Hagen, Johann Georg. "Karl Littrow als Geschichtsforscher." *Stimmen der Zeit* 93 (1917): 108–14.

Hagen, Johann Georg. "Washington und seine wissenschaftlichen Institute." *Stimmen aus Maria Laach* 34 (1888): 551–53.

Hagen, Rune Blix. "Vardøhus som sentrum for dansknorsk statsmakt i nord 1550–1738." In *Forpost mot øst: Fra Vardø og Finnmarks historie 1307–2007*, edited by Randi Rønning Balsvik and Jens Petter Nielsen, 45–60. Stamsund: Orkana forlag, 2008.

Hagland, Jan Ragnar, and Steinar Supphellen, eds. *Knud Leem og det samiske*. Det kongelige norske videnskabers selskabs skrifter 2. Trondheim: Tapir akademisk, 2003.

Halász, László. *A lőcsei királyi katholikus főgymnasium története*. Levoča: Józs T., 1896.

Hamann, Günther. "G.W. Leibnizens Plan einer Wiener Akademie der Wissenschaften." In *Akten des 11. Internationalen Leibniz-Kongresses*, edited by Kurt Müller, Heinrich Schepers and Wilhelm Totok, 1:205–27. Wiesbaden: Franz Steiner Verlag, 1973.

Hamel, Jürgen. "Ephemeriden und Informationen: Inhaltliche Untersuchung Berliner Kalender bis zu Bodes Astronomischen Jahrbuch." In *300 Jahre Astronomie in Berlin und Potsdam*, edited by Wolfgang R. Dick and Klaus Fritze, 49–70. Acta Historica Astronomiae 8. Frankfurt: Harri Deutsch Verlag, 2000.

Hammerstein, L.v. [Ludwig von]. "Der Astronom P. Hell S.J. und sein Verteidiger Professor Simon Newcomb." *Stimmen aus Maria Laach* 39 (1890): 455–58.

Hammerstein, Notker. "Besonderheiten der österreichischen Universitäts- und Wissenschaftsreform zur Zeit Maria Theresias und Josephs II." In *Österreich im Europa der Aufklärung: Kontinuität und Zäsur in Europa zur Zeit Maria Theresias und Josephs II*, edited by Richard Georg Plaschka, 787–812. Vienna: Verlag der Österreichischen Akademie der Wissenschaften, 1985.

Hankins, Thomas L. "In Defence of Biography: The Use of Biography in the History of Science." *History of Science* 17, no. 1 (1979): 1–16.

Hansen, Lars et al., eds. *The Linnaeus Apostles. Global Science & Adventure*. London: IK Foundation, 2006–12.

Hansen, Thorkild. *Arabia Felix: The Danish Expedition of 1761–1767*. London: St. James, 1964.

Harris, Steven J. "Boscovich, the 'Boscovich Circle' and the Revival of Jesuit Science." In *R.J. Boscovich: Vita e attività scientifica; His Life and Scientific Work*, edited by Piers Bursill-Hall, 527–48. Rome: Istituto della Enciclopedia Italiana, 1993.

Harris, Steven J. "Confession-Building, Long-Distance Networks, and the Organization of Jesuit Science." *Early Science and Medicine: A Journal for the Study of Science, Technology and Medicine in the Pre-modern Period* 1, no. 3 (1996): 287–318.

Harris, Steven J. "Mapping Jesuit Science: The Role of Travel in the Geography of Knowledge." In *The Jesuits: Cultures, Sciences, and the Arts 1540–1773*, edited by John W. O'Malley, Gauvin Alexander Bailey, Steven J. Harris, and T. Frank Kennedy, 1:213–40. Toronto: University of Toronto Press, 1999.

Harvey, E. Newton. *A History of Luminescence from the Earliest Times until 1900*. Philadelphia: American Philosophical Society, 1957.

Hasquin, Hervé, and Roland Mortier, eds. *Unité et diversité de l'empire des Habsbourg à la fin du XVIIIe siècle*. Brussels: Editions de l'Université de Bruxelles, 1988.

Haubelt, Josef. *Studie o Ignaci Bornovi*. Prague: University of Karlova, 1973.

Hegedűs, Béla. "Kalmár György a magyar nyelv származásáról." In *Historia litteraria a XVIII. században*, edited by Rumen István Csörsz, Béla Hegedűs, and Gábor Tüskés, 294–306. Budapest: Universitas, 2006.

Heilbron, J.L. [John Lewis]. *Electricity in the 17th and 18th Centuries: A Study in Early Modern Physics*. New York: Dover, 1979.

Heinrich, László. *Az első kolozsvári csillagda*. Bucharest: Kriterion, 1978.

Hellyer, Marcus. *Catholic Physics: Jesuit Natural Philosophy in Early Modern Germany*. Notre Dame: University of Notre Dame Press, 2005.

Hellyer, Marcus. "Jesuit Physics in Eighteenth-Century Germany: Some Important Continuities." In *The Jesuits: Cultures, Sciences, and the Arts 1540–1773*, edited by John W. O'Malley, Gauvin Alexander Bailey, Steven J. Harris, and T. Frank Kennedy, 1:538–54. Toronto: University of Toronto Press, 1999.

Hersche, Peter. *Muße und Verschwendung: Europäische Kultur und Gesellschaft im Barockzeitalter*. Freiburg: Herder, 2006.

Hersche, Peter. *Der Spätjansenismus in Österreich*. Vienna: Verlag der Österreichischen Akademie der Wissenschaften, 1977.

Hill, Elizabeth. "Roger Boscovich: A Biographical Essay." In *Roger Joseph Boscovich S.J., F.R.S., 1711–1787: Studies of His Life and Work on the 250th Anniversary of His Birth*, edited by Lancelot Law Whyte, 16–101. London: Allen & Unwin, 1961.

Hoffmann, Hermann. *Friedrich II: Von Preussen und die Aufhebung der Gesellschaft Jesu*. Bibliotheca Instituti Historici S.I. Rome: Institutum Historicum Societatis Iesu, 1969.

Hogg, Helen Sawyer. "Out of Old Books: The 1769 Transit of Venus, as Seen from Canada." *Journal of the Royal Astronomical Society of Canada* 41 (1947): 319–26.

Hogg, Helen Sawyer. "Out of Old Books: Le Gentil and the Transits of Venus, 1761 and 1769." *Journal of the Royal Astronomical Society of Canada* 45 (1951): 37–44, 89–92, 127–34, 173–78.

Hološová, Alžbeta, and Henrieta Žažová. *History of the Observatory at the University of Trnava*. Trnava: Trnavská Univerzita, 2013.

Holovics, Flórián. "Sajnovics János a Demonstratióról." *Magyar Nyelv* 68 (1972): 432–501.

Hóman, Bálint. "Tudományos történetírásunk megalapítása a XVIII. században." In Bálint Hóman, *Történetírás és forráskritika*, 353–80. Budapest: Magyar Történelmi Társulat, 1938.

Horányi, Elek. *Memoria Hungarorum et provincialium scriptis editis notorum*. Vienna: Loew, 1776.

Horn, Sonia. "Auftrag und Erfüllung: Erna Lesky and medizinhistorische Narrative im 20. Jahrhundert." In *Josephinismus zwischen den Regimen: Eduard Winter, Fritz Valjavec und die zentraleuropäischen Historiographien im 20. Jahrhundert*, edited by Franz Leander Fillafer and Thomas Wallnig, 181–212. Vienna: Böhlau, 2016.

Horstmann, Fred. *Alois Merz, Dom- und Kontroversprediger aus Augsburg, als Opponent der Aufklärung*. Frankfurt: Peter Lang, 1996.

Hovdhaugen, Even, Fred Karlsson, Carol Henriksen, and Bengt Sigurd. *The History of Linguistics in the Nordic Countries*. Helsinki: Societas Scientiarum Fennica, 2000.

Howse, Derek, and Andrew Murray. "Lieutenant Cook and the Transit of Venus, 1769." *Astronomy & Geophysics* 38 (1997): 27–30.

Hsia, Florence C. "Astronomy after the Deluge." In *Science in the Archive: Pasts, Presents, Futures*, edited by Lorraine Daston, 17–37. Chicago: University of Chicago Press, 2017.

Hsia, Florence C. "Jesuits, Jupiter's Satellites, and the Académie Royale des Sciences." In *The Jesuits: Cultures, Sciences, and the Arts 1540–1773*, edited by John W. O'Malley, Gauvin Alexander Bailey, Steven J. Harris, and T. Frank Kennedy, 1:241–57. Toronto: University of Toronto Press, 1999.

Hsia, Florence C. *Sojourners in a Strange Land: Jesuits and Their Scientific Missions in Late Imperial China*. Chicago: University of Chicago Press, 2009.

Hunt, Lynn. "Jacques Revel and the Question of Scale." In *La forza delle incertezze: Dialoghi storiografici con Jacques Revel*, edited by Antonella Romano and Silvia Sebastiani, 35–45. Bologna: Il Mulino, 2016.

Inglot, Marek. *La Compagnia di Gesù nell'Imperio Russo (1772–1820) e la sua parte nella restaurazione generale della Compagnia*. Rome: Editrice Pontificia Università Gregoriana, 1997.

Israel, Jonathan. *Democratic Enlightenment: Philosophy, Revolution, and Human Rights 1750–1790*. Oxford: Oxford University Press, 2011.

Israel, Jonathan. *Enlightenment Contested: Philosophy, Modernity, and the Emancipation of Man 1670–1752*. Oxford: Oxford University Press, 2006.

Israel, Jonathan. *Radical Enlightenment: Philosophy and the Making of the Modern World*. Oxford: Oxford University Press, 2001.

Israel, Jonathan. *A Revolution of the Mind: Radical Enlightenment and the Intellectual Origins of Modern Democracy*. Princeton: Princeton University Press, 2009.

Jacob, Margaret C. *Living the Enlightenment: Freemasonry and Politics in Eighteenth-Century Europe*. Oxford: Oxford University Press, 1991.

Jacob, Margaret C. *The Radical Enlightenment: Pantheists, Freemasons, and Republicans*. Cambridge: Cambridge University Press, 1981.

Jakobsen, Rolv Nøtvik. *Gunnerus og nordisk vitskapshistorie*. Oslo: Scandinavian Academic Press, 2015.

Jami, Catherine. *The Emperor's New Mathematics: Western Learning and Imperial Authority during the Kangxi Reign (1662–1722)*. Oxford: Oxford University Press, 2011.

Jankovič, Vendelín. *Dejiny jezuitov v Banskej Štiavnici: Príspevok k náboženským dejinám mesta od XVI. storočia do konca XVIII. storočia*. Bratislava: Vydava Filozofická Fakulta, 1941.

Janota, Dušan. "Život Maximiliána Hella/Das Leben Maximilian Hells." In *Maximilián Hell 1720–1792: Zborník prednášok z konferencie o živote a diele Maximiliána Hella*, edited by Ján Novák, 45–69. Bratislava: ÚRAD pre Slovenské banské múzeum v Ban. Štiavnici, 1970.

Jászó, Anna. "Deux études sur János Sajnovics." *Études Finno—Ougriennes* 16 (1983): 255–61.

Johns, Adrian. "The Ideal of Scientific Collaboration: The 'Man of Science' and the Diffusion of Knowledge." In *Commercium litterarium, 1600–1750: La communication dans la république des lettres/Forms of Communication in the Republic of Letters*, edited by Hans Bots and Françoise Waquet, 3–22. Amsterdam and Maarssen: Apa-Holland University Press, 1994.

Kachelmann, Johann. *Das Alter und die Schicksal des ungarischen zunächst Schemnitzer Bergbaues*. Pressburg [Bratislava]: n.p., 1870.

Kádár, László. "Eszterházy Károly racionalizmusa." *Vigilia* 64, no. 6 (1999): 443–52.

Kádár, Zsófia. "Jesuitische Kolleggründungen im Westungarischen Raum in der ersten Hälfte des 17. Jahrhunderts: Die Beispiele von Raab/Győr und Ödenburg/Sopron." In *Frühneuzeitforschung in der Habsburgermonarchie: Adel und Wiener Hof; Konfessionalisierung; Siebenbürgen*, edited by István Fazekas, Martin Scheuchtz, Csaba Szabó, and Thomas Winkelbauer, 155–70. Vienna: Institut für Ungarische Geschichtsforschung, Balassi Institut, Collegium Hungaricum, and Ungarische Archivdelegation beim Haus-, Hof- und Staatsarchiv, 2013.

Kallbrunner, Josef, and Clemens Biener, eds. *Kaiserin Maria Theresias Politisches Testament*. Munich: Oldenbourg, 1952.

Kamusella, Tomasz. *The Politics of Language and Nationalism in Modern Central Europe*. Basingstoke: Palgrave Macmillan, 2009.

Kármán, Gábor. "The Hardship of Being an Ottoman Tributary: Transylvania at the Peace Congress of Westphalia." In *Frieden und Konfliktmanagement in interkulturellen Räumen: Das Osmanische Reich und die Habsburgermonarchie in der Frühen Neuzeit,* edited by Arno Strohmeyer and Norbert Spannenberger, 163–83. Stuttgart: Franz Steiner Verlag, 2013.

Karstens, Simon. *Lehrer—Schriftsteller—Staatsreformer: Die Karriere des Joseph von Sonnenfels (1733–1817)*. Vienna: Böhlau, 2011.

Kelényi B., Ottó. *Az egri érseki líceum csillagvizsgálójának története*. Budapest: Athenaeum, 1930.

Kellner, Heinrich. "Franz, Joseph." *Allgemeine Deutsche Biographie* 7 (1878): 318–19.

Khavanova, Olga. "Joseph von Sonnenfels's Courses and the Making of the Habsburg Bureaucracy." *Austrian History Yearbook* 48 (2017): 54–73.

Kisbán, Emil. *Johann Sajnovics: Leben und Werk eines ungarischen Bahnbrechers und Gelehrten*. Budapest: Hungária, 1943.

Kiss, Farkas Gábor. "Johann Misch Astrophilus Nagyszombaton." *Magyar Könyvszemle* 121, no. 2 (2005): 140–66.

Klamt, Johann-Christian. *Sternwarte und Museum im Zeitalter der Aufklärung: Der Mathematische Turm zu Kremsmünster (1749–1758)*. Mainz: Zabern, 1999.

Klaniczay, Gábor. "Decline of Witches and Rise of Vampires in 18th-Century Habsburg Monarchy." *Ethnologia Europaea* 17 (1987): 165–80.

Klemun, Marianne. "'Living fossil'—'Fossilized life'? Reflections on Biography in the History of Science." *Earth Sciences History* 32, no. 1 (2013): 121–31.

Klemun, Marianne, and Helga Hühnel. *Nikolaus Joseph Jacquin (1727–1817): Ein Naturforscher (er)findet sich*. Göttingen: Vandenhoeck & Ruprecht, 2017.

Klingenstein, Grete. "Between Mercantilism and Physiocracy: Stages, Modes, and Functions of Economic Theory in the Habsburg Monarchy, 1748–1763." In *State and Society in Early Modern Austria*, edited by Charles W. Ingrao, 181–214. West Lafayette: Purdue University Press, 1994.

Klingenstein, Grete. *Staatsverwaltung und kirchliche Autorität im 18. Jahrhundert*. Munich: Oldenbourg, 1970.

Klueting, Harm. "'Der Genius der Zeit hat sie unbrauchbar gemacht': Zum Thema Katholische Aufklärung; Oder; Aufklärung und Katholizismus im Deutschland des 18. Jahrhunderts; Eine Einleitung." In *Katholische Aufklärung: Aufklärung im katholischen Deutschland*, edited by Harm Klueting, Norbert Hinske, and Karl Hengst, 1–35. Hamburg: Meiner, 1993.

Klueting, Harm. *Der Josephinismus: Ausgewählte Quellen zur Geschichte der Theresianisch-Josephinischen Reformen*. Darmstadt: Wissenschaftliche Buchgesellschaft, 1995.

Koerner, Lisbet. "Linnaeus' Floral Transplants." *Representations*, Special Issue, "National Cultures before Nationalism," 47 (1994): 144–69.

Koerner, Lisbet. *Linnaeus: Nature and Nation*. Cambridge, MA, and London: Harvard University Press, 1999.

Koerner, Lisbet. "Purposes of Linnean Travel: A Preliminary Research Report." In *Visions of Empire: Voyages, Botany, and the Representation of Nature*, edited by David Philip Miller and Peter Hanns Reill, 117–52. Cambridge: Cambridge University Press, 1996.

Kókay, György. *Geschichte des Buchhandels in Ungarn*. Wiesbaden: Harrassowitz, 1990.

Konečný, Peter. *250. výročie Banskej a lesníckej akadémie v Banskej Štiavnici: Jej význam pre vývoj montánneho školstva v Rakúsko—Uhorsku, 1762–1919/250; Jubiläum der Berg- und Forstakademie in Schemnitz; Ihre Bedeutung für die Entfaltung des höheren Montanschulwesens in Österreich-Ungarn, 1762–1919*. Košice: Banská agentúra, 2012.

Konečný, Peter. "Cestopisy európskych odborníkov ako forma komunikácie poznania o baníctve a hutníctve v Uhorsku, 1651–1759/Reiseberichte europäischer Fachleute als Kommunikationsform des Wissens über das Berg- und Hüttenwesen im Königreich Ungarn, 1651–1759." *Montánna história* 7 (2014): 200–39.

Konečný, Peter. "Die montanistische Ausbildung in der Habsburgermonarchie, 1763–1848." In *Staat, Bergbau und Bergakademie: Montanexperten im 18. und frühen 19. Jahrhundert*, edited by Hartmut Schleiff and Peter Konečný, 95–124. Stuttgart: Felix Steiner Verlag, 2013.

Kontler, László. *A History of Hungary*. Basingstoke: Palgrave Macmillan, 2002.

Kontler, László. "Introduction: The Enlightenment in Central Europe?" In *Discourses of Collective Identity in Central and Southeast Europe (1745–1945)*, vol. 1, *Late Enlightenment*, edited by Balázs Trencsényi and Michal Kopeček, 33–44. Budapest and New York: Central European University Press, 2006.

Kontler, László. "Introduction: What Is the (Historians') Enlightenment Today?" *European Review of History/Revue d'histoire européenne*, Special Issue, "Enlightenment and Communication: Regional Experiences and Global Consequences," edited by László Kontler, 13, no. 3, (2006): 337–55.

Kontler, László. "Distances Celestial and Terrestrial: Maximilian Hell's Arctic Expedition, 1768–1769; Contexts and Responses." In *The Practice of Knowledge and the Figure of the Savant in the Eighteenth Century*, edited by André Holenstein, Hubert Steinke, and Martin Stuber, 721–50. Leiden: Brill, 2013.

Kontler, László. "Politicians, Patriots, and Plotters: Unlikely Debates Occasioned by Maximilian Hell's Venus Transit Expedition of 1769." *Journal of Astronomical Data*, Special Issue, "Meeting Venus: A Collection of Papers Presented at the Venus Transit Conference in Tromsø 2012," edited by Christiaan Sterken and Per Pippin Aspaas, 19, no. 1 (Brussels and Tromsø: C. Sterken and University of Tromsø, 2013): 83–93

Kontler, László. "Polizey and Patriotism: Joseph von Sonnenfels and the Legitimacy of Enlightened Monarchy in the Gaze of Eighteenth-Century State Sciences." In *Monarchism and Absolutism in Early Modern Europe*, edited by Cesare Cuttica and Glenn Burgess, 75–90. London: Pickering & Chatto, 2012.

Kontler, László. "The Uses of Knowledge and the Symbolic Map of the Enlightened Monarchy of the Habsburgs: Maximilian Hell as Imperial and Royal Astronomer (1755–1792)." In *Negotiating Knowledge in Early Modern Empires: A Decentered View*, edited by László Kontler, Antonella Romano, Silvia Sebastiani, and Zsuzsanna Borbála Török, 79–105. Basingstoke: Palgrave Macmillan, 2014.

Kontler, László, and Balázs Trencsényi. "Hungary." In *European Political Thought 1450–1700: Religion, Law, and Philosophy*, edited by Howell A. Lloyd, Glenn Burgess, and Simon Hodson, 176–207. New Haven: Yale University Press, 2006.

Köpeczi, Béla, László Makkai, András Mócsy, and Zoltán Szász, with Gábor Barta, eds. *History of Transylvania*. Budapest: Akadémiai Kiadó, 1994.

Kosáry, Domokos. *Culture and Society in Eighteenth-Century Hungary*. Budapest: Corvina, 1987.

Kovács, Béla, ed. *Eszterházy Károly emlékkönyv*. Eger: Érseki Gyűjteményi Központ, 1999.

Kovacs, Elisabeth. "Katholische Aufklärung und Josephinismus." In *Katholische Aufklärung: Aufklärung im katholischen Deutschland*, edited by Harm Klueting, Norbert Hinske, and Karl Hengst, 246–59. Hamburg: Meiner, 1993.

Kovács, I. Gábor. *Kis magyar kalendáriumtörténet 1880-ig. A magyar kalendáriumok történeti és művelődésszociológiai vizsgálata*. Budapest: Akadémiai Kiadó, 1989.

Koyré, Alexandre. *From the Closed World to the Infinite Universe*. Baltimore: Johns Hopkins University Press, 1957.

Kragemo, Helge. "Pater Hell's observasjoner i Vardøhus 1769." In *Norvegica: Minneskrift til femti-årsdagen for opprettelsen av Universitetsbibliotekets norske avdeling 1883. 1. januar. 1933*, 220–26. Oslo: Grøndahl & Søn, 1933.

Kragemo, Helge. "Pater Hells ufullendte." In *Med boken som bakgrunn: Festskrift til Harald L. Tveterås*, 121–33. Oslo: Tanum, 1968.

Kragemo, Helge. "Pater Hells Vardøhusekspedisjon: Belyst ved Pater Sainovič's dagbok 1768–1769." In *Vardøhus Festning 650 år. Jubileumsskrift*, edited by G.I. Willoch, 92–125. Oslo: Generalinspektøren for Kystartilleriet, 1960.

Kragh, Helge. *Dansk Naturvidenskabs Historie*, vol. 2, *Natur, Nytte og Ånd 1730–1850*. Aarhus: Aarhus Universitetsforlag 2005.

Kragh, Helge. *The Moon That Wasn't: The Saga of Venus's Spurious Satellite*. Basel: Birkhäuser, 2008.

Krapka, Emil, and Vojtech Mikula. *Dejiny Spoločnosti Ježišovej na Slovensku*. Cambridge, ON: Dobrá Kniha, 1990.

Kravets, T.P., and V.L. Chenakal, eds. *M.V. Lomonosov: polnoe sobranie sochinenii*, vol. 4, *Trudy po fizike, astronomii i priborostroeniiu, 1744–1765 gg*. Moscow and Leningrad: Izdatel'stvo Akademii Nauk, 1955.

Kriegleder, Wynfrid, Andrea Seidler, and Jozef Tancer, eds. *Deutsche Sprache und Kultur in der Zips*. Presse und Geschichte: Neue Beiträge 24. Bremen: Edition lumière, 2007.

Kristóf, Ildikó Sz. "The Uses of Natural History: Georg C. Raff's *Naturgeschichte für Kinder* (1778) in Its Multiple Translations and Multiple Receptions." In *Le livre demeure: Studies in Book History in Honour of Alison Saunders*, edited by Alison Adams, Philip Ford, and Stephen Rawles, 309–33. Geneva: Droz, 2011.

Kröll, Helmut. "Die Auswirkungen der Aufhebung des Jesuitenordens in Wien und Niederösterreich: Ein Beitrag zur Geschichte des Josephinismus in Österreich." *Zeitschrift für bayerische Landesgeschichte* 34 (1971): 547–617.

Kubbinga, Henk K. "La théorie de la matière de Boscovich: L'atomisme de points et le concept d"individu substantiel." In *R.J. Boscovich: Vita e attività scientifica; His Life and Scientific Work*, edited by Piers Bursill-Hall, 281–306. Rome: Istituto della Enciclopedia Italiana, 1993.

Kürti, László. *The Remote Borderland: Transylvania in the Hungarian Imagination*. Albany, NY: SUNY Press, 2001.

La Vopa, Anthony J. "Conceiving a Public: Ideas and Society in Eighteenth-Century Europe." *Journal of Modern History* 64, no. 1 (1992): 79–116.

La Vopa, Anthony J. "Doing Fichte: Reflections of a Sobered (But Unrepentant) Contextual Biographer." In *Biographie schreiben*, edited by Hans Erich Bödeker, 107–72. Göttingen: Wallstein Verlag, 2003.

La Vopa, Anthony J. *Fichte: The Self and the Calling of Philosophy, 1762–1799*. Cambridge: Cambridge University Press, 2001.

Lackner, Karin, Isolde Müller, Franz Kerschbaum, Roland Ottensamer, and Thomas Posch. *Der historische Buchbestand der Universitätssternwarte Wien: Ein illustrierter Katalog*, vol. 2, *18. Jahrhundert*. Frankfurt: Peter Lang, 2006.

Lanska, Douglas, and Joseph T. Lanska. "Franz Anton Mesmer and the Rise and Fall of Animal Magnetism: Dramatic Cures, Controversy, and Ultimately a Triumph for the Scientific Method." In *Brain, Mind, and Medicine: Essays in Eighteenth-Century Neuroscience*, edited by Harry A. Whitaker, Christopher Upham Murray Smith, and Stanley Finger, 301–20. New York: Springer, 2007.

Larsen, Stian Bones. "Gerhard Schøning, Gothicism, and the Re-evaluation of the Northern Landscapes." *Acta borealia* 18, no. 2 (2001): 61–84.

Latour, Bruno. "Drawing Things Together." In *Representations in Scientific Practice*, edited by Michael E. Lynch and Steve Woolgar, 19–68. Cambridge, MA: MIT Press, 1990.

Latour, Bruno. *Science in Action: How to Follow Scientists and Engineers through Society*. Cambridge, MA: Harvard University Press, 1987.

Le Goff, Jacques. "Comment écrire une biographie historique aujourd'hui." *Le débat* 54 (1989): 49–53.

Le Goff, Jacques. *Saint Louis*. Paris: Gallimard, 1996.

Lehner, Ulrich L. *The Catholic Enlightenment: The Forgotten History of a Global Movement*. Oxford: Oxford University Press, 2016.

Lehner, Ulrich L. *Enlightened Monks: The German Benedictines 1740–1803*. Oxford: Oxford University Press, 2011.

Lehner, Ulrich L. "Introduction: The Many Faces of the Catholic Enlightenment." In *A Companion to the Catholic Enlightenment in Europe*, edited by Ulrich L. Lehner and Michael Printy, 1–62. Leiden: Brill, 2010.

Lehner, Ulrich L. "Johann Nikolaus von Hontheim's *Febronius*: A Censored Bishop and His Ecclesiology." *Church History and Religious Culture* 88, no. 2 (2008): 205–33.

Lengyel, Réka. "'A világosság a tudomány': A felvilágosodás mint módszer Verestói György halotti beszédben." In *A felvilágosodás előzményei Erdélyben és Magyarországon (1650–1750)*, edited by Mihály Balázs and István Bartók, 315–27. Szeged: SZTE Magyar Irodalmi Tanszék, 2016.

Lengyel, Réka, and Gábor Tüskés, eds. *Learned Societies, Freemasonry, Sciences, and Literature in 18th-Century Hungary*. Budapest: MTA Bölcsészettudományi Kutatóközpont, 2017.

Lepore, Jill. "Historians Who Love Too Much: Reflections on Microhistory and Biography." *Journal of American History* 88, no. 1 (2001): 129–44.

Lesky, Erna. "Gerard van Swieten: Auftrag und Erfüllung." In *Gerard van Swieten und seine Zeit*, edited by Erna Lesky and Adam Wandruszka, 11–62. Vienna: Böhlau, 1973.

Lesky, Erna. *Österreichisches Gesundheitswesen im Zeitalter des aufgeklärten Absolutismus*. Vienna: Rohrer, 1959.

Levi, Giovanni. "Les usages de la biographie." *Annales ESC* 44, no. 6 (1989): 1325–36.

Lilti, Antoine. *Figures publiques: L'invention de la célébrité 1750–1850*. Paris: Fayard, 2014.

Lockert, Sigri Skjegstad. *Havsvelget i nord: Moskstraumen gjennom årtusener*. Stamsund: Orkana akademisk, 2011.

Lomholt, Asger. *Det Kongelige Danske Videnskabernes Selskab 1742–1942: Samlinger til Selskabets Historie*. 5 Vols. Copenhagen: Munksgaard, 1942–61.

Loriga, Sabina. "Biographical and Historical Writing in the 19th and 20th Centuries." Transitions to Modernity Colloquium, MacMillan Center, Yale University, February 18, 2008.

Loriga, Sabina. "La biographie comme problème." In *Jeux d'échelles: La micro-analyse à l'expérience*, edited by Jacques Revel, 209–31. Paris: Gallimard-Seuil, 1996.

Lőrinczi, Réka. "Megjegyzések és adalékok a finnugor nyelvrokonítás fogadtatásához." *Nyelvtudományi Közlemények* 97 (2000): 261–72.

Lukács, László. *Catalogi personarum et officiorum provinciae Austriae S.I.* Rome: Institutum Historicum S.I., 1994.

Lukács, László. *A független magyar jezsuita rendtartomány kérdése és az osztrák abszolutizmus* (*1649–1773*). Szeged and Rome: n.p., 1989.

Lüsebrink, Hans-Jürgen, and York-Gothart Mix, eds. *Französische Almanachkultur im deutschen Sprachraum* (*1700–1815*). Göttingen: Vandenhoeck & Ruprecht, 2013.

Maas, Ferdinand. "Die österreichischen Jesuiten zwischen Josephinismus und Liberalismus." *Zeitschrift für katholische Theologie* 80 (1958): 66–100.

MacHardy, Karin J. *War, Religion, and Court Language in Habsburg Austria*. Basingstoke: Palgrave Macmillan, 2002.

Madriñán, Santiago. *Nikolaus Joseph Jacquin's American Plants: Botanical Expedition to the Caribbean* (*1754–1759*) *and the Publication of the* Selectarum stirpium americanarum historia. Leiden: Brill, 2013.

Mann, Michael. "The Autonomous Power of the State: Its Origins, Mechanisms, and Results." In *States in History*, edited by John A. Hall, 109–36. Oxford: Blackwell, 1986.

Maor, Eli. *Venus in Transit*. Princeton: Princeton University Press, 2004 [2000].

Margócsy, István. "Szerdahely György művészetelmélete." *Irodalomtörténeti Közlemények* 93, nos. 1–2 (1989): 1–34.

Margócsy, István. "A tiszta magyar: Nemzetkarakterológia és nemzeti történelem összefüggései Bessenyei és kortársai nyelvrokonság-felfogásában." In *A szétszórt rendszer Tanulmányok Bessenyei György életművéről*, edited by Csaba Csorba and Klára Margócsy, 131–40. Nyíregyháza: Bessenyei Kiadó, 1998.

Margócsy, István. "When Language Became Ideology: Hungary and the Eighteenth Century." In *Latin at the Crossroads of Identity: The Evolution of Linguistic Identity in the Kingdom of Hungary*, edited by Gábor Almási and Lav Šubarić, 25–34. Leiden and Boston: Brill, 2015.

Marino, Luigi. *Praeceptores Germaniae: Göttingen 1770–1820*. Göttingen: Vandenhoeck & Ruprecht, 1995 [1975].

Marlot, Christophe. *Les passages de Vénus: Histoire et observation d'un phénomène astronomique*. Paris: Vuibert/Adept, 2004.

Marov, Mikhail Ya. "Mikhail Lomonosov and the Discovery of the Atmosphere of Venus during the 1761 Transit." *Proceedings of the International Astronomical Union*, Special Issue, "Transits of Venus: New Views on the Solar System and Galaxy, Proceedings IAU Colloquium," edited by Don W. Kurtz, 196 (2004): 209–19.

Marshall, Peter J., and Glyndwr Williams. *The Great Map of Mankind: Perceptions of New Worlds in the Age of Enlightenment*. Cambridge, MA: Harvard University Press, 1982.

Marsina, Richard, ed. *Banské mestá na Slovensku*. Žiar nad Hronom: Okresný národný výbor, 1990.

Marten, Maria, and Carola Piepenbring-Thomas. *Fogels Ordnungen: Aus der Werkstatt des Hamburger Mediziners Martin Fogel (1634–1675)*. Frankfurt am Main: Vittorio Klostermann, 2015.

Martens, Wolfgang. *Die Botschaft der Tugend: Die Aufklärung im Spiegel der deutschen Moralischen Wochenschriften*. Stuttgart: Metzler, 1968.

Martinussen, Bente. "Anders Porsanger: Teolog og språkforsker fra 1700-tallets Finnmark." *Nordlyd* 18 (1992): 15–59.

Máté, Gábor. "Az alső-magyarországi bányavárosok etnikai képének történeti és földrajzi vizsgálata." *Földrajzi Értesítő* 56, nos. 3–4 (2007): 181–204.

McMahon, Darrin. *Enemies of the Enlightenment: The French Counter-Enlightenment and the Making of Modernity*. Oxford: Oxford University Press, 2001.

Meek, Ronald L. *Social Science and the Ignoble Savage*. Cambridge: Cambridge University Press, 1976.

Melton, James Van Horn. *Absolutism and the Eighteenth-Century Origins of Compulsory Schooling in Prussia and Austria*. Cambridge: Cambridge University Press, 1988.

Melton, James Van Horn. *The Rise of the Public in Enlightenment Europe*. Cambridge: Cambridge University Press, 2001.

Merkle, Sebastian. *Die katholische Beurteilung des Aufklärungszeitalters*. Berlin: Curtius, 1909.

Mészáros, István. *XVI. századi városi iskoláink és a "studia humanitatis."* Budapest: Akadémiai Kiadó, 1981.

Metz, Don. "William Wales and the 1769 Transit of Venus: Puzzle Solving and the Determination of the Astronomical Unit." *Science and Education* 18 (2007): 581–92.

Mézes, Ádám. "Insecure Boundaries: Medical Experts and the Returning Dead on the Southern Habsburg Borderland." MA thesis, Central European University, 2013.

Mihalovits, János. *A selmeci bányászati akadémia alapítása és fejlődése 1846-ig*. Budapest: József Nádor Műszaki és Gazdaságtudományi Egyetem, 1938.

Miller, Peter N. *Peiresc's Europe. Learning and Virtue in the Seventeenth Century*. New Haven and London: Yale University Press, 2000.

Miller, Peter N. *Peiresc's Mediterranean World*. Cambridge, MA, and London: Harvard University Press, 2015.

Minimaki, George. *The Chinese Rites Controversy: From the Beginnings to Modern Times*. Chicago: Loyola University Press, 1985.

Miskolczy, Ambrus. "A 'hungarus alternatíva': Példák és ellenpéldák." *Regio* 20, no. 2 (2009): 3–46.

Miskolczy, Ambrus. "'Hungarus Consciousness' in the Age of Early Nationalism." In *Latin at the Crossroads of Identity: The Evolution of Linguistic Identity in the Kingdom of Hungary*, edited by Gábor Almási and Lav Šubarić, 64–94. Leiden and Boston: Brill, 2015.

Molnár, Antal. "A jezsuita rend a 16. századi Magyarországon." *Vigilia* 64, no. 5 (1999): 348–59.

Molnár, Antal. *Lehetetlen küldetés? Jezsuiták Erdélyben és Felső-Magyarországon a 16–17. században*. Budapest: L'Harmattan, 2009.

Molvig, Ole. "The Berlin Urania, Humboldtian Cosmology, and the Public." In *The Heavens on Earth: Observatories and Astronomy in Nineteenth-Century Science and Culture*, edited by David Aubin, Charlotte Bigg, and Otto Sibum, 325–43. Durham, NC, and London: Duke University Press, 2010.

Moote, Lloyd. "New Bottles and New Wine: The Current State of Early Modernist Biographical Writing." *French Historical Studies* 19 (1996): 911–26.

Morovics, Miroslav Tibor, and Andrej Šperka. "The Beginnings of Scientific Interest in Electrical Phenomena in Hungarian Kingdom." In *The Global and the Local: The History of Science and the Cultural Integration of Europe; Proceedings of the 2nd ICESHS*, edited by Michal Kokowski, 926–33. Kraków, Poland, September 6–9, 2006. http://www.2iceshs.cyfronet.pl/2ICESHS_Proceedings/Chapter_29/R-Varia_II_Morovics_Sperka.pdf (accessed November 28, 2018).

Morrison, Heather. "Harmony and Discord in the Sciences: Vienna's Scientific Enlightenment and Its Engagement with the Republic of Letters." In *Multiple kulturelle Referenzen in der Habsburgermonarchie des 18. Jahrhunderts*, edited by Wolfgang Schmale, 103–22. Das achtzehnte Jahrhundert und Österreich 24. Bochum: Dieter Winkler, 2010.

Morrison, Heather. "Pursuing Enlightenment in Vienna, 1781–1790." PhD diss., Louisiana State University, 2005.

Mortier, Roland. "Diversité des Lumières." In *Unité et diversité de l'empire des Habsbourg à la fin du XVIIIe siècle*, edited by Hervé Hasquin and Roland Mortier, 15–24. Brussels: Editions de l'Université de Bruxelles, 1988.

Moutchnik, Alexander. *Forschung und Lehre in der zweiten Hälfte des 18. Jahrhunderts: Der Naturwissenschaftler und Universitätsprofessor Christian Mayer S.J. (1719–1783)*. Augsburg: Dr. Erwin Rauner Verlag, 2006.

Mühlberger, Kurt. "Universität und Jesuitenkolleg in Wien: Von der Berufung des Ordens bis zum Bau des Akademischen Kollegs." In *Die Jesuiten in Wien: Zur Kunst- und Kulturgeschichte der österreichischen Ordensprovinz der "Gesellschaft Jesu" im 17. und 18. Jahrhundert*, edited by Herbert Karner and Werner Telesko, 21–37. Vienna: Österreichische Akademie der Wissenschaften, 2003.

Müller, Winfried. "Der Jesuitenorden und die Aufklärung im süddeutsch-österreichischen Raum." In *Katholische Aufklärung: Aufklärung im katholischen Deutschland*, edited by Harm Klueting, Norbert Hinske, and Karl Hengst, 225–48. Hamburg: Meiner, 1993.

Navarro Brotón, Victor. "Science and Enlightenment in Eighteenth-Century Spain: The Contribution of the Jesuits before and after the Expulsion." In *The Jesuits: Cultures, Sciences, and the Arts 1540–1773*, edited by John W. O'Malley, Gauvin Alexander Bailey, Steven J. Harris, and T. Frank Kennedy, 2:390–404. Toronto: University of Toronto Press, 1999.

Németh, S. Katalin. "Magyar orátor a XVIII. században: Verestói György." *Irodalomtörténet* 73, no. 4 (1984): 855–88.

Németh, István H. "Unterdrückung oder Reform? Die Rekatholisierung in der ungarischen königlichen Freistädten." In *Město v převratech konfesionalizace v 15. až 18. stoleti*, edited by Václav Ledvinka and Jiří Pešek, 435–50. Prague: Scriptorium, 2014.

Newcomb, Simon. "Discussion of Observations of the Transits of Venus in 1761 and 1769." *United States Nautical Almanac, Astronomical Papers* 2, no. 5 (1890): 259–405.

Newcomb, Simon. "On Hell's Alleged Falsification of His Observations of the Transit of Venus in 1769." *Monthly Notices of the Royal Astronomical Society* 43 (May 1883): 372–81.

Newcomb, Simon. *The Reminiscences of an Astronomer*. Teddington: Echo Library, 2006 [1903].

Nielsen, Axel V. "Christian Horrebows observationer af Venuspassagen i 1761." *Nordisk Astronomisk Tidsskrift* (1957): 47–50.

Nielsen, Axel V. "Pater Hell og Venuspassagen 1769." *Nordisk Astronomisk Tidsskrift* (1957): 77–97.

Nordenmark, Nils Viktor Emanuel. *Astronomiens historia i Sverige intill år 1800*. Uppsala and Stockholm: Almqvist & Wiksell, 1959.

Nouzille, Jean. "Les jésuites en Transylvanie au XVII^{e} et XVII I^{e} siècles." *XVII^{e} siècle: Revue trimestrielle* 50, no. 3 (1998): 315–28.

Nunis, Doyce B. Jr., ed. *The 1769 Transit of Venus: The Baja California Expeditions of Jean-Baptiste Chappe d'Auteroche, Vicente de Doz, and Joaquín Velázquez Cárdenas de León*. Translated by James Donahue, Maynard J. Geiger, and Iris Wilson Engstrand. Baja California Travels Series 46. Los Angeles: Natural History Museum of Los Angeles County, 1982.

Nye, Mary Jo. "Scientific Biography: History of Science by Other Means?" *Isis* 97 (2006): 322–29.

O'Brien, Karen. *Narratives of Enlightenment: Cosmopolitan History from Voltaire to Gibbon*. Cambridge: Cambridge University Press, 1997.

O'Malley, John W. "The Distinctiveness of the Society of Jesus." *Journal of Jesuit Studies* 3, no. 1 (2016): 1–16.

O'Malley, John W. *The First Jesuits*. Cambridge, MA: Harvard University Press, 1993.

O'Malley, John W. "Jesuit Schools and the Humanities Yesterday and Today." *Studies in the Spirituality of Jesuits* 47, no. 1 (2015).

Oborni, Teréz. "Between Vienna and Constantinople: Notes on the Legal Status of the Principality of Transylvania." In *The European Tributary States of the Ottoman Empire in the Sixteenth and Seventeenth Centuries, edited by Gábor Kármán and Lovro Kunčević, 67–89.* Leiden: Brill, 2013.

Orchiston, Wayne. "From the South Seas to the Sun: The Astronomy of Cook's Voyages." In *Science and Exploration in the Pacific: European Voyages to the Southern Ocean in the Eighteenth Century*, edited by Margarette Lincoln, 55–72. Woodbridge: Boydell Press and the National Maritime Museum, 1998.

Orchiston, Wayne. "James Cook's 1769 Transit of Venus Expedition to Tahiti." *Proceedings of the International Astronomical Union*, Special Issue, "Transits of Venus: New Views on the Solar System and Galaxy, Proceedings IAU Colloquium," edited by Don W. Kurtz, 196 (2004): 2–66.

Osler, Margaret J., ed. *Rethinking the Scientific Revolution*. Cambridge: Cambridge University Press, 2000.

Paço, David Do. *L'Orient à Vienne au dix-huitième siècle*. Oxford: Voltaire Foundation, 2015.

Pagani, Catherine. "Clockwork and the Jesuit Mission in China." In *The Jesuits: Cultures, Sciences, and the Arts 1540–1773*, edited by John W. O'Malley, Gauvin Alexander Bailey, Steven J. Harris, and T. Frank Kennedy, 2:658–77. Toronto: University of Toronto Press, 1999

Pagden, Anthony. *European Encounters with the New World*. New Haven: Yale University Press, 1993.

Pagden, Anthony. *The Fall of Natural Man: The American Indian and the Origins of Comparative Ethnology*. Cambridge: Cambridge University Press, 1986.

Palmer, Robert. "The French Jesuits in the Age of Enlightenment." *American Historical Review* 45 (1939): 44–58.

Paquette, Gabriel. *Enlightenment, Governance, and Reform in Spain and Its Empire, 1759–1808*. Basingstoke: Palgrave Macmillan, 2008.

Park, Katherine, and Lorraine Daston, eds. *The Cambridge History of Science*, vol. 3, *Early Modern Science*. Cambridge: Cambridge University Press, 2006.

Pärr, Nora. "Maximilian Hell und sein wissenschaftliches Umfeld im Wien des 18. Jahrhunderts." PhD diss., University of Vienna, 2011; published Nordhausen: Bautz Verlag, 2013.

Pärr, Nora. "Wiener Astronomen: Ihre Tätigkeit an Privatobservatorien und Universitätssternwarten." MA thesis, Vienna: Geisteswissenschaftliche Fakultät der Universität Wien, 2001.

Pasachoff, J.M. [Jay Myron], and Naomi Pasachoff. "Helge Kragh, *The Moon that Wasn't*." *Physics in Perspective* 12 (2010): 105–8.

Pasachoff, J.M., Glenn Schneider, and Leon Golub. "The Black Drop Effect Explained." *Proceedings of the International Astronomical Union*, Special Issue, "Transits of Venus: New Views on the Solar System and Galaxy, Proceedings IAU Colloquium," edited by Don W. Kurtz, 196 (2004): 242–53.

Pascu, Ştefan. *A History of Transylvania*. Detroit, MI: Wayne University State Press, 1982.

Paulinyi, Oszkár. "Tulajdon és társadalom a Garam-vidéki bányavárosokban." *Történelmi Szemle* 5, no. 2 (1962): 173–88.

Péch, Antal. *Alsó-Magyarország bányamívelésének története*. Budapest: Magyar Tudományos Akadémia, 1884–87.

Péch, Antal. *A tudományok haladásának befolyása a selmeczvidéki bányaművelésre*. Budapest: Magyar Tudományos Akadémia, 1881.

Pecker, Jean-Claude. "Jérôme de Lalande and International Cooperation." In *The Message of the Angles: Astrometry from 1798 to 1998*, edited by Peter Brosche, Wolfgang R. Dick, Oliver Schwarz, and Roland Wielen, 52–62. Acta Historica Astronomiae 3. Frankfurt am Main: Verlag Harri Deutsch, 1998.

Pecker, Jean-Claude. "L'oeuvre scientifique de Joseph-Jérôme Lefrançois de Lalande (1732–1807)." *Les nouvelles annales de l'ain* (1985): 1–31.

Pekonen, Osmo. "The Amateur Astronomer Anders Hellant and the Plight of His Observations of the Transits of Venus in Tornio, 1761 and 1769." *Journal of Astronomical Data*, Special Issue, "Meeting Venus: A Collection of Papers Presented at the Venus Transit Conference in Tromsø 2012," edited by Christiaan Sterken and Per Pippin Aspaas, 19, no. 1 (Brussels and Tromsø: C. Sterken and University of Tromsø, 2013): 49–57.

Penke, Olga. *Filozofikus világtörténetek és történetfilozófiák: A francia és a magyar felvilágosodás*. Budapest: Balassi Kiadó, 2000.

Perkmann, Rochus. *Die Jesuiten und die Universität Wien*. Leipzig: Otto Wigand, 1866.

Péter, László. "Montesquieu's Paradox of Freedom and Hungary's Constitutions 1790–1990." *History of Political Thought* 16, no. 1 (1995): 77–104.

Péter, Róbert. "General Introduction." In *British Freemasonry 1717–1783*, edited by Róbert Péter, 1:xi–xlvi. 5 Vols. London and New York: Routledge, 2016.

Péteri, János [Antal Petruch]. *Az első jezsuiták Magyarországon*. Rome: n.p. 1963.

Petrovič, Marija. "Austrian Enlightenment in Cyrillic: Joseph Kurzböck's Cyrillic Printing Shop and the Transmission of the Enlightenment to Austria's Serbs." *Austrian History Yearbook* 48 (2017): 25–38.

Petz-Grabenbauer, Maria. "Zu Leben und Werk von Nikolaus Joseph Freiherr von Jacquin." *Wiener Geschichtsblätter* 50, no. 3 (1995): 121–50.

Pigatto, Luisa. "The 1761 Transit of Venus Dispute between Audiffredi and Pingré." *Proceedings of the International Astronomical Union*, Special Issue, "Transits of Venus: New Views on the Solar System and Galaxy, Proceedings IAU Colloquium," edited by Don W. Kurtz, 196 (2004): 74–86.

Pihlaja, Päivi Maria. "The Study of the North in the 18th Century: Knowledge of Lapland in Europe, and Its Significance for Foreign Scholars." In *The North Calotte: Perspectives on the Histories and Cultures of Northernmost Europe*, edited by Maria Lähteenmäki and Päivi Maria Pihlaja, 25–37. Helsingin yliopiston historian laitoksen julkaisuja 18. Inari: Puntsi, 2005.

Pinsker, Anton. "Der Astronom Pater Max Hell S.J." *Freinberger Stimmen* 41 (1971): 99–111.

Pinzger, Ferenc, S.J. "Hell Miksa emlékezete." In *Stella Csillagászati Egyesület Almanachja 1927-re*, 177–200. Budapest: Királyi Magyar Egyetemi Nyomda, 1926.

Pinzger, Ferenc, S.J. *Hell Miksa emlékezete*. 2 Vols. Budapest: Magyar Tudományos Akadémia, 1920, 1927.

Plongeron, Bernard. "Recherches sur l'Aufklärung' catholique en Europe occidental, 1770–1830." *Revue d'histoire moderne et contemporaine* 16 (1969): 555–605.

Plongeron, Bernard. *Théologie et politique au siècle des Lumières*. Geneva: Droz, 1973.

Plongeron, Bernard. "Wahre Gottesverehrung und das Problem des Unglaubens: Debatten um Inhalte und Wege von Religiosität und Seelsorge." In *Die Geschichte des Christentums*, vol. 10, *Aufklärung, Revolution, Restauration* (*1750–1830*), edited by Bernard Plongeron, 233–93. Freiburg: Herder, 2000.

Pocock, J.G.A. [John Greville Agard]. *Barbarism and Religion*. 5 Vols. Cambridge: Cambridge University Press, 1999–2011.

Pocock, J.G.A. [John Greville Agard]. "Clergy and Commerce: The Conservative Enlightenment in England." In *L'età dei lumi: Studi storici in onore di Franco Venturi*, edited by R. [Raffaello] Ajello, E. Cortese, and Vincenzo Piano Mortari, 1:523–62. Naples: Iovene Editore, 1985.

Pocock, J.G.A. [John Greville Agard]. "Introduction: The State of the Art." In J.G.A. Pocock, *Virtue, Commerce, and History: Essays on Political Thought and History, Chiefly in the Eighteenth Century*, 1–34. Cambridge: Cambridge University Press, 1985.

Porter, Roy, and Mikuláš Teich, eds. *The Enlightenment in National Context*. Cambridge: Cambridge University Press, 1981.

Posch, Thomas, and Franz Kerschbaum. "Kepler, Horrocks, Hevelius und der Venustransit von 1631." In *Astronomy in and around Prague: Colloquium of the Working Group of the History of Astronomy, Prague, September 20, 2004*, edited by Gudrun Wolfschmidt and Martin Šolc, 89–100. Prague: Univerzita Karlova, 2005.

Posch, Thomas, and Karin Lackner. "Anton Pilgram: Mitbegründer neuzeitlicher wissenschaftlicher Meteorologie?" In *Konferenzbeiträge/Proceedings: Festkolloquium und Fachtagung 250 Jahre Universitätssternwarte Wien*, edited by Maria G. Firneis and Franz Kerschbaum, 55–69. Communications in Asteroseismology 149. Vienna: Austrian Academy of Sciences Press, 2008.

Powalky, Carl Rudolph. *Neue Untersuchung des Venusdurchganges von 1769 zur Bestimmung der Sonnenparallaxe*. Kiel: C.F. Mohr, 1864.

Prieto, Andrés I. *Missionary Scientists: Jesuit Science in Missionary South America, 1570–1810*. Nashville: Vanderbilt University Press, 2011.

Printy, Michael. "Catholic Enlightenment in the Holy Roman Empire." In *A Companion to the Catholic Enlightenment in Europe*, edited by Ulrich L. Lehner and Michael Printy, 165–214. Leiden: Brill, 2010.

Rabenalt, Ansgar. "Astronomische Forschung im 18. Jahrhundert in Kremsmünster: Zu den ersten Berechnungen der Bahn des Uranus nach dem Briefwechsel zwischen Placidus Fixlmillner O.S.B. and Maximilian Hell S.J. (1771–1790)." *Mitteilungen des Oberösterreichischen Landesarchivs* 15 (1986): 93–216.

Rabin, Sheila J. "Early Modern Jesuit Science: A Historiographical Overview." *Journal of Jesuit Studies* 1, no. 1 (2014): 88–104.

Rady, Martyn, ed. *Custom and Law in Central Europe*. Cambridge: Centre for European Legal Studies, 2003.

Rasmussen, Stig T., ed. *Den Arabiske Rejse 1761–1767: En dansk ekspedition set i videnskabshistorisk perspektiv*. [Copenhagen]: Munksgaard, 1990.

Reeves, Eileen. *Evening News: Optics, Astronomy, and Journalism in Early Modern Europe*. Philadelphia: University of Pennsylvania Press, 2014.

Reinalter, Helmut, ed. *Die Aufklärung in Österreich. Ignaz von Born und seine Zeit*. Frankfurt am Main: Peter Lang, 1991.

Reinalter, Helmut, ed. *Freimaurer und Geheimbünde im 18. Jahrhundert in Mitteleuropa*. Frankfurt: Suhrkamp, 1983.

Reinalter, Helmut, ed. *Der Illuminatenorden (1776–1785/87): Ein politischer Geheimbund der Aufklärungszeit*. Frankfurt: Peter Lang, 1997.

Reinalter, Helmut, ed. *Joseph II und die Freimaurer im Lichte zeitgenössischer Broschüren*. Vienna: Böhlau, 1987.

Reinalter, Helmut, ed. *Joseph von Sonnenfels*. Vienna: Verlag der Österreichischen Akademie der Wissenschaften, 1988.

Révauger, Cécil. "English Freemasonry during the Enlightenment: How Radical, How Conservative?" *Lumières* (*Lumières radicales et Franc-maçonnerie*) 22, no. 2 (2013): 33–48.

Revel, Jacques, ed. *Jeux d'échelles: La micro-analyse à l'expérience*. Paris: Gallimard–Seuil, 1996.

Richter, Ede, and Ernő Király. "Selmeczbánya." In *Magyarország vármegyéi és városai: Hont vármegye és Selmeczbánya sz. kir. város*, edited by Samu Borovszky, 85–127. Budapest: Apolló, 1984. http://www.mek.oszk.hu/09500/09536/html/0011/8.html (accessed November 26, 2018).

Riskin, Jessica. *Science in the Age of Sensibility: The Sentimental Empiricists of the French Enlightenment*. Chicago and London: University of Chicago Press, 2002.

Robertson, John. *The Case for the Enlightenment: Scotland and Naples 1680–1760*. Cambridge: Cambridge University Press, 2005.

Robertson, John. "The Enlightenment Above National Context." *Historical Journal* 40 (1997): 667–97.

Robertson, John. "Franco Venturi's Enlightenment." *Past and Present* 137 (1992): 183–206.

Robertson, Ritchie. "Curiosity in the Austrian Enlightenment." *Oxford German Studies* 38 (2009): 129–42.

Roche, Daniel, ed. *Journal de ma vie: Jacques-Louis Ménétra, compagnon vitrier au 18e siècle*. Paris: Montalba, 1982.

Rogier, Louis G. "L'*Aufklärung* catholique." In Louis G. Rogier, Guillaume de Bertier de Sauvigny, and Joseph Hajjar, *Nouvelle histoire de l'église*, vol. 4, *Siècle des Lumières, révolution, restauration*, 137–61. Paris: Seuil, 1966.

Romano, Antonella. *La Contre-Réforme mathématique: Constitution et diffusion d'une culture mathématique jésuite à la Renaissance*. Rome: École française de Rome, 1999.

Romano, Antonella. *Impressions de Chine: L'Europe et l'englobement du monde (XVI^e–XVII^e siècle)*. Paris: Fayard, 2016.

Rosa, Mario. *Cattolicesimo e lumi nel settecento italiano*. Rome: Herder, 1981.

Rosenberg, Charles. "Woods or Trees? Ideas and Actors in the History of Science." *Isis* 79 (1988): 565–70.

Rubiés, Joan-Pau. "The Jesuits and the Enlightenment." In *The Oxford Handbook of the Jesuits*, edited by Ines G. Županov, 855–90. Oxford: Oxford University Press, 2018.

Safier, Neil. *Measuring the New World: Enlightenment Science and South America*. Chicago: University of Chicago Press, 2008.

Salánki, István. "Levél Sajnovicsról." *Magyar Nyelv* 60 (1964): 250–52.

Sammalahti, Pekka. "History of Finno-Ugric Linguistics in the Nordic Countries." In *Studies in the Development of Linguistics in Denmark, Finland, Iceland, Norway, and Sweden*, edited by Carol Henriksen, Even Hovdhaugen, Fred Karlsson, and Bengt Sigurd, 297–323. Oslo: Novus Forlag, 1996.

Sarton, George. "Vindication of Father Hell." *Isis* 35 (1944): 97–105.

Sashegyi, Oszkár. *Zensur und Geistesfreiheit unter Joseph II: Beitrag zur Kulturgeschichte der Habsburgischen Länder*. Budapest: Akadémiai Kiadó, 1958.

Schaefer, Bradley Jr. "The Transit of Venus and the Notorious Black Drop Effect." *Journal for the History of Astronomy* 32, no. 109 (2001): 325–36.

Schaffer, Simon. "The Astrological Roots of Mesmerism." *Studies in History of Biological and Biomedical Sciences* 41 (2010): 160.

Schlafly, Daniel L. "The Post-suppression Society of Jesus in the United States and Russia: Two Unlikely Settings." In *The Jesuits: Cultures, Sciences, and the Arts 1540–1773*, edited by John W. O'Malley, Gauvin Alexander Bailey, Steven J. Harris, and T. Frank Kennedy, 2:772–83. Toronto: University of Toronto Press, 1999.

Schindling, Anton. "Theresianismus, Josephinismus, katholische Aufklärung." *Würzburger Diözesansgeschichtsblätter* 50 (1988): 215–24.

Schlitter, Hans. *Gründung der kaiserlichen Akademie der Wissenschaften: Ein Beitrag zur Geschichte der vormärzlichen Österreich*. Vienna: Hölder, 1921.

Schlögl, Rudolf. "Secularization: German Catholicism at the Eve of Modernity." *German Historical Bulletin* 25, no. 1 (2003): 5–21.

Schmidt, James. "Introduction." In *What Is Enlightenment? Eighteenth-Century Answers and Twentieth-Century Questions*, edited by James Schmidt, 5–28. Berkeley: University of California Press, 1996.

Schneider, Bernhard. "Katholische Aufklärung: Zum Werden und Wert eines Forschungsbegriffs." *Revue d'histoire ecclésiastique* 93 (1998): 354–97.

Schörg, Cornelia Maria. "Die Präsenz der Wiener Universitätssternwarte und ihrer Forschungen in den deutschsprachigen astronomischen Jahrbüchern und Fachzeitschriften 1755–1830." Mag. Phil. thesis, University of Vienna, 2009.

Schreiber, John [Johann]. "Jesuit Astronomy." *Popular Astronomy* 12 (1904): 9–19, 94–112.

Schröder, Wilfried. *Das Phänomen des Polarlichts*. Darmstadt: Wissenschaftliche Buchgesellschaft, 1984.

Schwernin, Friedhelm. *Der Berliner Astronom: Leben und Werk von Johann Elert Bode 1747–1826*. Frankfurt: Harri Deutsch Verlag, 2006.

Scott, H.M. [Hamish Marshall]. "The Problem of Government in Habsburg Enlightened Absolutism." In *Europa im Zeitalter Mozarts*, edited by Moritz Csáky and Walter Pass, 254–64. Vienna, Cologne, and Weimar: Böhlau Verlag, 1995.

Scott, H.M. [Hamish Marshall]. "Reform in the Habsburg Monarchy, 1740–1790." In *Enlightened Absolutism: Reform and Reformers in Later Eighteenth-Century Europe*, edited by H.M. Scott, 145–88. London: Macmillan, 1990.

Sebastiani, Silvia. *I limiti del progresso: Razza e genere nell'Illuminismo scozzese*. Bologna: Il Mulino, 2008.

Sebastiani, Silvia. *The Scottish Enlightenment: Race, Gender, and the Limits of Progress*. Basingstoke: Palgrave Macmillan, 2013.

Sebők, Marcell. *Humanista a határon: A késmárki Sebastian Ambrosius története* (*1554–1600*). Budapest: L'Harmattan, 2007.

Sebők, Marcell. "Victims of Reformations? 16–17th-Century Refugees and Their Impact on Artistic and Cultural Production." In *Expulsion and Diaspora Formation: Religious and Ethnic Identities in Flux from Antiquity to the Seventeenth Century*, edited by John Tolan, 135–48. Turnhout: Brepols, 2015.

Sellers, David. *The Transit of Venus: The Quest to Find the True Distance of the Sun*. Leeds: MegaVelda Press, 2001.

Shapin, Steven. *The Scientific Revolution*. Chicago: University of Chicago Press, 1996.

Shapin, Steven. *A Social History of Truth: Civility and Science in Seventeenth-Century England*. Chicago: University of Chicago Press, 1994.

Sheehan, William, and John Westfall. *The Transits of Venus*. Amherst: Prometheus Books, 2004.

Shek Brnardić, Teodora. "The Enlightenment in Eastern Europe: Between Regional Typology and Particular Micro-history." *European Review of History: Revue européenne d'histoire* 13, no. 3 (2006): 411–35.

Shek Brnardić, Teodora. "Intellectual Movements and Geo-political Regionalization: The Case of the East European Enlightenment." *East-Central Europe/L'Europe du Centre-Est* 32, nos. 1–2 (2005): 147–77.

Shiltsev, Vladimir. "The 1761 Discovery of Venus's Atmosphere: Lomonosov and Others." *Journal of Astronomical History and Heritage* 17, no. 1 (2014): 85–112.

Shiltsev, Vladimir. "Lomonosov's Discovery of Venus Atmosphere in 1761: English Translation of Original Publication with Commentaries." https://arxiv.org/abs/1206.3489 (accessed November 29, 2018).

Shore, Paul. "Enduring the Deluge: Hungarian Jesuit Astronomers from Suppression to Restoration." In *Jesuit Survival and Restoration: A Global History 1773–1900*, edited by Robert A. Maryks and Jonathan Wright, 148–61. Leiden and Boston: Brill, 2015.

Shore, Paul. *Jesuits and the Politics of Religious Pluralism in Eighteenth-Century Transylvania: Culture, Politics, and Religion, 1693–1773*. Aldershot: Ashgate, 2007.

Shore, Paul. *Narratives of Adversity: Jesuits in the Eastern Peripheries of the Habsburg Realms (1640–1773)*. Budapest and New York: Central European University Press, 2012.

Šíma, Zdislav. *Astronomie a Klementinum/Astronomy and Clementinum*. Prague: Národní knihovna České republiky, 2006.

Skinner, Quentin. "General Preface." In Quentin Skinner, *Visions of Politics*, vol. 1, *Regarding Method*, vi–viii. Cambridge: Cambridge University Press, 2002.

Skuncke, Marie-Christine. *Carl Peter Thunberg: Botanist and Physician*. Uppsala: Swedish Collegium for Advanced Study, 2014.

Slezák, Friedrich. "Johann Jakob Marinoni (1676–1755)." *Donauraum* 21 (1976): 195–207.

Slezkine, Yuri. "Naturalists versus Nations: 18th-Century Russian Scholars Confront Ethnic Diversity." *Representations*, Special Issue, "National Cultures before Nationalism," 47 (Summer 1994): 170–95.

Smidt, Andrea J. "*Luces por la fe*: The Cause of Catholic Enlightenment in 18th-Century Spain." In *A Companion to the Catholic Enlightenment in Europe*, edited by Ulrich L. Lehner and Michael Printy, 403–52. Leiden: Brill, 2010.

Snorrason, Egil. *C.G. Kratzenstein: Professor physices experimentalis Petropol. et Havn. and His Studies on Electricity during the Eighteenth Century*. Acta historica scientiarum naturalium et medicinalium edidit bibliotheca universitatis Hauniensis 29. Odense: Odense University Press, 1974.

Söderqvist, Thomas. "Existential Projects and Existential Choice in Science: Science Biography as an Edifying Genre." In *Telling Lives in Science: Essays in Scientific Biography*, edited by Michael Shortland and Richard Yeo, 45–84. Cambridge: Cambridge University Press, 1996.

Söderqvist, Thomas. "Introduction." In *The History and Poetics of Scientific Biography*, edited by Thomas Söderqvist, 1–16. Aldershot: Ashgate, 2007.

Sogner, Sølvi. "Fromhed styrker rikene." In *Norsk innvandringshistorie*, edited by Knut Kjeldstadli, 1:240–58. Oslo: Pax forlag, 2003.

Sommervogel, Carlos. "Hell, Maximilien." In *Bibliothèque de la Compagnie de Jésus* [...] *Bibliographie*, 4:238–58. Brussels and Paris: Oscar Schepens and Alphonse Picard, 1893.

Soós, István. "11. József nyelvrendelete és a 'hivatalos Magyarország.'" In *Tanulmányok a magyar nyelv ügyének 18. századi történetéből*, edited by Ferenc Bíró, 261–301. Budapest: Argumentum, 2005.

Sorkin, David. *The Religious Enlightenment: Protestants, Jews, and Catholics from London to Vienna*. Princeton: Princeton University Press, 2008.

Sörlin, Sverker. "Ordering the World for Europe: Science as Intelligence and Information as Seen from the Northern Periphery." *Osiris*, Special Issue, "Nature and Empire: Science and the Colonial Enterprise," edited by Roy MacLeod, 15 (2000): 51–69.

Sörlin, Sverker. "Science, Enlightenment, and Empire: Geographies of Northern Field Science." *European Review of History/Revue d'histoire européenne* 13, no. 3 (2006): 455–72.

Sörlin, Sverker. "Scientific Travel: The Linnean Tradition." In *Science in Sweden: The Royal Swedish Academy of Sciences 1739–1989*, edited by Tore Frängsmyr, 96–123. Canton, MA: Science History Publications, 1989.

Sortkær, Allan. "Hvilken fortræffelig gave fra den danske nation til videnskaben! Fremkomsten af internationale videnskabelige ekspeditioner i 1700-tallet." *Den Jyske Historiker* 119 (2008): 5–25.

Spinale, Kevin. "The Intellectual Pedigree of the Virtue of Magnanimity in the Jesuit Constitutions." *Journal of Jesuit Studies* 2, no. 3 (2015): 451–69.

Splinter, Susan. *Zwischen Nützlichkeit und Nachahmung: Eine Biografie des Gelehrten Christian Gottlieb Kratzenstein (1723–1795)*. Frankfurt am Main: Peter Lang, 2007.

Standaert, Nicolas. "Jesuit Corporate Culture as Shaped by the Chinese." In *The Jesuits: Cultures, Sciences, and the Arts 1540–1773*, edited by John W. O'Malley, Gauvin Alexander Bailey, Steven J. Harris, and T. Frank Kennedy, 2:352–63. Toronto: University of Toronto Press, 1999.

Standish, E. Myles. "The Astronomical Unit Now." *Proceedings of the International Astronomical Union*, Special Issue, "Transits of Venus: New Views on the Solar System and Galaxy, Proceedings IAU Colloquium," edited by Don W. Kurtz, 196 (2004): 163–79.

Steinicke, Wolfgang, and Wilhelm Brüggenthies. "Maximilian Hell und der Venustransit von 1769: Eine abenteuerliche Reise nach Vardø." *VdS-Journal* 15 (2004): 78–81.

Steinmayr, Johann. "Die alte Jesuiten-Sternwarte in Graz [1935]." Edited by Isolde Müller and Thomas Posch. In *Beiträge zur Astronomiegeschichte*, edited by Wolfgang R. Dick, Hilmar W. Duerbeck, and Jürgen Hamel, 11:232–60. Acta historica astronomiae 43. Frankfurt: Harri Deutsch, 2011.

Steinmayr, Johann. "Die Geschichte der Universitätssternwarte Wien." In *Die Geschichte der Universitätssternwarte Wien: Dargestellt anhand ihrer Instrumente und eines*

Typoskripte von Johann Steinmayr [various papers from 1932–36], edited by Jürgen Hamel, Isolde Müller, and Thomas Posch, 169–304. Acta Historica Astronomiae 38. Frankfurt: Harri Deutsch, 2010.

Stén, Johan C.-E. *A Comet of the Enlightenment: Anders Johann Lexell's Life and Discoveries*. Cham: Springer, 2014.

Sterken, Christiaan, and Per Pippin Aspaas. "A Synoptic Overview of Selected Key People and Key Places Involved in Historical Transits of Venus." *Journal of Astronomical Data*, Special Issue, "Meeting Venus. A Collection of Papers Presented at the Venus Transit Conference in Tromsø 2012," edited by Christiaan Sterken and Per Pippin Aspaas, 19, no. 1 (Brussels and Tromsø: C. Sterken and University of Tromsø, 2013): 3–18.

Stipa, Günter Johannes. *Finnisch-ugrische Sprachforschung: Von der Renaissance bis zum Neupositivismus*. Helsinki: Suomalais-ugrilainen Seura, 1990.

Stollberg-Rillinger, Barbara. *Maria Theresia: Die Kaiserin in ihrer Zeit*. Munich: C.H. Beck, 2017.

Stuber, Regina. "Die hannoversche Sukzession von 1714: Leibniz im Wiener Abseits?" In *Leibniz, Caroline und die Folgen der englischen Sukzession*, edited by Wenchao Li, 31–50. Stuttgart: Franz Steiner Verlag, 2016.

Suhling, Lothar. "Von der Alten zur Neuen Welt und zurück: Der Vor- und Frühgeschichte der Europäischen Amalgamation nach Ignaz von Born im Überblick." In *Technik, Arbeit und Umwelt in der Geschichte: Günter Bayerl zum 60. Geburtstag*, edited by Günter Bayerl, Torsten Meyer, and Marcus Popplow, 77–94. Münster: Waxmann Verlag, 2006.

Sührig, Hartmut. "Die Entwicklung der niedersächsischen Kalender im 17. Jahrhundert." *Archiv für die Geschichte des ganzen Buchwesens* 20 (1979): 329–794.

Szabados, György. *A magyar történelem kezdeteiről: Az előidő-szemlélet hangsúlyváltásai a XV–XVIII. században*. Budapest: Balassi Kiadó, 2006.

Szabo, Franz A.J. *Kaunitz and Enlightened Absolutism 1753–1780*. Cambridge: Cambridge University Press, 1994.

Szabó, László. *Magyar múlt Dél-Amerikában* (*1519–1900*). Budapest: Európa, 1982.

Szekfü, Gyula. *Magyar történet*. Budapest: Királyi Magyar Egyetemi Nyomda, 1935.

Szijártó, M. István. *A Diéta: A magyar rendek és az országgyűlés 1708–1792*. Budapest: Osiris, 2005.

Szilas, László. "Austria I. Antigua." In *Diccionario histórico de la Compañía de Jesús: Biográfico-temático*, edited by Charles Edward O'Neill and Joaquín María Domínguez, 1:277–92. Rome and Madrid: Institutum Historicum S.I. and Universidad Pontificia Comillas, 2001.

Szilas, László. "Quellen der ungarischen Kirchengeschichte aus ehemaligen Jesuitenarchiven." *Ungarn-Jahrbuch: Zeitschrift für die Kunde Ungarns und verwandte Gebiete* 4 (1972): 172–89.

Szinnyei, József. *Magyar írók élete és munkái*. Budapest: Hornyánszky, 1896.

Szörényi, László. "A latin költészet helyzete Magyarországon a XIX. Században." *Irodalomtudományi Közlemények* 89, no. 1 (1985): 1–17.

Szörényi, László. "Nyelvrokonság, őstörténet és epika a 18. századi magyarországi jezsuita latin irodalomban." *Irodalomtörténeti Közlemények* 101, nos. 1–2 (1997): 16–24.

Szűcs, Jenő. "Theoretische Elemente in Meister Simon de Kézas 'Gesta Hungarorum' (1282–1285): Beiträge zur Herausgestaltung der 'europäischen Synchronismus' der Ideenstrukturen." In Jenő Szűcs, *Nation und Geschichte*, 263–328. Cologne and Vienna: Böhlau, 1981.

Tar, Sándor, and László Zsámbék, eds. *Selmectől Miskolcig, 1735–1985: A magyarországi műszaki felsőoktatás megindulásának 250. évfordulójára*. Miskolc: Nehézipari Műszaki Egyetem, 1985.

Tarnai, Andor. *Extra Hungariam non est vita* [...] (*Egy szállóige történetéhez*). Budapest: Akadémiai Kiadó, 1969.

Taylor, A.J.P. [Alan John Percivale]. "The Historian as Biographer." In *Biographie und Geschichtswissenschaft: Aufsätze zur Theorie und Praxis biographischer Arbeit*, edited by Grete Klingenstein, Heinrich Lutz, and Gerald Stourzh, 254–61. Munich: Oldenbourg, 1979.

Terrall, Mary. *The Man Who Flattened the Earth: Maupertuis and the Sciences in the Enlightenment*. Chicago and London: University of Chicago Press, 2002.

Thompson, D. Gillian. "The French Jesuits 1756–1814." In *The Jesuit Suppression in Global Context: Causes, Events, and Consequences*, edited by Jeffrey D. Burson and Jonathan Wright, 181–98. Cambridge: Cambridge University Press, 2015.

Thykier, Claus, Kjeld Gyldenkerne, and Per Barner Darnell. *Dansk Astronomi Gennem Firehundrede År*. 3 Vols. Copenhagen: Rhodos, 1990.

Tibenský, Jan. *A királynő könyvtárosa: Adam František Kollár élete és művei*. Budapest: Madách, 1985.

Tibenský, Jan. "Pokusy o o organizowanie vedeckého života v Habsburskej Ríši a na Slovensku v 18. storoči/Versuche zur Organisierung des wissenschaftlichen Lebens im Habsburgerreich und in der Slowakei in 18. Jahrhundert." In *Maximilián Hell 1720–1792: Zbornik prednášok z konferencie o živote a diele Maximiliána Hella*, edited by Ján Novák, 3–25. Bratislava: ÚRAD pre Slovenské banské múzeum v Ban. Štiavnici, 1970.

Tibenský, Jan. *Slovenský Sokrates: Život a dielo Adama Františka Kollára*. Bratislava: Tatran, 1983.

Tobé, Erik. *Anders Hellant: En krönika om sjuttonhundratalets märkligaste Tornedaling*. Tornedalica 49. [Luleå]: Tornedalica, 1991.

Török, Enikő. *Mikoviny Sámuel*. Budapest: Magyar Országos Levéltár, 2011.

Török, István. "A kolozsvári collegium *XVIII*. századi tanárainak életrajza (Verestói György 1728–1764 tanár s később püspök.)." *Protestáns Közlöny* 3, nos. 13–14 (1886): 122–23; 14:128–30.

Török, István. *A kolozsvári ev. ref. kollégium története*. Cluj: Ev. Ref. Collegium, 1905.

Török, Zsolt. *Bél Mátyás, Mikoviny Sámuel és a honismereti iskola*. Budapest: Országos Pedagógiai Könyvtár és Múzeum, 2003.

Tóth, Béla. *Hatvani István*. Budapest: Közgazdasági és Jogi Könyvkiadó, 1977.

Tóth, István György. "Les analphabets et les almanachs en Hongrie au *XVIII^e* siècle." In *Les lectures du peuple en Europe et dans les Amériques du* XVII*^e au XX^e siècle*, edited by Hans-Jürgen Lüsebrink, York-Gothart Mix, Jean-Yves Mollier, and Patricia Sorel, 127–33. Brussels: Editions Complexe, 2003.

Tóth, István György. *Literacy and Written Culture in Early Modern Central Europe*. Budapest: Central European University Press, 2000.

Trampus, Antonio. *I gesuiti e l'Illuminismo: Politica e religione in Austria e nell'Europa centrale (1773–1798)*. Florence: Olschki, 2000.

Tribe, Keith. "Cameralism and the Sciences of the State." In *The Cambridge History of Eighteenth-Century Political Thought*, edited by Mark Goldie and Robert Wokler, 525–46. Cambridge: Cambridge University Press, 2006.

Tuck, Richard. *Philosophy and Government, 1572–1651*. Cambridge: Cambridge University Press, 1993.

Udías, Agustín. *The Jesuit Contribution to Science: A History*. Cham: Springer, 2015.

Udías, Agustín. "Los libros y manuscritos de los profesores de matemáticas del Colegio Imperial de Madrid, 1627–1767." *Archivum historicum Societatis Iesu* 74 (2005): 369–448.

Udías, Agustín. *Searching the Heavens and the Earth: The History of Jesuit Observatories*. Dordrecht: Kluwer Academic, 2003.

Ullmaier, Hans. *Puncta, particulae et phaenomena: Der dalmatinische Gelehrte Roger Joseph Boscovich und seine Naturphilosophie*. Hannover and Laatzen: Wehrhahn Verlag, 2005.

Vajthó, László, ed. *Barcsay Ábrahám költeményei*. Budapest: Királyi Magyar Egyetemi Nyomda, 1933. mek.oszk.hu/06000/06097/06097.pdf (accessed December 3, 2018).

Van Dülmen, Richard. "Antijesuitismus und katholische Aufklärung in Deutschland." In Richard van Dülmen, *Religion und Gesellschaft: Beiträge zur einer Religionsgeschichte der Neuzeit*, 141–71. Frankfurt: Fischer, 1989.

Van Dülmen, Richard. *Der Geheimbund der Illuminaten*. Stuttgart: Frommann-Holzboog, 1977.

Van Gelder, Klaas. "Networks, Agency and Policy: A New Approach to Maria Theresa's Advisors during the War of the Austrian Succession." In *Maria Theresia? Neue Perspektive der Forschung*, edited by Thomas Wallnig, Elisabeth Lobenwein, and Franz-Stefan Seitschek, 151–70. Das achtzehnte Jahrhundert und Österreich 32. Bochum: Dr. Dieter Winkler Verlag, 2017.

Van Gent, Robert H. "Observations of the 1761 and 1769 Transits of Venus from Batavia (East Indies)." *Proceedings of the International Astronomical Union*, Special Issue,

"Transits of Venus: New Views on the Solar System and Galaxy, Proceedings IAU Colloquium," edited by Don W. Kurtz, 196 (2004): 67–73.

Van Kley, Dale K. "Jansenism and the International Suppression of the Jesuits." In *Enlightenment, Reawakening, and Revolution, 1660–1815*, edited by Stewart J. Brown and Timothy Tackett, 302–28. Cambridge: Cambridge University Press, 2006.

Van Kley, Dale K. "Religion and the Age of Patriotic Reform." *Journal of Modern History* 80 (2008): 252–95.

Vanpaemel, Geert. "Jesuit Mathematicians, Military Architecture, and the Transmission of Technical Knowledge." In *The Jesuits and the Low Countries: Identity and Impact* (*1540–1773*), edited by Rob Faesen and Leo Kenis, 109–28. Leuven: Peeters, 2012.

Varga, Júlia. "Katolikus közép- és felsőoktatás Erdélyben a 17. századtól a 19. század közepéig." PhD diss., Budapest, Eötvös Loránd University, 2007.

Varićak, Vladimir. "Drugi ulomak Boškovićeve korespondencije." *Rad Jugoslavenske akademije znanosti i umjetnosti, Matematičko-prirodoslovni razred* 52 (1912): clxiii–ccclxxxiii.

Venturi, Franco. *Jeunesse de Diderot* (*de 1713 à 1753*). Paris: Albert Skira, 1939.

Venturi, Franco. *Settecento riformatore*. 6 Vols. Turin: Einaudi, 1969–90.

Verdun, Andreas. "Die Bestimmung der Sonnen-Parallaxe aus den Venus-Transits im 18. Jahrhundert." *Orion* 322, no. 3 (2004): 4–20.

Veres, Madalina. "Constructing Imperial Spaces: Habsburg Cartography in the Age of Enlightenment." PhD diss., University of Pittsburgh, 2015.

Vermes, Gábor. *From Feudalism to Revolution: Hungarian Culture and Politics in the Habsburg Monarchy, 1711–1848*. Budapest: Central European University Press, 2014.

Vermeulen, Han F. "Anthropology in Colonial Contexts: The Second Kamchatka Expedition (1733–1743) and the Danish–German Arabia Expedition (1761–1767)." In *Anthropology and Colonialism in Asia and Oceania*, edited by Jan van Bremen and Akitoshi Shimizu, 13–39. Richmond, Surrey: Curzon Press, 1999.

Vermeulen, Han F. *Before Boas: The Genesis of Ethnography and Ethnology in the German Enlightenment*. Lincoln, NE: University of Nebraska Press, 2015.

Vlachovič, Jozef. "Banská Štiavnica—prostredie, v ktorom vyrastal Maximilián Hell/ Banská Štiavnica—das Milieu, in dem Maximilián Hell herangewaschsen war." In *Maximilián Hell 1720–1792: Zborník prednášok z konferencie o živote a diele Maximiliána Hella*, edited by Ján Novák, 31–42. Bratislava: ÚRAD pre Slovenské banské múzeum v Ban. Štiavnici, 1970.

Vladár, Zsuzsa C. "Hell mint nyelvész: A Kar-jelia etimológia és a kínai hasonlítás példája." In *A nyelvtörténeti kutatások újabb eredményei* IX, edited by Tamás Forgács, Miklós Németh, and Balázs Sinkovics, 337–50. Szeged: SZTE, 2017.

Vladár, Zsuzsa C. "Pereszlényi Pál grammatikája (1682): Források és párhuzamok." *Magyar Nyelv* 103, no. 3 (2007): 257–70.

Vladár, Zsuzsa C. "Sajnovics's *Demonstratio* and Gyarmathi's *Affinitas*: Terminology and Methodology." *Acta linguistica hungarica* 55, nos. 1–2 (2008): 145–81.

Vladár, Zsuzsa C. "Valójában ki a szerzője a Demonstrációnak?" *Magyar Nyelv* 112, no. 3 (2016): 316–24.

Voje Johansen, Nils. "In ultimo fine Europae: Astronomen Maximilian Hell på besøk i Vardø." In *Kompassrosen: Orientering mot Nord*, edited by Benedicte Gamborg Briså and Bente Lavold, 40–51. Oslo: Nasjonalbiblioteket, 2009.

Voje Johansen, Nils. "Vitenskap som springbrett: Jens Finne Borchgrevinck satset og vant." *Fjellfolk: Årbok for Rørosmuseet* 29 (2004): 20–29.

Voje Johansen, Nils. "The Expeditions of William Bayly and Jeremiah Dixon to Honningsvåg and Hammerfest, 1769." *Journal of Astronomical Data*, Special Issue, "Meeting Venus: A Collection of Papers Presented at the Venus Transit Conference in Tromsø 2012," edited by Christiaan Sterken and Per Pippin Aspaas, 19, no. 1 (Brussels and Tromsø: C. Sterken and University of Tromsø, 2013): 59–69.

Von Aretin, Karl Otmar. "Katholische Aufklärung im Heiligen Römischen Reich." In Karl Otmar von Aretin, *Das Reich: Friedensgarantie und europäisches Gleichgewicht 1648–1806*, 403–33. Stuttgart: Klett-Cotta, 1986.

Von Bieberstein, Johannes Rogalla. *Die These von Verschwörung 1776–1945*. Frankfurt: Peter Lang, 1976.

Von Littrow, Karl. *Die neue Sternwarte der k. k. Universität Wien*. Vienna: n.p., 1874.

Wagner, Florian. *Die Entdeckung Lapplands: Die Forschungsreisen Carl von Linnés und Pierre Louis Moreau de Maupertuis' in den 1730er Jahren*. Norderstedt: Books on Demand, 2004.

Wakefield, Andre. "Leibniz and the Wind Machines." *Osiris* 25 (2010): 171–88.

Wallace, William A. *Galileo and His Sources: The Heritage of the Collegio Romano in Galileo's Science*. Princeton: Princeton University Press, 1984.

Wallerstein, Immanuel. *The Modern World System: Capitalist Agriculture and the Origins of the European World-Economy in the Sixteenth Century*. New York: Academic Press, 1976.

Wallnig, Thomas. *Critical Monks. The German Benedictines, 1680–1740.* Leiden: Brill, 2019.

Wallnig, Thomas. "Franz Stephan Rautenstrauch (1734–1785)." In *Enlightenment and Catholicism in Europe: A Transnational History*, edited by Jeffrey D. Burson and Ulrich Lehner, 209–25. Notre Dame: University of Notre Dame Press, 2014.

Wangermann, Ernst. *The Austrian Achievement, 1700–1800*. London: Thames and Hudson, 1973.

Wangermann, Ernst. "'By and by we shall have an enlightened populace': Moral Optimism and the Fine Arts in Late-Eighteenth-Century Austria." *Austrian History Yearbook* 31 (1999): 1–15.

Wangermann, Ernst. *Die Waffen der Publizität: Zum Funktionswandel der politischen Literatur unter Joseph II*. Munich: Oldenbourg, 2004.

Weisz, Boglárka. "Mining Town Privileges in Angevin Hungary." *Hungarian Historical Review* 2, no. 2 (2013): 288–312.

Weyss, Norbert. "Maximilian Hell und sein Fernsehen vor 200 Jahren, Part ii." *Maria Enzensdorfer Kulturnachrichten* (December 1986): 3–6.

Wheeler, Roxann. *The Complexion of Race: Categories of Difference in Eighteenth-Century British Culture*. Philadelphia: University of Pennsylvania Press, 2000.

Widmalm, Sven. "Accuracy, Rhetoric, and Technology: The Paris–Greenwich Triangulation." In *The Quantifying Spirit of the Eighteenth Century*, edited by Tore Frängsmyr, John L. Heilbron, and Robin E. Rider, 179–206. Berkeley: University of California Press, 1990.

Widmalm, Sven. "Auroral Research and the Character of Astronomy in Enlightenment Sweden." *Acta borealia* 29, no. 2 (2012): 137–56.

Widmalm, Sven. "A Commerce of Letters: Astronomical Communication in the 18th Century." *Science Studies* 5 (1992): 43–58.

Widmalm, Sven. *Mellan kartan och verkligheten: Geodesi och kartläggning, 1695–1860*. Institutionen för idé- och lärdomshistoria, Uppsala universitet, Skrifter 10. Uppsala: Institutionen för idé- och lärdomshistoria, Uppsala universitet, 1990.

Widmalm, Sven. "Science in Transit: Enlightenment Research Policy and Astronomy in Sweden." *Journal of Astronomical Data*, Special Issue, "Meeting Venus. A Collection of Papers Presented at the Venus Transit Conference in Tromsø 2012," edited by Christiaan Sterken and Per Pippin Aspaas, 19, no. 1 (Brussels and Tromsø: C. Sterken and University of Tromsø, 2013): 21–32.

Wilcke, Johan Carl. *Tal, om de nyaste förklaringar öfver norr-skenet, hållet, i Kongl. Maj:ts höga nårvaro, för dess Vetenskaps-Academie*. Stockholm: Johan Georg Lange, 1788.

Willoch, G.I., ed. *Vardøhus Festning 650 år. Jubileumsskrift*. Oslo: Generalinspektøren for Kystartilleriet, 1960.

Winner, Gerhard. *Die Klosteraufhebungen in Niederösterreich und Wien*. Vienna and Munich: Herold, 1967.

Withers, Charles W.J. *Placing the Enlightenment: Thinking Geographically about the Age of Reason*. Chicago: University of Chicago Press, 2007.

Wolf, Rudolf. *Geschichte der Astronomie*. Geschichte der Wissenschaften in Deutschland: Neuer Zeit, Sechzehnter Band. Munich: R. Oldenbourg, 1877.

Wolfschmidt, Gudrun. "Cultural Heritage and Architecture of Baroque Observatories." Paper delivered at the European Society for Astronomy in Culture 17th Annual Meeting, SEAC 2009. http://www.math.uni-hamburg.de/spag/ign/stw/seac09-obsbarock.pdf (accessed November 28, 2018).

Wolfschmidt, Gudrun. "Die Entwicklung und Verbreitung der Urania zur Popularisierung der Astronomie." In *Konferenzbeiträge/Proceedings: Festkolloquium und Fachtagung 250 Jahre Universitätssternwarte Wien*, edited by Maria G. Firneis and Franz Kerschbaum, 92–103. Communications in Asteroseismology 149. Vienna: Austrian Academy of Sciences Press, 2008.

Woolf, Harry. *Les astronomes françaises, le passage de Vénus et la diffusion de la science au XVIII^e siècle*. Paris: Université de Paris, 1962.

Woolf, Harry. *The Transits of Venus: A Study of Eighteenth-Century Science*. Princeton: Princeton University Press, 1959.

Woolley, Richard van der Riet. "The Significance of the Transit of Venus." In *Captain Cook: Navigator and Scientist*, edited by G.M. [Geoffrey Malcolm] Badget, 118–35. Canberra: Australian National University Press, Canberra, 1970.

Wrba, J. "Der Orden der Gesellschaft Jesu im Alten Universitätsviertel von Wien: Hundertfünfzig Jahre von den Jesuiten geprägte Universität." In *Das alte Universitätsviertel in Wien, 1385–1985*, edited by Günther Hamann, Kurt Mühlberger, and Franz Skacel, 2:47–74. Vienna: Universitätsverlag für Wissenschaft und Forschung, 1985.

Wright, Jonathan A. "Ruggiero Boscovich (1711–1787): Jesuit Science in an Enlightenment Context." In *Enlightenment and Catholicism in Europe: A Transnational History*, edited by Jeffrey D. Burson and Ulrich Lehner, 353–70. Notre Dame: University of Notre Dame Press, 2014.

Wulf, Andrea. *Chasing Venus: The Race to Measure the Heavens*. New York: Penguin, 2012.

Young, Brian. "Religious History and the Eighteenth-Century Historian." *Historical Journal* 43 (2000): 849–68.

Young, Francis. *English Catholics and the Supernatural, 1553–1829*. Aldershot: Ashgate, 2013.

Zemplén, Jolán M. *Dejiny fyziky na Slovensku do polovice 19. storočia*. Bratislava: Veda, 1974.

Zemplén, Jolán M. *A felvidéki fizika története 1850-ig*. Revised and edited by István Gazda. Budapest: Magyar Tudománytörténeti és Egészségtudományi Egyesület, 2016 [1973].

Zemplén, Jolán M. *A magyarországi fizika története a XVIII. században*. Budapest: Akadémiai Kiadó, 1964.

Zuidervaart, Huib J., and Robert H. Van Gent. "'A bare outpost of learned European culture on the edge of the jungles of Java': Johan Maurits Mohr (1716–1775) and the Emergence of Instrumental and Institutional Science in Dutch Colonial Indonesia." *Isis* 95 (2004): 1–33.

Online Resources

Aspaas, Per Pippin, László Kontler, and Katalin Pataki. "Metadata serving as basis for illustrations of Maximilian Hell's network in the book 'Maximilian Hell (1720-1792) and the Ends of Jesuit Science in Enlightenment Europe' by Per Pippin Aspaas and László Kontler (Brill Academic Publishers, 2020)." https://doi.org/10.18710/CVW8YU, DataverseNO, V1

Proverbio, Edoardo, ed. "Catalogo delle opere a stampa di Ruggiero Giuseppe Boscovich (1711–1787)." http://www.brera.inaf.it/boscovich/progetto-sito/opere_a_stampa.pdf (accessed June 11, 2019).

Mrozik, Dagmar. "Jesuit Science Network." http://www.jesuitscience.net/ (accessed June 11, 2019).

"Nuovo catalogo della corrispondenza di Ruggiero G. Boscovich." http://www.brera.inaf.it/boscovich/progetto-sito/Nuovo_catalogo_lettere.doc (accessed June 11, 2019).

Szilas, László. "Jezsuita névtár." http://jezsuita.hu/nevtar/ (accessed June 11, 2019).

Index

Académie des Inscriptions et des belles Lettres, Paris 176
A magyar nemzetnek szokásairul... (Bessenyei) 326–27
A magyar néző (Bessenyei) 326
A'törvénynek útja (Bessenyei) 328
Aaskow, Urban Bruun 180
Abafi, Ludwig (Lajos)
Geschichte der Freimaurerei in Österreich-Ungarn 319
absolutism 7, 306–7, 324, 386. *See also* Habsburgs
enlightened absolutism 7, 306–7
unenlightened absolutism 386
Académie des Sciences, Paris 103, 127, 143, 145, 152–53, 163, 182, 285, 294, 296, 302, 390
Académie Royale des Sciences, Paris 3, 103, 128, 162, 179–80, 182, 210, 217, 272, 274, 278–79, 345
Academy of Fine Arts, Vienna 122
Academy of Stockholm, Stockholm 178
Adjumentum memoriae manuale chronologico-genealogico-historicum (Hell) 70
Adolphus, Gustavus 174
Advancement of Learning (Bacon) 385
Aesthetica (Szerdahely) 376
Affinitas linguae Hungaricae cum linguis Fennicae... (Gyarmathi) 235
Ahasverus (Xerxes) 315
Alexander the Great 245, 380
Alexandrovich, Paul (Grand Duke Paul of Russia) 352
Allgemeine Deutsche Biographie 67
Allgemeine Naturgeschichte und Theorie des Himmels (Kant) 375
Allgemeine nordische Geschichte (von Schlözer) 233, 247, 381
Alma Universitas 81
Almagestum novum (Riccioli) 168
Altdorf, Switzerland 50–51
Aman, Cäsar 261
Amazon River 66
Angevins 38–39
Anich, Peter 116–17, 152, 371
Animadversiones Subitaneæ (Planman and Kreander) 292
Anleitung zum nützlichen Gebrauch der künstlichen Stahl-Magneten (Hell) 85, 94
Annales Ungaria (Pray) 249
Annales veteres Hunnorum Avarum et Hungarorum (Pray) 240, 249
Anonymus Bele regis notarius 240–41, 246–48
Gesta Hungarorum 240–41, 247
anti-clericalism 365
anti-Jesuitism 17
antiquarianism 82
Apologia pro lingua latina (Szerdahely) 378
Arabia Felix, expedition 175–77, 202, 224, 274
Arctic circle 35
Arctic expedition 3, 75, 127, 129, 136, 173, 297, 303, 333, 344, 367, 369, 390
Arctic Sea 195, 228
Aristotelianism 21, 23
Arkhangelsk, Russia 177
Armenians 77
Árpád (prince) 248
Ars generalis poetica (Szerdahely) 376
Astronomiae physicae juxta Newtoni principia breviarium (Weiss) 76
astronomical observatory 67, 74, 83, 131, 149, 336–37. *See also* specific locations
Astronomie (de Lalande) 83, 160, 168, 284–85, 287
Astronomisches Jahrbuch, Berlin 109–10, 164, 336
Attila the Hun 240–41, 246, 254, 328
Audiffredi, Giovanni Battista 160
Aulic War Council 91
aurora borealis 75, 86–87, 126, 209, 225–26, 228–29, 257, 272, 358, 360, 389
Aurorae borealis theoria nova (Hell) 126, 216, 226–27
Austrian Academy of Sciences 306, 351

* Index prepared by Raymond Depew-Paas.

Austrian Province, Jesuit 55, 394–95
Avars 240, 249
Bachoff von Echt, Johann Friedrich 186–87, 189, 193–95, 198, 209
Bacon, Francis 31–32, 385
Advancement of Learning 385
Baia Mare (Nagybánya, Rivulus Dominarum, Neustadt), Romania 47
Baja California, Mexico 136–37, 189, 191, 279
Balajthi, Máté 129–30, 353, 370
Balkan Orthodox Serbs 46
Banat region, Central Europe 71, 98, 320
Bane, Štiavnické 34, 37, 46–47
Banská Bystrica (Besztercebánya, Neosolium, Neusohl), Slovakia 34, 37–42, 45, 53, 55, 57, 63–64, 74, 123, 129, 396
Banská Štiavnica (Selmecbánya, Schemic[z]ium, Schemnitz), Slovakia 34, 37–49, 51–54, 59, 63, 65, 71, 73, 104, 107, 389, 397
Barcsay, Ábrahám 380, 386
Barents Sea 229
Barkóczy, Ferenc 130
Bartakovics, József 66
Basel, Switzerland 84, 118, 342
Batavia, Indonesia 137, 144, 177, 192. *See also* Jakarta
Báthori, István 41
Batthyány, Ignác 82, 370
Battle of Mohács 39, 76
Battle of Trenčín 48–49
Baudouin, Baudouin de Guémadeuc, Armand-Henri 162–64
Bavaria, Germany 45–46, 55–56, 113, 321
Bay of Mexico 229
Bel/Bél, Matej/Mátyás/Matthias 50, 90, 199, 233, 241, 323
Notitia Hungariae 50, 323
Belgium 195, 197
Benczur, József 254
Benedict XIV (pope) 129
Benedictine observatory 336
Benedictines 15, 18, 93, 107, 113, 151, 334–35
Benzon, Jacob 203
Bercsényi, Miklós 48
Bergrath 72
Bergwissenschaften (mineralogy and chemistry) 51
Berlin, Germany 5, 12, 83, 93, 96, 109, 113, 123, 128, 164, 171, 182, 277, 288, 298–99, 301, 308, 334–38, 340, 342, 349–50, 355, 365, 368, 372, 377–78
Bernoulli, Johann III 83–84, 93, 101, 128, 171, 182, 277, 279, 288, 294, 332, 334–38, 340, 342, 350, 365, 372, 377–78
Nouvelles littéraires 279, 332, 340
Recueil pour les astronomes 101, 171
Bernstorff, Johann Hartvig Ernst 186–87, 189, 195, 201–2, 209, 239
Berzeviczy, Gergely 323
Bessenyei, György 325–29, 383–86
A magyar nemzetnek szokásairul… 326–27
A magyar néző 326
A' törvénynek útja 328
"Egész Európa' formája a XI[dik] Században" 327
Magyarországnak törvényes állása 328–29, 383
Bethlen, Gábor 78
Beyträge zur Praktischen Astronomie (Hell) 354
black-drop effect 161, 167, 268
Blaeu atlas (Blaeu) 246
Blaeu, Joan
Blaeu atlas 246
Bocskai, István 42
Bode, Johann Elert 109–10, 182, 277, 336, 355, 377
Bohemia 38, 46, 50, 56, 59, 122, 154, 313, 316
Bologna, Italy 24, 28, 44, 103, 111, 113–14, 134, 152, 154, 243, 345
Borchgrevink, Jens Finne 172, 181, 200, 212, 221–22, 267–68, 272, 275, 281, 287, 292, 294, 301
Boscovich, Ruggiero Giuseppe (Ruđer Josip Bošković) 4, 25–26, 62, 69, 75, 109, 124–27, 143, 152, 189–91, 217–18, 287–88, 295, 366, 390
Dissertationes quinque ad dioptricam pertinentes 125
Botanical Garden, Vienna 107
Brahe, Tycho 23, 178, 355
Brandenburg, Germany 45, 195
Bratislava (Pozsony, Posonium, Pressburg), Slovakia 5, 37, 39, 42–43, 45–46, 48–49, 63–64, 97, 101, 128–29, 199, 249, 252, 379–80, 396
Bredal, Niels Krog 180, 214

Breslau (Wrocław), Poland 113, 227, 331, 354
Brest, France 113, 182, 278
Briefe über mineralogische Gegenstände... (von Born) 320
Brno (Bruna, Brünn), Czech Republic 124, 395
Buda, Hungary 37, 66, 75, 119, 128, 133, 244, 250, 298, 300, 330–31, 335, 338–39, 341, 343, 368–70, 372–73, 376–78, 396
Bugge, Thomas 67, 75, 84, 180, 187–88
Bureau des Longitudes, Paris 109
Bürg, Johann Tobias 122, 300, 375
Büsching, Anton Friedrich 233, 236
Erdbeschreibung 233

Cagliostro, Alessandro 2
Cajaneborg (Kajaani), Finland 280–82, 287–91, 294
Calvinism 77
Canisius, Peter 59
Cape of Good Hope 112–13, 155, 285
Cape of Lapland 183–84
capellanus major castrensis 79–80
Caribbean 33, 51, 107, 197
Carjelia (or Karjelia) 239, 245
Carjelia, Hungarian tribe 240
Carpathian basin 246
Cartesian algebra 70
Cartesian analytical geometry 24
Cartesianism 88
Cassini de Thury, César-François 103, 113, 124–25, 144, 146–47, 150, 191, 210
Cassini dynasty 297
Catherine II (empress)/ Catherine the Great 164, 192, 331
Catholic Enlightenment 7, 11–13, 16–18, 36
Catholic Reform, Europe 14, 99
Catholic universalism 35
Catholicism 4, 7, 10–17, 19, 22, 93, 99, 116, 152, 185, 250, 308
Celsius, Anders 226, 228–29
Censorship Patent (Joseph II) 318
Chappe d'Auteroche, Jean Baptiste 103, 109, 113, 136–37, 143–44, 146–47, 155, 191, 271, 279, 287, 293
Charles Eugene (duke of Württemberg) 352
Charles of Lorraine (prince) 352
Charles Theodore (prince-elector) 150
Charles V (emperor) 59
Charles VI/III (emperor) 58, 67
Charles XII (king) 174
chemistry 48, 51, 107, 346–47, 351
China 24, 81–82, 113, 220, 240, 242, 249, 274, 279, 332, 340
Chinese rites controversy 250
Christian VII (king) 2, 35, 176, 199–200, 236, 239, 268, 366
Christiania (Oslo), Norway 172, 201, 203, 215, 226, 237, 266
Cicero
De officiis 20
Clavius, Christoph 22–23
Clement XIII (pope) 195–97
Clement XIV (pope)
Dominus ac redemptor noster 312, 344, 391
Clementi, Muzio 352
Cluj (Kolozsvár, Claudiopolis, Klausenburg), Romania 34, 41–42, 44, 64, 76, 79–89, 92, 94, 118, 120, 220, 330, 335, 339, 359–60, 396
Colegio Imperial, Madrid 141–42
College of the Reformed Church, Cluj 85
Collegio Romano, Rome 23
Collegium Academicum Viennense Societatis Jesu, Vienna 60, 81, 231
Collegium Germanicum et Hungaricum, Rome 129, 370
Collegium Pazmanianum, Vienna 70
Collegium Regium Theresianum Claudiopolitanum, Cluj 83
Collegium Theresianum, Vienna 60, 62, 107, 141–42, 323–24, 333, 340, 347
Collinson, Peter 1
Commissioners of Longitudes, London 109
Confessio montana 41
Connoissance des temps 103, 109–10, 140, 165, 168
Constantine VII Porphyrogenitus (emperor) 246–47
Constitutions (Saint Ignatius) 20, 324
convents 42–43, 56
convictus nobiliorum 81
Cook, James 136–38, 156, 175, 181, 271, 278–79, 287, 294, 357
Copenhagen, Denmark 67, 113, 128, 156, 163, 167, 172–73, 176–80, 184–89, 193, 195, 199–203, 209, 211, 215–16, 218, 221–24, 227, 231, 234–36, 238–39, 248, 251–54, 258–61, 263–64, 268–69, 273–74,

Copenhagen, Denmark (cont.)
276–79, 286, 289, 300, 305, 344–45, 364, 368–69
Copernicanism 23, 25, 62
Copernicus 149, 227
Copper 38–39, 259
Córdoba, Spain 65
Matthias I, Corvinus (king) 39
Cossebaude, Johann Ludewig of 117
Council of Trent 13
Counter-Enlightenment 16
Counter-Reformation 7, 310
Crabtree, Simon 134
Crivelli, Giovanni Francesco 69–70
Elementa arithmeticae numericae et litteralis… 70
Elementi di fisica 70
Croatia 55, 340
Csokonai Vitéz, Mihály 382
crypto-Catholics 196
Cumans 247
Czech Academy of Sciences 52
Czechoslovakia 5
Czvittinger, Dávid
Specimen Hungariae litteratae 233

d'Albert d'Ailly, Michel Ferdinand 153
d'Alembert, Jean le Rond 315
da Espinha, José 368
da Rocha, Felix 368
Danish Society of Sciences. *See* Royal Danish Society of Sciences, Copenhagen
Danish Venus transit efforts 187
Danube River 55, 123, 125, 298
Darwin, Charles 31
de Almeida, José Bernardo 368
de Bernis, François-Joachim de Pierre Cardinal 344
de Charlevoix, Pierre-François-Xavier 254
De Finnicae linguae indole observationes (Fogel) 231
de Fontenelle, Bernard le Bovier 3
de Guignes, Joseph 240, 242
Histoire générale des Huns, des Turcs, des Mongols, et des autres peuples Tartares… 240
de Haen, Anton 357
de Lacaille, Nicolas-Louis 69, 103, 109, 113, 127–28, 142, 144, 150, 153–54, 163, 167, 277
de Lagrange, Joseph Louis 167, 182
"Mémoire sur le passage de Vénus du 3 Juin 1769" 182
de Lalande, Joseph-Jérôme Lefrançois 4, 69, 83, 103, 109, 125, 137, 144, 153, 160, 163, 165–66, 168–69, 179–80, 182, 190–91, 209, 217, 272, 277–79, 283–96, 299–300, 355, 390
Astronomie 83, 160, 168, 284–85, 287
Memoire sur le passage de Venus 288
de Luca, Ignaz 372–73
de Luynes, Paul d'Albert 153, 285
de Mairan, Jean-Jacques Dortous 167
Traité physique et historique de l'aurore boréale 228
de Malzet, Louis-Sébastien Jacquet 326
de Maupertuis, Pierre-Louis Moreau 32–33, 75, 175, 209–11, 260, 297
Figure de la terre 297
portrait of 297
shape of the Earth 297
De officiis (Cicero) 20
De origine Ungarorum (Fischer) 232–33
De originibus et usu perpetuo… (Kollár) 381
De parallaxi Solis (Hell) 159–60, 269, 278, 288–92, 294–96, 368
de Peiresc, Nicolas-Claude Fabri 32
De satellite Veneris (Hell) 125–26, 163–64, 167
De statu ecclesiae (von Hontheim) 373
De Veneris ac Solis Congressu Observatio habita in Astronomico (Zanotti) 134
de Ville-Issey, Jean-Nicolas Jadot 92
Debrecen, Hungary 118–20
Decker, Raimund 43, 83
Delisle, Joseph-Nicolas 94–95, 98, 102–3, 105, 109, 125, 140, 144, 155, 158, 165, 192, 277, 286
Delius, Christoph Traugott 51
Demonstratio Idioma Ungarorum et Lapponum idem esse (Sajnovics) 234–43, 246–52, 254–56, 258, 362, 378–80, 383, 385–87
Denmark–Norway 2, 95, 124, 174, 179–80, 182, 184–85, 209, 221, 227, 236, 238, 239, 279, 286, 340, 344
Dentumoger 246. *See also* Hungary
Department of Mints and Mines, Vienna 72

Der Mann ohne Vorurtheil (von Sonnenfels) 317
Der Venusdurchgang von 1769 als Fortsetzung der Abhandlung (Encke) 299
Dernschwam, Hans 40
Descartes, René 25, 31–32, 62, 118
Desing, Anselm 93
Dictionnaire de Trévoux 25
Diderot, Denis 29–30
Dimensio graduum meridiani Viennensis et Hungarici (Liesganig) 124
Diploma Leopoldinum 78
Dissertatio physica de motu corporum (Borgia) 62
Dissertatio physico-medica de planetarum influxu (Mesmer) 85
Dissertationes historico-criticae in annales veteres Hunnorum… (Pray) 249
Dissertationes quinque ad dioptricam pertinentes (Boscovich) 125
distillation apparatus 224
Dobler, Eugen 93–94, 151
Döbrentei, Gábor 3–5, 74, 82
Dominican order 23, 40, 250
Dominus ac redemptor noster (Clement XIV) 312, 344, 391
Draskovich Observance 322
Draskovich, János 322
Dresden, Germany 100, 111, 117, 151, 198
Dugonics, András 386
Duhr, Bernhard
  Jesuiten-Fabeln 304
Dutch United East India Company 192
dyspepsia 88

Eder, Xaver Franz 65–66, 255, 379
Edict of Tolerance 313
education 6, 13, 18, 20–21, 34, 39, 55, 60–61, 64, 81, 83, 88, 90, 118, 200, 280, 298, 309, 311, 313, 323, 331, 371, 373–74, 378
Eger, Hungary 106, 129–130, 148, 170, 191, 336, 343, 353–54, 365, 367–70, 372–74, 378, 387, 396
"Egész Európa' formája a XIdik Században" (Bessenyei) 327
electricity 1, 63, 84, 86–88, 99, 118, 127, 141, 224, 226–27, 345, 357–58, 389
electromagnetism 226. *See also aurora borealis*
Elegia epidictica, per quam demonstratur Uraniam (Szerdahely) 375
Elementa arithmeticae numericae et litteralis… (Crivelli) 70
Elementa arithmeticae numericae et literalis, exposita a Joanne Crivellio (Hell) 69, 88–89
Elementa mathematica naturali philosophiae ancillantia (Hell) 88
Elementa physicae (van Musschenbroek) 118
Elementi di fisica (Crivelli) 70
Encke, Johann Franz 298–303
  Der Venusdurchgang von 1769 als Fortsetzung der Abhandlung 299
  "Über den Venusdurchgang von 1769" 299, 301
England 9, 85, 95, 103, 110–11, 130, 145, 150, 154, 173, 190, 195, 197, 199–200, 278, 290, 318, 366–68
Enlightenment 9, 315, 344–45, 347, 349, 351, 353, 355, 357, 359, 361, 363, 365, 367, 369, 371, 373, 375, 377, 379, 381, 383, 385, 387. *See also* Republic of Letters
  Austrian Enlightenment 52
  Catholic Enlightenment 7, 11–13, 16–18, 36
  enlightened absolutism 7, 306–7, 324
  secularism and 24
  unenlightened absolutism 386
Ephemerides ad meridianum Vindobonensem (Hell) 34–35, 83, 94–96, 100–2, 108–14, 116–17, 121–22, 126–27, 129–31, 141–42, 145–46, 151, 154–55, 159–60, 164–71, 188, 192, 197, 206, 208, 212–14, 216, 220, 226, 228, 259, 285, 292, 294, 306, 329, 332–34, 337–41, 349, 354–55, 360, 367–78
Erdbeschreibung (Büsching) 233
Erdélyi Muzéum 1, 81–82, 380
"Errors of Star-Watcher Sajnovits and Hell Being Refuted" (Orczy) 380
Esztergom (Strigonium, Gran), Hungary 41, 65, 79, 130, 331, 397
Eszterházy, Károly 106, 129–30, 148, 170, 336, 343, 353–54, 369–71, 373–74, 387
Euclid 22
Euler, Johann Albert 199, 269, 278–79, 282, 291
Exercitationes arithmeticae (Hell) 88

Expeditio litteraria ad Polum arcticum (Hell) 193, 209, 211, 213, 215–21, 223, 225, 227, 229–31, 233, 235, 237, 239–41, 243, 245–47, 249, 251, 253, 255, 257–59, 297, 306, 333, 350, 362–63, 366, 374
Eybel, Josef Valentin 318

Faye, Hervé Auguste Étienne Albans 302–3
Febronianism 15
Fenni, or Finns 239
Fennoscandinavia 232
Feodorovna, Maria (Sophia Dorothea of Württemberg) 352
Ferchault de Réaumur, René Antoine 228
Ferdinand I (king) 59
Ferdinand VI (king) 154
Ferner, Bengt 154
Fichte, Johann Gottlieb 30–31
Fifteen Years' War 39
Figure de la terre (de Maupertuis) 297
Finland 148, 174, 176, 178, 181, 237–38, 280
Finnmarchia. *See* Finnmark, Norway
Finnmark, Norway 113, 172, 207, 212, 222, 225, 228, 230, 235–36, 238, 259
Finno-Ugrian
  group 231–32
  linguistic kinship 35, 231
  people 232–33
  theory 233, 249
First World War 5
Fischer, Johann Eberhard 17, 67, 83–84, 123, 131, 142, 149, 232–33, 248, 316, 17, 67, 83–84, 123, 131, 142, 149, 232–33, 248, 316
  De origine Ungarorum 232–33
Fixlmillner, Alexander 93
  Fixlmillner, Placidus 67, 71, 93–94, 109, 131–32, 151, 164, 288, 334, 336
Fleuret, professor 149
Flora Danica (Oeder) 221
Flora Norvegica (Gunnerus) 221–22
Florence, Italy 18, 24, 103, 111, 113–14, 141, 152, 274
Fogel, Martin 231–32
  De Finnicae linguae indole observationes 231–32
Formula vivendi 19
Forsskål, Pehr 224
Forster, Georg 322, 324, 382
France 15–16, 18, 83, 103, 110–11, 124, 137, 140, 144–46, 148–50, 152–53, 163, 168, 187, 191, 195, 197, 199, 287, 296, 311, 344, 357, 368
Francis I (Francis Stephen of Lorraine, Holy Roman emperor) 51, 92, 119, 319
Francis I (Austrian emperor) 386
Franklin, Benjamin 1
Franz (Frantz), Joseph 1, 63, 67
  Godefridus Hierosolymitanus 63
Frederick II (emperor) 352, 365
Frederick V (king) 176
Fredrikshald (Halden), Norway 203, 215
freemasons 52, 320–21, 323, 342, 363–64, 392. *See also* lodge (masonic)
freemasonry 319, 322. *See also* lodge (masonic)
Frivaldszky, János 82
Frölich, Erasmus 67, 74, 91
Fucus alatus 222
Fuegians 243
Fuggers of Augsburg 39
Funen (Fyn), Denmark 305

Galicia 124, 298, 310, 333–34, 338, 340–41
Galileo 22–23, 33, 62, 70
Garampi, Giuseppe 349, 353, 364, 374
Gärber, Johann Gustav 248
Gauss, Carl Friedrich 298
Gazette de France 287
Gazette de Vienne 96
Generalreformator 60
geodesy 84, 124, 143, 181, 218, 266
"Geographical Latitude of Several Places" (Hell) 215
Géographie historique, ecclésiastique et civile (Vaissète) 242
geography 23, 44, 84, 92, 97, 148, 176, 225, 242, 259, 323, 371, 398
George III (king) 354, 366, 375–76
Georgia Augusta, Göttingen 283
Georgian star 375
Germany 12, 23, 25, 55, 76, 101–2, 109, 111, 152, 168–69, 182, 199, 290, 293, 322, 341, 344, 369
  Geschicte Sibiriens bis auf die Eroberung ...(Fischer) 365

Gesta Hungarorum (Anonymus) 240–41, 247
Giunta Economale 309
Gmunden, Austria 68
Godefridus Hierosolymitanus (Frantz) 63
gold 39, 49
Gothenburg, Sweden 215
Göttingen, Germany 26, 33, 100, 111, 114, 151, 169–70, 176, 202, 221, 233, 235, 243, 248, 277, 283, 298, 305, 332, 345, 363–64, 377, 385
Göttingische Anzeigen von gelehrten Sachen 169
Gottsched, Johann Christoph 108, 316
Graham, George 156
Grammatica linguae Ungaricae (Pereszlényi) 44
Grammatica, Lappish grammar (Leem) 237
Grass, Theresia 383
Graz, Austria 57, 68–69, 73, 75, 82, 85, 113, 123–24, 131–33, 151, 178, 211, 305, 330, 334, 336–38, 341–42, 350, 396
Graz observatory 68, 75, 131–32, 151
Green, Charles 138, 181, 279, 287, 294. *See also* Cook, James
Greenwich, United Kingdom 408
Greifswald, Germany 113, 128, 160, 368
Grueber, Anton 54
Guldin, Paul 68
Gulf Stream 229
Gunnerus, Johan Ernst 180, 200, 204–5, 214, 221–22, 224–25, 264
  Flora Norvegica 221
gunpowder 99
Güsman, Franz 339–40
gutta nigra. See black-drop effect
Gyarmathi, Sámuel 235
  Affinitas linguae Hungaricae cum linguis Fennicae originis grammatice demonstrata 235
gymnasium 34–35, 41–42, 53, 58, 64–65, 75, 81, 123, 129, 141, 370, 376, 396
Gyöngyös, Hungary 65, 396
Győr (Jaurinum, Raab), Hungary 42, 128–29, 373, 396

Habsburgs 6, 42, 44–45, 77–78, 81, 108, 307, 311, 314–15, 322–23, 351, 361, 388
  dynasty 76, 110, 519
  ecclesiastical reforms 317
  enlightened absolutism 307, 324
  monarchy 6–7, 16, 33–39, 41, 43–45, 47, 49, 51, 53, 55–57, 59–67, 69, 71, 73, 75–79, 81, 83, 85, 87, 89, 91, 93, 98, 100, 106–8, 110–11, 121, 124–25, 128–29, 131, 137, 140–41, 143, 146–47, 149, 152–53, 166, 174, 187, 215, 230, 235, 277, 306–8, 310, 312, 315–17, 321–22, 324, 329–33, 339, 341, 345, 349, 366, 369, 372, 378, 387–88, 390–92
Haid, Johann Elias 2–3
Hajnóczy, József 323
Halley, Edmond 69, 96, 119, 135, 138, 140, 151, 155–60, 165, 183
  "Methodus singularis quâ Solis..." 135
Halley's Comet 96, 119, 151
Halloy, Peter 132
Hamburg, Germany 13, 113, 198–99, 231, 233, 298, 305
Hanseatic League 38
Harrison, John 155
Hartmann, Ferdinand 83–84
Hatvani, István 118–21, 150
Haunold, Johann 40
Hauser, Berthold 151
Heidelberg, Germany 102, 114, 118, 141–42
Heinsius, Gottfried 199, 262
heliocentrism (heliocentric cosmos) 21–23, 25
Hell, Maximillian
  Adjumentum memoriae manuale chronologico-genealogico-historicum 70
  Animadversiones 229, 250
  Anleitung zum nützlichen Gebrauch der künstlichen Stahl-Magneten 85, 94
  Arctic expedition led by 3, 75, 127, 129, 136, 173, 297, 303, 333, 344, 367, 369, 390
  astronomers of Paris and 102, 277, 284, 293
  Aurorae borealis theoria nova 126, 216, 226–27
  Austrian Academy of Sciences plans 306
  Beyträge zur Praktischen Astronomie 354
  Borchgrevink, Jens Finne and 301
  Celsius, Anders and 226, 228–29
  change of name's orthography 37

Hell, Maximillian (cont.)
De satellite Veneris 125–26, 163–64, 167
death of 108, 228
Dominus ac redemptor noster and 391
eclipses of Sun and Moon 261
Elementa arithmeticae numericae et literalis, exposita a Joanne Crivellio 69, 88–89
Elementa mathematica naturali philosophiae ancillantia 88
Eszterházy, Károly and 106, 129–30, 148, 343, 353–54, 369–70
Exercitationes arithmeticae 88
Expeditio litteraria 193, 209, 211, 213, 215–21, 223, 225, 227, 229–31, 233, 235, 237, 239, 241, 243, 245–47, 249, 251, 253, 255, 257–59, 297, 306, 333, 350, 362–63, 366, 374
Faye, Étienne Albans and 302–3
Flora Danica and 221
Frederick II for 365
freemasons and 363
Hatvani, Istvan and 119–21, 150
Lappish and Hungarian language for 251
Liesganig, Joseph and 119, 123–26, 128, 132, 142–43, 146–47, 190, 298, 333–34, 336, 338, 340–43
Lis astronomorum 375–77
longitude of Vardø 258, 260–61, 284
magnetism and 35, 84–86, 88, 167, 220, 226–27, 345, 357–60
modern scholarship and 4, 7
Münter, Friedrich on 364–65
Newton, Isaac and 4, 70, 76, 118, 218
Nova acta eruditorum and 101, 164, 168, 216
"Observationes astronomicae Agriae in Ungaria..." 372
"Observationes astronomicae anni 1761 & 1762..." 54
"Observationes astronomicae et caeterae..." (Hell) 156, 202, 263, 265, 273, 301
"Observationes Astronomicae in Novo Observatorio..." 372
"Observationes astronomicae latitudinum, et longitudinum..." 12–13, 215, 259, 263, 333, 370
"Observationes astronomicae latitudinum geographicarum..." 370–71
Observatio transitus Veneris (*1761*) 122, 145–52, 163, 296, 340
Observatio transitus Veneris (*1769*) 122, 187, 189, 193, 202, 211, 259, 261–62, 267–69, 278, 283, 301
Physikalischer Almanach 348
Pingré, Alexandre Guy and 286
Pray, György and 64, 199, 240–42, 246–52, 254–55, 331, 361, 379, 384
Sajnovics, János and 5, 65, 75, 128–29, 172, 198–201, 203–5, 207–8, 211–16, 218, 221–22, 224–26, 228, 230–31, 234–42, 246–47, 249–58, 261, 264–65, 267–69, 272–74, 276–77, 281, 284, 287, 300–2, 305, 335, 338–39, 357, 362, 370, 379–81, 383–84, 387
solar parallax and 4, 113, 135, 137–38, 140, 144, 155, 159–60, 165, 168, 183, 258–61, 263, 269, 280–82, 285–96, 299, 301–3, 306, 368, 389–90
"Supplementum dissertationis de parallaxi Solis" 294–95
Szerdahely, György Alajos and 375–78
Thott, Otto and 238
Uranus and 71, 375, 377
Varia compendia praxesque operationum arithmeticarum 88
Venus transit report 122, 145, 154, 156, 211, 215, 225, 260–63, 265, 268–69, 279, 334
von Zach, Franz Xaver and 123, 263, 298–99, 302, 333–34, 341–43
Hellant, Anders 181, 263, 283
Helsingborg, Sweden 203, 215
Helsingør, Denmark 203, 215
Herbert, Joseph 147–48
heresy 41, 350
Herschel, Frederick William (Friedrich Wilhelm) 354, 375–77
Hevenesi, Gábor 44
Heyne, Christian Georg 322
Hiorter, Olof 228
Histoire de l'Académie Royale des Sciences 103, 146, 158, 165, 179, 182, 210, 294
Histoire générale des Huns, des Turcs, des Mongols... (de Guignes) 240
Historia astronomiae (Weidler) 119
Historia Regni Hungariae (Kazy) 63
Historia Uraniae musae (Szerdahely) 375
Hoffmann, Gotthold 151–52

Höll, Ignaz Cornelius 46
Höll, Joachim Michael 47
Höll, Joseph Karl 46–47, 49, 41, 53, 55
Höll, Matthäus Cornelius 44, 47, 51
Höll, Maximilianus Rudolphus 37
Holland 154, 195, 197, 218, 270
Holstein, Germany 180, 197, 305
Holstein, Johan Ludvig 180
Holy League 45
Holy Roman Empire 16, 44, 56, 195, 197
Holy See 197
Horányi, Elek 241, 373
Hornsby, Thomas 160, 183
Horrebow, Christian 178–80, 188, 199, 202–3, 222, 224, 259, 261, 264
Horrebow, Peder the Younger 179
Horrocks, Jeremiah 134
Hron (Granus, Garam) River 37
Hsiung-nu 240. *See also* Huns
Huberti, Franz 102, 150, 168
Hudson Bay, California 271, 278, 287, 296, 309
Hungary 3, 5–7, 34, 36–38, 40–47, 49–50, 54–59, 63–66, 72, 75–78, 83, 89–90, 98, 101, 109–10, 118, 123–24, 128, 143, 149–50, 230–31, 233, 239–42, 244, 247–48, 251, 275, 307, 310, 312–15, 320, 322–24, 326–29, 331, 335, 338, 343, 347, 351, 361, 365, 368–76, 378–83, 386–87, 392
  Hungarian diet 313, 317
  Hungarian National Museum 323
  Hungarian–Sámi (language) kinship 241
  Hun–Hungarian kinship 240
Huns 240–41, 249, 254, 256, 328–29, 382, 386
Hviid, Andreas Christian 218, 345, 349–50, 353, 364
hydraulics 23, 53, 73
  hydraulic machines 49
hysteria 358

Iceland 112, 177, 229, 238, 369
illuminati 320–21
Imperial Academy of Sciences, St. Petersburg 107, 192
Imperial and Royal Library, Vienna 254
Imperial and Royal Observatory (Vienna University Observatory), Vienna 1, 34–35, 67, 86, 90–93, 95–97, 105–8, 111, 117, 122, 124, 127–29, 133, 140, 143, 145–49, 154, 166–67, 187, 202, 253, 264, 295, 300, 302–3, 306–7, 331–34, 340–42, 349, 352, 375, 388, 391
Imperial Court Chamber, Vienna 38, 48–49, 71
Imperial Observatory, Vienna. *See* Imperial and Royal Observatory
Ingenhousz, Jan 358
Imperial Observatory, St. Petersburg 154
Ingolstadt, Germany 111, 113, 150, 261, 305, 320, 357, 368
Innocent XI (pope) 13
Innocent XII (pope) 13
Innsbruck, Austria 117, 365
Institutiones astronomiae theoreticae (Scherffer) 69
Institutiones physicae (Jaszlinszky) 88
Institutionum Physicae Pars Prima, seu Physica Generalis (Scherffer) 68
Istanbul, Turkey 63
Italy 14, 23, 110–11, 145, 150, 152, 191, 290, 368

Jáchymov (Sankt Joachimsthal) 50
Jacobin conspiracy 386
Jakarta, Indonesia 144, 177
Jánossi, Miklós 82
Jansenism 15, 61
Japan 177
Jászapáti, Hungary 371
Jaszlinszky, András 88
  Institutiones physicae 88
Jazigs 247
jellyfish 214, 224
Jena, Germany 50, 200
Jesuitism 17, 19, 350, 363
Jesuits
  accommodation 6, 16, 26, 36, 352, 392
  Catherine the Great and 331
  Catholic Enlightenment and 7, 11–13, 16–18, 36
  civic humanism 21
  curriculum 23
  dissolution of 83, 185, 295, 312, 317, 331–32, 353, 367
  distinctiveness 19–20
  Dominus ac redemptor noster 312, 344, 391
  education 20–21, 55, 60, 310
Enlightenment 18
  ex-Jesuits 83, 330, 332, 339, 342–43, 345, 347, 351

Enlightenment (cont.)
Frederick II and 352, 365
Joseph II and 63, 83, 309–14, 333, 339, 342
missionaries 220, 296, 305, 363
missions 340
natural philosophy 23
network 91–133, 152, 154, 168, 189, 341, 364
observatory, Vienna 60, 67–68, 91, 103, 119, 122–25, 127, 143, 146–47, 333–36, 341
science 4, 6–7, 17, 21, 23–24, 26, 36, 81, 103, 148, 152, 342, 351, 392
suppression 17, 25–26, 35, 55, 61, 66, 73, 81, 84, 106, 114, 123, 129, 141, 187, 235, 241, 298, 307, 310–12, 317, 330–37, 340, 344–45, 351, 353–54, 361, 366, 370, 389–91
teaching 20
Transylvania mission 78
Joannes Physiophilus. *See* von Born, Ignaz
Joseph I (emperor) 49
Joseph II (emperor) 63, 83, 96, 309–14, 317–19, 322, 324, 333, 339, 342, 352, 355, 370, 391
Patent of Toleration, Germany and Bohemia 312–13
Patent on Freemasonry 322
Josephism 35, 61, 323, 365
Journal de Trévoux 24–25
Journal des Sçavans 101, 110, 165, 168–70, 216, 235, 278, 283, 287, 293, 368
Journal enyclopédique 284
Journal für Freymaurer 321
Judenburg, Austria 74–75, 396
Jungnitz, Longinus Anton 227, 354
Jutland 305

Kampmiller, Ignaz 79–80, 311
Kancelli, Danske 186, 189
Kant, Immanuel 8, 270, 375
Allgemeine Naturgeschichte und Theorie des Himmels 375
Kaprinai, István (Stephanus) 64, 246–247, 331, 383
Karelian 232, 237
Karlovy Vary 46
Kästner, Abraham Gotthelf 114, 159, 169–70, 283, 332, 364, 377–78
Katona, István (Stephanus) 64, 244, 246–47, 331
Kaunitz-Rietberg, Wenzel Anton 62, 147, 186, 190, 198–99, 250, 307, 310–12, 316, 345
Kayserlich königlich allergnädigst privilegirte Realzeitung 355–56
Kazinczy, Ferenc 322
Kazy, Ferenc 63–64, 66, 74
Kepler, Johannes 24, 68, 131, 134–35
Kéri Borgia, Ferenc 62–63, 66, 74–75
Kézai, Simon 240–41, 328
Khazaria 247
Khevenhüller-Metsch, Johann Joseph 108
Kircher, Athanasius 23, 122
Kjelvik, Norway 206, 213–14
Klagenfurt, Austria 73, 133, 396
Kláštor pod Znievom (Zniováralja) 41
Klesl, Melchior 60
Klingenstierna, Samuel 153
Kollár, Adam František (Franz) 64–66, 74, 254–56, 348, 362, 381–83
De originibus et usu perpetuo... 381
Hungaria et Atila, sive de originibus gentis Hungariae 381
Komárom (Komárno, Comaromium, Komorn), Hungary 66, 123, 396
Kongelig Astronom 178
Königsegg family 71–72
Königsegg, Karl Ferdinand 71
Koppi, Károly 384
Košice (Kassa, Cassovia, Kaschau), Slovakia 39, 42, 45, 50, 82, 123, 129, 373, 384, 396
Kraków, Poland 149, 300
Kratz, Georg 150
Kratzenstein, Christian Gottlieb 177–78, 180, 201–2
Kremnica, Slovakia 37, 39, 41, 45
Kremsmünster monastery, Austria 71, 93–94, 113, 131, 151, 288, 305, 334–36, 341, 368–69, 372
Kunstmeister 54
"Kurzer Unterricht der Oster-Feyer für den gemeinen Mann" (Hell) 100–1
Kven, language 237

La Condamine, Peru 75, 124
Lacy, Franz Moritz 370
Laínez, Diego 20

Lambach, Austria 330, 336, 341
Lapland, Finland 2, 32, 174, 182–84, 209–10, 231, 237, 246, 255, 263, 276, 352
Lappianism 380, 385
Lapponia (Schefferus) 233, 236, 242, 244, 383
Lapps 209, 212, 215, 225, 230, 234–37, 239, 242–43, 245, 253, 255, 269, 362, 380, 384, 386
latitude 84, 119–20, 140, 157, 202, 204, 212–13, 228, 258–59, 262–66, 280, 284, 301, 370. *See also* longitude
Le Gentil de la Galaisière, Guillaume 103, 144
Le Jay, Claude 59
league of the Rhineland towns 38
league of the Spiš towns 38
Leclerc, Georges-Louis Leclerc
  Histoire naturelle, générale et particulière 254
Leem, Knud 230–31, 236–38
  Grammatica 237
  Nomenclator 236–37
Leibniz, Gottfried Wilhelm 18, 25, 70, 72, 107–8, 118, 232, 345
Leiden, The Netherlands 13, 24, 30, 51, 78, 90, 107, 118–19, 173, 230, 324, 338
Leipzig, Germany 59, 101, 113, 164, 168, 198–99, 216, 233, 303, 320, 359
Leitha River 2, 388
Leopold I (emperor) 43, 79
Leopold II (grand duke, king of Hungary, Holy Roman emperor) 312, 374
Leopold of Tuscany (grand duke). *See* Leopold II
Leroy, Julien 202
Levoča (Lőcse, Leuchovia, Leutschau), Slovakia 34, 42, 45, 57–58, 63, 71, 396
Lexell, Anders Johan 114, 168, 279, 282–83, 289–96, 368
Liechtenstein, Prince 143
Liesganig, Joseph 119, 123–26, 128, 132, 142–43, 146–47, 190, 298, 333–34, 336, 338, 340–43
  Dimensio graduum meridiani Viennensis et Hungarici 124
Lima, Peru 65
Linnaeus, Carolus 107, 174–75, 181, 200, 209, 211, 244
Linnean empire 174
Linneas (*Linnaea borealis*) 212
Linz, Austria 47, 73, 123, 133, 305, 337, 340, 396
Lis astronomorum (Hell) 375–77
Ljubljana, Slovenia 40, 111, 113, 141, 151, 340, 396
Locke, John 18, 118
lodge (masonic) 52, 319–22
  Hungarian 322
  Pest 322
  Zur wahren Eintracht 52, 320–22, 361
Lombardy, Italy 91, 309–10
Lomonosov, Mikhail Vasil'evich 161
London, United Kingdom 1, 9, 21, 28, 76, 109, 134, 145–46, 153, 155, 170, 175–76, 180, 183, 185, 189–92, 217, 221, 298, 307–9, 319–20, 344, 346, 349, 357–58, 366
longitude 84, 120, 122, 140, 157–59, 165, 170, 202, 204, 258, 260–61, 266, 280, 284, 289–90, 293, 301. *See also* latitude
Louis II (king) 40
Loyola, Ignatius of 20, 59, 250, 339, 362–63, 370
Lund, Sweden 113, 369
Luther, Martin 27, 40–41, 117
Lutheran 15, 41, 58, 90, 150–53, 233, 298, 374
Lutheranism 77
Lviv, Ukraine 113, 148–49, 298, 330, 333–34, 340–41, 343, 365
Lyngen, Norway 224
Lysogorski, Dominik (abbé) 111, 148–49, 334

Madarassy, János 130, 353, 369–70, 373
Madrid, Spain 103, 109, 111, 113, 141–42, 153, 166
magnates 42, 44–45
magnetism 35, 84–86, 88, 167, 220, 226–27, 345, 357–60
magnets 85, 87, 167, 359–60
Magyar 5, 37, 44, 47–48, 50, 55, 63–66, 74, 86, 90, 105, 118, 129, 170, 199, 232, 240, 244–45, 247–49, 252, 255, 260, 315, 325–26, 375, 378, 380–82, 387, 392
Magyar Tudományos Akadémia 5, 37, 47–48, 199

Magyarországnak törvényes állása (Bessenyei) 328–29, 383
Makó, Pál 347
Malebranche, Nicolas 18
Mannheimer Zeitung (Mannheim newspaper) 354–55
Mappa geographica novissima regni Hungariae (Müller) 370
Marburg, Germany 118
Maria Theresa (empress and queen of Hungary) 34, 54, 60, 71, 79, 91–92, 98, 107, 127, 130, 147, 195, 299, 307, 309–14, 324–25, 331, 351, 370, 381, 383, 391
Marinoni, Johann Jakob (Giovanni Jacopo) 67, 91–93, 95, 105, 121, 398
Markscheidekunst 71–72
Maskelyne, Nevil 144, 170, 180, 183–84, 191, 217, 261, 278, 367
Måsøy, Norway 213
mathematics 21, 23, 25, 34, 44, 46, 48, 50, 53, 59–60, 62, 66, 68, 70–73, 76, 82–85, 88–89, 93, 117–19, 123, 125, 129, 131–33, 141, 148, 151, 205, 220, 282, 334–35, 337, 339–40, 346–47, 350, 370–71, 390, 396
Mayer, Anton 337–38
Mayer, Christian 95, 99, 102, 113–14, 116, 141–42, 150–51, 159, 164, 168, 190–91, 202, 260–61, 263, 277, 282–83, 295–96, 337, 354–55, 366
  Ad Augustissimam Russiarum omnium Catharinam II 159, 190, 260
Mayer, Tobias 113, 151, 202, 277, 283
Mayr, Johann Baptist 55, 151, 395
Mayr, Joseph 131–33
Mead, Richard 357
mechanics 1, 48, 53, 73, 87, 92, 104, 135, 141, 346, 390, 398–99
medicine 18, 21, 59, 83, 107, 118, 199, 356–58, 360
Melk, Austria 93, 330, 335–36
Memoire sur le passage de Venus (de Lalande) 288
"Mémoire sur le passage de Vénus du 3 Juin 1769" (de Lagrange) 182
Mémoires pour l'histoire des sciences et des beaux-arts 24. *See also Journal de Trévoux*
Mercury, planet 135, 138
Merz, Alois 362, 365
Mesmer, Franz Anton 85, 88, 167, 357–61
  Dissertatio physico-medica de planetarum influxu 139
Messier, Charles 167, 176, 225, 229, 246, 263, 408
"Methodus singularis quâ Solis…" (Halley) 135
Michaelis, Johann David 176
microscope 223–24
Middle Ages 76, 80, 240
Migazzi, Christoph Anton 61
Mikoviny, Sámuel 50–51, 53
Milan, Italy 91, 103, 113, 126, 152, 336, 368
military technology 23
Millot, Claude-François-Xavier 326
mining 34, 37–40, 42–44, 46–52, 54, 57, 71–73, 104, 107, 143, 320–21
  academy (Bergbauakademie) 50, 52, 107
  companies 48
  school 46, 49, 73
  towns 37, 39, 42
Molnár, Albert Szenczi 42, 65, 238
  Nova grammatica Ungarica 238
Moltke, Adam Gottlob 189, 199–201, 274
monarchy 6–7, 11, 16, 34–36, 47, 56, 62, 64, 66, 78, 93, 98, 110–11, 125, 128, 131, 140, 146, 149, 166, 173, 175, 202, 235, 246, 306–7, 313–15, 321, 324, 326, 329–30, 345, 350, 369, 372, 378, 387–88
monasticism 52
Montaigne, Jacques 162
Montanistiche Schule 49
Montesquieu, Charles-Louis de Secondat 323–24, 326
  Spirit of the Laws 324
Moravia 56, 98, 108, 381
Morton, Charles 189–90
Moser, Johann Jakob 2
Mozart, Wolfgang Amadeus 5, 352
Müller, Caspar 122, 148–48, 156
Müller, Heinrich 51
Müller, Ignaz 311, 348, 370
  Mappa geographica novissima regni Hungariae 370
Münster, Germany 15, 44, 52
Münter, Gerhard Friedrich 364–66
Muratori, Lodovico Antonio 100
Muscovy 111, 143

Museum Mathematicum, Vienna 68, 84, 141
Museum of Natural History, Vienna 52

Naples, Italy 9, 113, 200
Nautical Almanac, London 109–10, 170
navigation 23, 263, 342
Nemesis Theresiana 317
Netherlands 71, 319
New World 39, 47
Newcomb, Simon 303–4
  "Discussion of Observations of the Transits of Venus in 1761…" 303
Newton, Isaac 14, 18, 25, 30, 62, 70, 76, 118, 218
  Newtonian astronomy 25
  Hell, Maximillian and 4, 70, 76, 118, 218
  Principia 76
  telescope 121–22, 84
  theory of gravity 86, 135, 218
Newtonianism 69, 88
Niebuhr, Carsten 176–78, 202, 222–24, 263–65
Nilson, Johann Esaias 219
Nomenclator (Leem) 236–37
Norges Naturlige Historie (Pontoppidan) 221, 223
northern lights. *See* aurora borealis
Norway 2, 87, 95, 124, 172, 174, 179–86, 195, 200–1, 203–4, 207–9, 212–13, 215, 220–21, 227–28, 236–39, 259, 279, 286, 295, 305, 340, 344
Notitia Hungariae (Bél) 50, 323
Nova acta eruditorum, Leipzig 101, 164, 168, 216
Nova grammatica Ungarica (Molnár) 238
Nova reformatio, University of Vienna 59
Novaya Zemlya, Russia 229
Novi commentarii Academiae Scientiarum Imperialis Petropolitanae. St. Petersburg 160, 164, 262, 282
Nuremberg, Germany 50–51

Oberkunstmeister 48, 53
Oberperfuss, Austria 117
"Observationes astronomicae Agriae in Ungaria…" 372
"Observationes astronomicae anni 1761 & 1762..." (Hell) 154
"Observationes astronomicae et caeterae…" (Hell) 156, 202, 263, 265, 273, 301
"Observationes astronomicae in Novo Observatorio…" (Hell) 372
"Observationes astronomicae latitudinum, et longitudinum…" (Hell) 212–13, 215, 259, 263, 333, 370
"Observationes astronomicae latitudinum geographicarum…" (Hell) 370–71
Observatio transitus Veneris (*1761*) (Hell) 122, 145–52, 163, 296, 340
Observatio transitus Veneris (*1769*) (Hell) 122, 187, 189, 193, 202, 211, 259, 261–62, 267–69, 278, 283, 301
Observationes meteorologicae in insula Maris Glacialis Wardoehus dicta (Hell) 358
Observatoire Royal, France 124, 146
observatoriolum australe 267
observatories
  Altdorf 51
  Benedictine, Kremsmünster 93–94, 151, 334–35, 341
  Benedictine, Lambach 336
  Bologna 152
  Brera, Milan 152
  Buda 335, 338–39, 343, 369, 372
  Castle Wetzlas, Pölla 121–22
  Eger 130, 170, 191, 367–70, 372–73, 378
  Graz 68, 73, 75, 131–33, 151, 336–37, 341
  Imperial and Royal Observatory (Vienna University Observatory), Vienna 1, 34–35, 67, 86, 90–93, 95–97, 105–8, 111, 117, 122, 124, 127–29, 133, 140, 143, 145–49, 154, 166–67, 187, 202, 253, 264, 295, 300, 302–3, 306–7, 331–34, 340–42, 349, 352, 375, 388, 391
  Imperial Observatory, St. Petersburg 154, 277
  Jakarta 192
  Jesuit Academy, Cluj 76, 82–84, 335
  Jesuit Observatory, Vienna 60, 67–68, 91, 103, 119, 122–25, 127, 143, 146–47, 333–36, 341
Kraków 149
  Lyon 153
  Lviv 333–34
  Marinoni's home, Vienna 91
  Pondicherry 144
  Royal Observatory, Greenwich 170
  Royal Observatory, Stockholm 153
  Royal Observatory, Uppsala 184

Kraków (cont.)
Rundetårn (Round tower) Observatory, Copenhagen 178, 199, 202, 263
Seeberg 298
University of Trnava, Trnava 74–76, 86, 150, 231, 338–39, 342, 369
Vardø 122, 172, 206, 208, 226–27, 258, 261–63, 266, 273
Vilnius 367
von Matt, Elisabeth's, Vienna 122
Oeder, Georg Christian 221
Oláh, Miklós 41, 381
Oldenburgs 6. *See also* Habsburgs
Olomouc (Olmütz), Moravia 108, 114
Orczy, Lőrinc 380–81, 384–86
"Errors of Star-Watcher Sajnovits and Hell Being Refuted" 380
Ordo divinorum (Order of divine services) 41
Orenburg, Russia 302
Oriental Academy, Vienna 60, 62–63, 67, 107
Osnabrück, Germany 15, 44
Österlin, Franziska 358–59
Ottoman wars 42
Ottomans 37, 42, 44, 56, 78, 335

P. Hell's Reise nach Wardoe (von Littrow) 71, 104, 300–1
Padua, Italy 103, 111, 142, 152
papacy 45
Papal States 124, 217, 331
Paradis, Maria Theresia 358
Pars Secunda seu Physica Particularis (Scherffer) 68–69
Passau, Germany 55, 131, 141, 305, 396
Patent of Toleration, Germany and Bohemia (Joseph II) 312–13
Patent on Freemasonry (Joseph II) 322
Paus, Hans 212
Pavia, Italy 125–26, 189–90
Pázmány, Péter 42, 65
Peace of Karlovci 45
Peace of Satu Mare 45
Pereszlényi, Pál 44, 238
Grammatica linguae Ungaricae 44
Peru 65
Pézenas, Esprit 114
Pezzl, Johann
Skizze von Wien 352
Philadelphia, United States 1, 96, 224, 243
Philosophical Transactions of the Royal Society of London 145, 170, 278
Physikalische Arbeiten (Zur wahren Eintracht) 321
Physikalischer Almanach (Hell) 348
Pietism 323
Pilgram, Anton 127, 197, 202, 205, 216, 222, 224, 253, 261, 264, 334, 367–68, 375
Pingré, Alexandre Guy 103, 155, 160, 165, 182, 285–86, 294–95
Pius VI (pope) 318, 365
Planman, Anders 113, 155, 160, 280–83, 285, 288–95
Plongeron, Bernard 12–13, 15
"Recherches sur l'Aufklärung catholique en Europe occidental, 1770–1830..." 15
Poda, Nikolaus 49, 51, 73–74, 131, 151
Pohl, Wenzel 2, 219
Poland 12, 45, 58, 111, 118, 124, 149, 314, 331, 333
Poland–Lithuania 45, 149
Polizeywisswenschaft 308
Polling, Bavaria 113
polygamy 80
Pondicherry, India 112, 144
Pont-à-Mousson, France 113–14
Pontoppidan, Erik 221, 223–24
Norges Naturlige Historie 221, 223
Portugal 75, 187, 191
Potosí, Bolivia 39
Powalky, Karl Rudolph 301–2
Prager Gelehrte Nachrichten, Prague 362
Prague, Czech Republic 43, 49, 52, 109, 113–14, 131, 134, 151, 198, 300, 320, 342, 350, 361–62, 369, 372
Pray, György 64, 128, 199, 240–42, 246–52, 254–55, 331, 361, 379, 384
Annales Ungaria 249
Annales veteres Hunnorum Avarum et Hungarorum 240, 249
Dissertationes historico-criticae in annales veteres Hunnorum, Avarum et Hungarorum 249
Prešov (Eperjes, Eperiesinum, Preschau), Slovakia 42, 45, 396
Priesterseminar (Migazzi) 61
Privatgesellschaft 52

Protestant Reformation 11, 14–15, 77. *See also* Reformation
Protestantism 41, 58, 77, 117, 366
Prussia 331–32, 365
Ptolemy 23
Pütter, Johann Stephan 2

Questionibus oeconomicis, & ad usum Civilem ac Mercatorum applicatis declaratae 89
Quito, Peru 75

Rákóczi war 45
Rákóczi, Ferenc II 45
Ratio educationis (1777) 83, 314, 325, 373
Ratio studiorum (1599) 18, 20, 43
Rautenstrauch, Franz Stephan 93, 348
Rebsdorf Abbey, Bavaria 55
"Recherches sur l'Aufklärung catholique en Europe…" (Plongeron) 15
Recueil pour les astronomes (Bernoulli) 101, 171
Reform Catholicism 12
Reformation 7, 11, 14–15, 20, 40–41, 59, 77, 185, 310, 315
  Counter-Reformation 7, 310
  Counter Counter-Reformation 315
  Protestant 11, 14–15, 77
Reformed University, Cluj 85
religious pluralism 7, 44
Renaissance 20
Renaissance humanism 11
Republic of Letters 6, 10, 21, 23, 32, 35, 90, 114, 121, 141, 150, 161, 192, 197, 209, 216, 257, 269–70, 274, 277, 298, 321, 329, 345, 347, 353, 366, 389, 390. *See also* Enlightenment
Ricci, Julian 336
Ricci, Lorenzo 186–87, 195
Riccioli, Giovanni Battista 24, 168–69
  Almagestum novum 168
Rieger, Christian 109, 141–42, 147, 153, 166, 362
Rijeka, Croatia 340, 396
Roma ("gypsies") 77
Rømer, Ole 178
Rossignol, Professor 149
Rousseau, Jean-Jacques 2, 323
Royal Court Library, Vienna 64
Royal Danish Society of Sciences, Copenhagen 172, 177, 179, 200, 227, 239, 252, 268, 273, 277, 284, 390
Royal Observatory, Stockholm 153
Royal Observatory, Vienna. *See* Imperial and Royal Observatory
Royal Society for Science, Uppsala 175
Royal Society of Copenhagen, Copenhagen. *See* Royal Danish Society of Sciences
Royal Society of London, London 183, 189–91, 217, 366
Rožňava (Rozsnyó, Rosnavia, Rosenau), Slovakia 42, 397
Rudbeck, Olof [Olaus] 248
Rumovskii, Stepan Yakovlevich 160, 164, 294
Rundetårn Observatory, Copenhagen 178, 199, 202, 263
Russia 45, 145, 148, 153–54, 161, 174, 182, 192, 229, 232–33, 271, 290, 302, 331–32, 352, 365
Russian Empire 232, 364

Sacred Heart devotion 366
Sajnovics, János (Joannes) 5, 65, 75, 128–29, 172, 198–201, 203–5, 207–8, 211–16, 218, 221–22, 224–26, 228, 230–31, 233–42, 246–47, 249–58, 261, 264–65, 267–69, 272–74, 276–77, 281, 284, 287, 300–2, 305, 335, 338–39, 357, 362, 370, 379–81, 383–84, 386–87
  Demonstratio Idioma Ungarorum et Lapponum idem esse 234–43, 246–52, 254–56, 258, 362, 378–80, 383, 385–87
  Hell, Maximillian and 5, 65, 75, 128–29, 172, 198–201, 203–5, 207–8, 211–16, 218, 221–22, 224–26, 228, 230–31, 234–42, 246–47, 249–58, 261, 264–65, 267–69, 272–74, 276–77, 281, 284, 287, 300–2, 305, 335, 338–39, 357, 362, 370, 379–81, 383–84, 387
Sajnovics, Matthias 128
Sallioth, M. T. 207
Salzburg, Austria 55, 93, 128
Sambach, Caspar 111, 122, 147, 261
Sámi 35, 65, 129, 205–6, 209, 211, 213, 225, 230–35, 237–238, 240–45, 251, 253–55, 380–81, 386, 389. *See also* Lapps
  Sámi–Hungarian kinship 242, 253

satellites (*Fixsterntrabanten, Nebenplaneten*) 126, 260, 355
Saxony, Germany 38, 45, 117, 152, 195, 198
Schefferus, Johannes 233, 236, 242
Lapponia 233, 236, 242, 244, 383
Scherffer, Karl 62–63, 68–69, 75, 125–26, 131, 190, 210–11, 220, 340, 347, 354
Institutiones astronomiae theoreticae 69
Institutionum Physicae Pars Prima, seu Physica Generalis 68
Pars Secunda seu Physica Particularis … 68–69
Schleswig, Germany 305
Schlichtegroll, Anton Heinrich Friedrich 1, 5, 67, 71, 104
Scholastic theology 18
Schönbrunn gardens 51
Schøning, Gerhard 259, 305
Schöttl, Johann Baptist 151
Schumacher, Christoph Sigismund 100–1, 118, 150, 186, 220
Schwandtner, Johann Georg 241
Schwetzingen, Germany 95, 111, 113–14, 150, 305
Schytte, Erik Gerhard 224
scurvy 356–57
Scythia 245
Scythianism 328
secularism 9
Seitenstetten, Austria 341
Seminarium Nobilium. *See Collegium Theresianum*
seminarium or *convictus nobilium*, Jesuit 44
Seutter, Matthäus 55, 395
Seven Years' War 124, 144, 308
Short, James 160
Siberia, Russia 103, 136, 144, 146, 232–33, 279
Sibiu (Nagyszeben, Cibinium/Hermannopolis, Hermannstadt), Romania 80, 84, 396
Silesia 56, 365
Silva Parnassi Pannonii (Szerdahely) 375
silver 39, 49, 72
Simen, Johann Peter 311
Skizze von Wien (Pezzl) 352
Skleno, Slovakia 52, 73
slavery 45
Slavs 55, 383
Slovakia 5, 34, 37, 55
Smith, Adam 270, 358
Societas Eruditorum Incognitorum in Terris Austriacis, Olomouc 108
Societät der Bergbaukunde 52
Society of Jesus. *See* Jesuits
Solander, Daniel 175, 181, 287
solar eclipse 122, 157, 162, 260–61, 274, 276, 334
solar parallax 4, 113, 135, 137–38, 140, 144, 155, 159–60, 165, 168, 179, 183, 252, 258–61, 263, 269, 280–82, 285–96, 299, 301–3, 306, 368, 389–90
solar system 113, 135, 137–38, 186, 297, 375, 389
solar tables 113
Sophia Dorothea (duchess of Württemberg/empress of Russia) 352. *See also* Maria Feodorovna
Sopron (Sopronium, Ödenburg), Hungary 42, 397
Spain 16, 75, 111, 142, 145, 153, 190–91
Specimen Hungariae litteratae (Czvittinger) 233
Specimen monachologiae, methodo Linnaeano… (von Born) 361
Spirit of the Laws (Montesquieu) 324
Spiš (Szepes, Scepusium, Zips), Slovakia 37–38, 58, 397
Spitsbergen, Norway 229
Spittelberg, Vienna 111, 147
St. Petersburg, Russia 103, 109, 111, 114, 142–43, 153–54, 159, 161, 164, 190, 192, 199, 233, 261, 269, 277–79, 281–83, 290–92, 294–96, 368
St. Petersburg Academy, Russia 161, 192
Staindl, Julianna Victoria 46
Staudacher, Sigmund (Zsigmond) 41
Stephansdom 92
Stephen I (king/saint) 247
Stepling, Joseph 109, 114, 151, 362
Stimmen aus Maria Laach 304
Stimmen der Zeit 304
Stimmungsberichte 318
Stockholm, Sweden 103, 111, 114, 153–54, 170, 178, 184, 228, 232, 246, 261, 269, 276, 278–83, 291–96, 337, 345, 348
studia humanitatis 20, 41
Studien- und Zensurkommission 318

Studien-Hofkommission 64
Styria, Austria 74
sugar 356–57
Sun's parallax. *See* solar parallax
superstition 11, 80, 97–98, 100–1, 254, 398
"Supplementum dissertationis de parallaxi Solis" (Hell) 294–95
"Sur les passages de Vénus et la parallaxe du Soleil" (Faye) 302
Svatopluk, prince 380
Sweden 111, 145, 148, 153, 174–75, 178, 181–82, 184, 191, 195, 200, 203–4, 212, 228, 237–38, 260, 263, 278, 290, 348
Swedish Academy of Sciences, Stockholm 182, 191, 280
Systema Academiae Montanisticae, Bohemia 50
Széchényi, Ferenc 323
Szekels (*székelyek*, *siculi*), Hungrian subgroup 76, 246
Székesfehérvár (Alba Regia, Stuhlweißenburg) 128, 338, 396
Szerdahely, György Alajos 375–78
Apologia pro lingua Latina 378
Aesthetica 376
Ars generalis poetica 376
Historia Uraniae musae 375
Elegia epidictica, per quam demonstratur Uraniam 375
Sztojka, Zsigmond Antal 79–80

Tahiti, French Polynesia 136–38, 181, 258, 271, 278–79, 287, 290, 294
Talvik, Norway 211–12
Tamerlane 315
Tartarotti, Girolamo 100
Tatra Mountains 37
Taucher, Franz 339
telescope 84, 96, 119, 122, 147–48, 202, 261, 267, 362
Telescopium Christiano-Hellianum (von Born) 362–63
Theresan cadaster 91. *See also* Marinoni, Johann Jakob
Theresianum. *See* Collegium Theresianum, Vienna
Thirty Years' War 15, 44
Thököly, Imre 44–45, 48
Thott, Otto 8, 200–1, 215, 238–39, 274
Thurzó family 39
Tobolsk, Russia 103, 109, 112–13, 137, 143–44, 155
Tomus physicus 220, 222–23. *See also Expeditio litteraria*
Torne River Valley, Finland/Sweden 75, 175, 181
Tragedy of Agis (Bessenyei) 325
Traité physique et historique de l'aurore boréale (de Mairan) 228
Tranquebar, India 112–13, 155, 177
Transylvania 6–7, 34, 41–42, 44–45, 47, 55, 76–78, 80, 82–85, 88, 101, 120, 123, 246, 314, 320, 370–71, 388
Transylvanian Society for Agriculture, Cluj 82
Traunkirchen, Abbey, Austria 73
Trautson, Johann Joseph 92
Traventhal, Germany 197, 199
Treaty of Paris 144
Trébuchet, Claude-Étienne 165–66, 168
Trenčín (Trencsén, Trenchinium, Trentschin), Slovakia 34, 42, 49, 55, 57, 63–66, 88, 128, 254, 397
Tripartitum (Werbőczy) 241, 328
Trnava (Nagyszombat, Tyrnavia, Tyrnau), Slovakia 39, 41–43, 55, 57, 62, 64–65, 74–76, 82, 84, 86–88, 92, 103, 111, 113–14, 128–31, 149–50, 166, 169, 190, 198–99, 217, 231, 234–36, 239, 241, 243, 247–49, 252, 255, 264, 276, 288, 293–94, 330–31, 334–35, 337–39, 341–44, 349–50, 360, 368–70, 372–73, 376, 397
Tromsø, Norway 6, 136, 205, 207, 212–13, 224–25, 261, 266
Trondheim, Norway 112, 137, 172, 177–80, 188, 195, 200–1, 203–5, 211–12, 214–15, 221–22, 224–25, 237–38, 251, 264, 275, 305, 345, 356, 369
Tyrol, Austria 38, 56, 117

"Über den Venusdurchgang von 1769" (Encke) 299, 301
Udine, Italy 91
Ueber die Liebe des Vaterlandes (von Sonnenfels) 309
Ukraine 124

Ulm, Germany 125
Ulva caprina, algae 222
ungesellige Geselligkeit 270. *See also* Kant, Immanuel
University of Salzburg 93
University of Trnava 62, 64–65, 74, 376
University of Vienna 6, 34, 57, 59, 62, 64, 68–69, 94, 139, 147, 167, 206, 208, 234, 236, 314, 345, 374
Unzer, Johann Christoph 359
Uppsala, Sweden 113, 154, 158, 164, 175, 178, 181, 184, 209–10, 221, 225, 263, 280
Urania 75, 96, 119, 375–77
Urania-Sternwarten 96
Uranus 71, 375, 377

Vaissète, Jean-Joseph 242, 326
vampirism 98–100, 254
van Musschenbroek, Pieter
  Elementa physicae 118
van Swieten, Gérard 51, 60–61, 64, 92, 99, 105, 107, 127, 253–54, 256, 311
van Swieten, Gottfried 318
Vanossius 131
Varanger Peninsula 211
Varaždin (Varasd, Varasdinum, Warasdin), Croatia 124, 397
Várdai, Pál 41
Vardø (Vardøhus), Norway 122, 137–38, 146, 156, 172, 178, 183, 185–86, 189, 194–95, 199–202, 204–11, 216, 218, 221–26, 229, 231, 234, 236–37, 250, 253–54, 258–66, 268–69, 273–74, 276, 279–81, 283–84, 286–92, 294, 296, 298–301, 303, 305–6, 335, 339, 356, 390
Varia compendia praxesque operationum arithmeticarum (Hell) 88
Venice, Italy 45, 70, 152, 223–24, 320
Venus 2–6, 32–33, 35, 69, 71, 103, 111, 116, 121–122, 125, 133–72, 174, 177–94, 199, 201–2, 207, 209–11, 214–15, 217–18, 220, 225, 236, 258–63, 265–69, 271–93, 295–97, 299–303, 305–6, 334–35, 340–41, 363, 367, 378, 389–90
  1761 transit observations 2–4, 32–33, 35, 103, 111, 116, 121–22, 125, 133–46, 148–66, 168–72, 174, 177–94, 199, 201–2, 209, 211, 215, 217–18, 225, 236, 258, 260–63, 265–69, 271–74, 276–80, 282, 284–86, 288, 291, 293, 295–96, 301–3, 305–6, 334–35, 340, 367, 389–90
  recorded transits of 134
  transit project of 1761 140, 148, 154
Verenigde Oostindische Compagnie (VOC) 192
Verestói, György 85–86
vernacular language 13, 56, 77, 81, 87, 94, 100, 104, 110, 217, 232, 314–16, 325, 353, 355, 396, 398
Vienna, Austria 1, 5–6, 9, 13, 33–34, 37, 45–47, 50–53, 56–73, 75, 78, 80, 82–88, 90–94, 96, 98, 100–103, 105–7, 109–11, 113, 116, 119–32, 137, 139–41, 144–49, 151–53, 155–56, 163–67, 170–72, 180, 185–93, 195–200, 202, 204–9, 216, 220, 222, 224, 227, 229, 234–36, 239–40, 248–49, 252–55, 259–61, 264–65, 274, 277, 286, 288–89, 293–95, 300, 302, 305–8, 310–11, 314–16, 318–19, 321–22, 324, 328–38, 340–46, 349–54, 357–60, 363–65, 367–75, 386–87, 397
  Imperial and Royal Observatory (Vienna University Observatory), Vienna 1, 34–35, 67, 86, 90–93, 95–97, 105–8, 111, 117, 122, 124, 127–29, 133, 140, 143, 145–49, 154, 166–67, 187, 202, 253, 264, 295, 300, 302–3, 306–7, 331–34, 340–42, 349, 352, 375, 388, 391
  Jesuit Observatory, Vienna 60, 67–68, 91, 103, 119, 122–25, 127, 143, 146–47, 333–36, 341
  siege of 45
  Viennese Academy of Sciences 64, 392
  Viennese Botanical Gardens 51, 347
  Viennese Imperial and Royal Academy for Engineering 91
Vilnius, Lithuania 113, 367
Voltaire 2, 12, 60, 103, 136, 272, 316, 323, 326–27, 331
von Borié, Egid Valentin 316
von Born, Ignaz 52, 73, 75, 82, 320–22, 337, 356, 361–64, 366
  Briefe über mineralogische Gegenstände... 320
  Specimen monachologiae, methodo Linnaeano, tabulis tribus aeneis illustratum 361

Telescopium Christiano-Hellianum 362–63
von der Osten, Johann Wibe 203–4, 214
von Eckhart, Johann Georg 232
von Ehrmans zum Schlug, Johann Felix 121–22, 141
von Gondola, Franz Joseph 204
von Hallerstein, Augustin 182, 582
von Haugwitz, Friedrich Wilhelm 60, 62, 107
von Hess, Ignaz Mathes 345–46
von Hontheim, Johann Nikolaus 373
De statu ecclesiae 373
von Jacquin, Nikolaus Joseph 33, 51, 107, 172, 174, 196–97, 347, 362, 371
von Kempelen, Farkas Wolfgang 352
von Linné, Carl (Carolus Linnaeus) 51, 107, 174, 200, 209, 211, 221–22, 224–25, 244
von Littrow, Johann Joseph 300–1
von Littrow, Karl Ludwig 298, 300–4
P. Hells Reise nach Wardoë 300
von Martini, Karl Anton 311, 348
von Pergen, Johann Anton 311, 319
von Petrasch, Josef 107–8, 345
von Rain, Freiherr Ignaz 148, 339–40
von Schlözer, August Ludwig 233, 235, 247–49, 363, 366, 381–82, 385
Allgemeine nordische Geschichte 233, 247, 381
von Sonnenfels, Joseph 94, 105, 308–9, 311, 316–18, 320–21
Der Mann ohne Vorurtheil 317
Ueber die Liebe des Vaterlandes 309
von Stock, Simon 310
von Storm, Caspar Herman 203, 226, 237
von Strahlenberg, Philipp Johann 232
von Trattner, Johann Thomas 349–51
as publisher 1, 69, 88, 101, 111, 117, 123, 125, 141, 164, 170, 243–44, 349–51, 354
von Triesnecker, Franz de Paula 67, 71, 82, 106, 109, 295, 300, 331, 334, 337–38, 375
von Zach, Franz Xaver 123, 263, 298–99, 302, 333–34, 341–43
von Zinzendorf, Karl 316
von Zinzendorf, Ludwig 316

Waldbürger 39
Wallerstein, Immanuel 10–11
wars
Austrian Succession, War of 62, 124, 307, 324
Fifteen Years' War 39
Seven Years' War 124, 144, 308
Spanish Succession, War of 45
Thirty Years' War 15, 44
Wargentin, Pehr Wilhelm 114, 153, 163, 167, 170, 178, 181–84, 191, 227, 260–61, 269, 276, 278–83, 289, 291–96, 337
Warsaw, Poland 113
water mills 49. *See also* hydraulics
Weidler, Johann Friedrich
Historia astronomiae 119
Weindling, Jan 153
Weinhart, Ignaz 117, 152
Weiss, Xaver Franz 68, 75–76, 82, 86–87, 103, 114, 127–31, 150, 166–70, 190, 210–11, 217, 231, 288, 292–94, 334–35, 338–39, 343–44, 349–50, 360–61, 370, 372, 378
Astronomiae physicae juxta Newtoni principia breviarium 76
Werbőczy, István 241, 328, 381
West Indies 51, 174
Wienerisches Diarium, Vienna 96, 164, 166, 347, 354, 356
Wilcke, Johan Carl 153, 181, 227–28
Winckelmann, Johann Joachim 2
Wolf, Rudolf 303
Geschichte der Astronomie 302
Wolff, Christian 18, 200, 323
Woolf, Harry 3, 135–38, 140, 144, 178, 183, 190, 271

Ximenes (Ximenez), Leonardo 114, 116, 141, 152

Yemen 175, 202

Zakarjás, János 65–66, 74
Zanotti, Eustachio 114, 134, 152, 154–55, 160–61
De Veneris ac Solis Congressu Observatio... 134
Zur wahren Eintracht lodge 52, 320–22, 361