AHR Forum

Historical Research in a Digital Age: Reflections from the Mapping the Republic of Letters Project

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ABOUT EIGHT YEARS AGO, WE rather serendipitously found ourselves in the early stages of a group research project that seemed to have potential as an experiment with how to do digital history. The result was Mapping the Republic of Letters, a collaborative endeavor based at Stanford University. The project consists of a growing number of wide-ranging case studies, including "British Architects on the Grand Tour in Eighteenth-Century Italy," the subject of the second article in this *AHR* Forum. The case studies engage in multiple ways with the early modern Republic of Letters, and, as each is based on a different source of information, they pose a variety of problems for data-handling and unique challenges for visualizing it. All of them are available on our common website.[1]

At one time, archival material remained more or less in the archives. Historians inclined to use such materials routinely performed acts of intellectual pilgrimage, as many of us still do today, to be initiated into this essential rite of historical apprenticeship. They traveled, learned how to use their archives onsite, and extracted hard-earned information like Forty-Niners panning for gold, returning home with pages of notes, perhaps even a bit of microfilm to read on a machine or print out on that nauseatingly smelly paper whose pungent chemical odor was anything but the nirvana of

[1] See http://republicofletters.stanford.edu/publications/.

the past.[2] A much smaller subset of the scholarly community, whose delight in documents long predated the rise of the professional historian of the mid-nineteenth century, ambitiously undertook the laborious project of transcription, creating critical editions of key documents that form the backbone of many histories of famous figures, defining moments, and other noteworthy events.[3] This tiny portion of the infinite documentation of the past found its way into print, while the majority remained in the archive.

In the 1960s, social science historians began to consider how computers facilitated quantitative analysis. An entire generation or two of historians discovered the punch card and began to code. During the 1970s, a steady stream of scholarship emerged from these early experiments with historical datasets. This approach appealed especially to historians who wished to migrate away from traditional political and intellectual history, writing the kind of historical sociology and family, labor, and economic history whose grandest manifestos might be Emmanuel Le Roy Ladurie's 1974 essay "History That Stands Still," which summarized well the goals and ambitions of the early Annales School, and historical sociologist Charles Tilly's evocatively titled *Big Structures, Large Processes, Huge Comparisons* a decade later.[4] The foundations of the new social history of the 1960s through the 1980s rest upon these impressive early experiments with big historical data and its insistence on the value of cliometrics.

This was the old era of big history with big data. We are now in the early stages of a new age of historical data that offers new possibilities as well as challenges. The past fifteen years have seen a gradual but perceptible shift in where the archive is located as an ever greater portion of the historical record migrates piecemeal from boxes and books to PDFs and JPGs, and a vast sea of digitized text. A growing number of manuscripts can be viewed online, and hefty multivolume document collections are now digitized, indexed, and easily searchable. Historians increasingly find themselves utilizing digital databases as the idea of the searchable document and the virtual archive reorganize how libraries, research institutes, teams of scholars, and even individual researchers present and share interesting sources. To take one example, bibliometrics once belonged primarily to librarians and archivists and now seems to interest a broad, interdisciplinary array of scholars as an analytic research tool. For all these reasons, it is not surprising that the history of information has become an important topic.[5] To paraphrase Raymond Williams, "information" is one of the keywords of the

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[2] For an enjoyable meditation on the origins of these historical practices, see Carolyn Steedman, *Dust: The Archive and Cultural History* (New Brunswick, N.J., 2002). The early modern archive in particular is beautifully evoked in Arlette Farge, *The Allure of the Archives*, trans. Thomas Scott-Railton (New Haven, Conn., 2013).

[3] On this subject, a classic point of departure is Anthony Grafton, *The Footnote: A Curious History* (Cambridge, Mass., 1997).

[4] Emmanuel Le Roy Ladurie, "History That Stands Still," in Ladurie, *The Mind and Method of the Historian*, trans. Siân Reynolds and Ben Reynolds (Chicago, 1981), 1–27; Charles Tilly, *Big Structures, Large Processes, Huge Comparisons* (New York, 1984). The most recent overview of the Annales School is André Burguière, *The Annales School: An Intellectual History*, trans. Jane Marie Todd (Ithaca, N.Y., 2009). For early methodological reflections on quantitative history, see William O. Aydelotte, "Quantification in History," *American Historical Review* 71, no. 3 (April 1966): 803–825; William O. Aydelotte, Robert William Fogel, and Allan G. Bogue, eds., *The Dimensions of Quantitative Research in History* (Princeton, N.J., 1972).

[5] See, for instance, Paul N. Edwards, Lisa Gitelman, Gabrielle Hecht, Adrian Johns, Brian Larkin, and Neil Safier, "Historical Perspectives on the Circulation of Information," *AHR* Conversation, *American Historical Review* 116, no. 5 (December 2011): 1393–1435.

early twenty-first century, and so too is "data."[6] The question, however, is not how to write the history of information but what to do with all of it, as historians in an era when we have a burgeoning array of techniques and technologies available to help us scrape, mine, curate, analyze, and visualize data.

Too much information, it turns out, might be a good thing. Perhaps the first-year graduate student, overwhelmed by shelves full of books in his or her field, may not immediately agree. "Information overload" is a common reaction—now as in the past—to the vast collections of knowledge that have accumulated in our libraries, and are increasingly migrating online.[7] But sometimes, to paraphrase Jean-Jacques Rousseau, the cure lies in the poison.[8] "Big data" is the name commonly given to the exponential increase in information, whether it results from the digitization of analog data stores or is collected in real time from remote sensors, the web, or mobile devices.[9] The difference between these datasets and that multitude of books is the potential for discovery and analysis. "Big data" refers not to size alone, as the term suggests, but to the interconnectedness of resources. For our purposes, big data is what you get when those shelves of books have been digitized, structured, and interlinked in such a way that the information contained within them can be filtered, plotted, measured, parsed, and visualized. The scholar starting out in a new field still has to ingest and process the literature the old-fashioned way—by reading it. But we can put computational tools to work to help with the ingesting and processing and to inspire other questions we might ask with this material as we look across, as well as within, our sources.

Few humanists would argue that reading books and manuscripts is a bad thing. Indeed, the newfound availability of large datasets in the humanities at times conjures up the worrisome specter of digitally savvy sorcerer's apprentices who, thanks to new databases, "cite anything and construe nothing."[10] Searchable, sortable data can make even beginning scholars look erudite and clever. An eager researcher can accumulate

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[6] Raymond Williams, *Keywords: A Vocabulary of Culture and Society* (New York, 1976). On the history of information, see especially C. A. Bayly, *Empire and Information: Intelligence Gathering and Social Communication in India, 1780–1870* (Cambridge, 1996); Daniel R. Headrick, *When Information Came of Age: Technologies of Knowledge in the Age of Reason and Revolution, 1700–1850* (Oxford, 2001); and Jacob Soll, *The Information Master: Jean-Baptiste Colbert's Secret State Intelligence System* (Ann Arbor, Mich., 2009). Daniel Rosenberg has a project underway on the history of data, with related work published as "Data before the Fact," in Lisa Gitelman, ed., *"Raw Data" Is an Oxymoron* (Cambridge, Mass., 2013), 15–40; "Enter Data," in Katherine Behar, ed., *Data's Entry* (Istanbul, 2016), 14–33; and "An Archive of Words," in Lorraine Daston, ed., *Sciences of the Archive* (Chicago, forthcoming 2017).

[7] Daniel Rosenberg, "Early Modern Information Overload," *Journal of the History of Ideas* 64, no. 1 (2003): 1–9; Ann M. Blair, *Too Much To Know: Managing Scholarly Information before the Modern Age* (New Haven, Conn., 2010). More generally, see Peter Burke, *A Social History of Knowledge: From Gutenberg to Diderot* (Cambridge, 2000).

[8] Jean Starobinski, *Le remède dans le mal: Critique et légitimation de l'artifice à l'âge des Lumières* (Paris, 1989).

[9] See Danah Boyd and Kate Crawford, "Six Provocations for Big Data," paper presented at "A Decade in Internet Time: Symposium on the Dynamics of the Internet and Society," University of Oxford, September 21, 2011, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1926431; Viktor Mayer-Schönberger and Kenneth Cukier, *Big Data: A Revolution That Will Transform How We Live, Work, and Think* (Boston, 2013). For a humanistic take on this debate, see Gitelman, *"Raw Data" Is an Oxymoron*; Lev Manovich, "Trending: The Promises and the Challenges of Big Social Data," in Matthew K. Gold, ed., *Debates in the Digital Humanities* (Minneapolis, 2012), 460–475; Christof Schöch, "Big? Smart? Clean? Messy? Data in the Humanities," *Journal of Digital Humanities* 2, no. 3 (2013), http://journalofdigitalhumanities.org/2-3/big-smart-clean-messy-data-in-the-humanities/.

[10] Jonathan Barnes, quoted by Anthony Grafton in *Worlds Made by Words: Scholarship and Community in the Modern West* (Cambridge, Mass., 2009), 322.

historical mass very quickly. Superficial engagement with this material can also lead to gross misinterpretations when the context for interpreting data is missing and when one has read only what is available online. Stopping there, however, would be premature, indeed shortsighted. These perils notwithstanding, the digitization and datafication of historical documents can open up promising methodological avenues and opportunities for new insights.

We began our project, Mapping the Republic of Letters, with these opportunities in mind and with an awareness of the growing number of projects that are digitizing letters and other key documents of scholarly, cultural, political, and religious life from the sixteenth through eighteenth centuries. Such projects generate tremendous amounts of valuable metadata about social networks, travel, institutional affiliations, publication history, and so forth. In the age of Edward Snowden, most people are now familiar with the concept of metadata, such as information about who communicated (or traveled) with whom, when, and where. Typically, metadata is everything except the "what" that was communicated. Mapping the Republic of Letters deals primarily with the metadata about letters or travels rather than with their actual content. Or rather, we use the metadata to produce maps, charts, and other data visualizations, and then refer back to the content to elucidate or complement what we see. Similarly (yes) to the NSA, we engage in "traffic analysis" to explore the breadth, shape, and hubs of intellectual networks.[11]

Since we began our project, the increase in available online data has been accompanied by a growing conversation about its impact and meaning for historical research. In the last couple of years alone, a string of new handbooks and manifestos have tackled "big data," laying out its promises for historians while introducing the various methodologies by which digital historians approach it.[12] In the pages of the *AHR*, Lara Putnam has recently shown how digital search—the now-widespread scholarly use of Google, JSTOR, and WorldCat, among others—is bringing many of the issues associated with big-data historical research to the doorsteps even of historians who have not explicitly adopted digital tools meant to quantify and visualize data.[13] Our reflections here, particularly about our experience with digital historical databases and how this has affected our work in early modern intellectual history, aim to contribute to this conversation. The publications emerging from our project all employ computational technologies and visualization techniques to make discoveries

[11] For the U.S. government's practice of traffic analysis, see Vera R. Filby, *A Collection of Writings on Traffic Analysis* (Fort Meade, Md., 1993), http://www.governmentattic.org/8docs/NSA-TrafficAnalysis Monograph_1993.pdf.

[12] See Jo Guldi and David Armitage, *The History Manifesto* (Cambridge, 2014), chap. 4, for their take on big data's promise for historians. Among the recent proliferation of companions and handbooks for digital humanities, and digital history in particular, note Shawn Graham, Ian Milligan, and Scott Weingart, *Exploring Big Historical Data: The Historian's Macroscope* (London, 2016), which most explicitly addresses digital history as big data history. For a methodological reflection on big data history, see also Cameron Blevins, "The Perpetual Sunrise of Methodology," paper prepared for AHA Session 158, "Authoring Digital Scholarship for History: Challenges and Opportunities," 129th Annual Meeting of the American Historical Association, New York City, January 4, 2015, http://www.cameronblevins.org/posts/perpetual-sunrise-methodology/.

[13] Lara Putnam, "The Transnational and the Text-Searchable: Digitized Sources and the Shadows They Cast," *American Historical Review* 121, no. 2 (April 2016): 377–402, with rich references on the recent conversation on history in the digital age. See also Ted Underwood, "Theorizing Research Practices We Forgot to Theorize Twenty Years Ago," *Representations* 127, no. 1 (2014): 64–72.

about the past that would have been difficult, if not impossible, to reach by analog means. These scholarly outcomes have emerged in—indeed, could not exist outside of—a dialogue with a longstanding tradition of early modern intellectual historiography. They also grew out of research practices that our group established along the way, such as digital visualizations, tool development, publication format, and co-authored scholarship, which speak to how history might be done in a digital age.

Mapping the Republic of Letters is a research project with many heads. It contains two seventeenth-century (Athanasius Kircher and John Locke) and three eighteenth-century (Voltaire, Benjamin Franklin, and the Grand Tour) case studies.[14] Their geography primarily traverses Great Britain, Europe, and British North America, though each intellectual network makes strategic excursions that lie beyond these boundaries, raising questions about not only the nature of early modern cosmopolitanism and travel, but also the nature of global connections and communications. Historians of the Republic of Letters have also long debated how it evolved over time. Did the erudite *Respublica litteraria* of humanist scholars differ significantly from the worldly *République des lettres*? What can we learn by examining not only the most prolific correspondents who represent the strongest ties in a given network, but also the "long tail" of letter writers, often the vast majority in most instances, who sent no more than a single letter or a handful of letters? As David Lux and Harold Cook observe in an important essay inspired by the work of sociologist Mark Granovetter, understanding how people expand the reach of their network by "widening the network of weak ties" is an essential component of network analysis.[15]

One of our groups has focused on the German Jesuit polymath Athanasius Kircher (1602–1680). Paula Findlen, Suzanne Sutherland, and Iva Lelková have explored why Kircher's mid-seventeenth-century network was more cosmopolitan, in terms of geographic breadth, than those of his Enlightenment successors.[16] As a member of the Society of Jesus, Kircher could plug into an already established global missionary network while also making himself a useful participant in the scholarly Republic of Letters, and inserting himself successfully in Habsburg networks in Central Europe and Italian networks emanating to and from his adoptive city, Rome. (See Figure 1.)[17] A fine-grained analysis of the community that corresponded with him shows how his publishing projects grew and evolved with the expanding reach of the Jesuit missionary network into many different parts of the world. This research has been able to map the multiple ways in which Kircher self-consciously shaped and reshaped his religious, political, and intellectual networks to bolster his reputation as the man to know in the Eternal City, someone whose books and reputation circum-

[14] Interactive visualizations, datasets, and links to research articles related to these case studies can be found at http://republicofletters.stanford.edu/publications/.

[15] David S. Lux and Harold J. Cook, "Closed Circles or Open Networks? Communicating at a Distance during the Scientific Revolution," *History of Science* 36, no. 2 (1998): 179–211, here 190; Mark S. Granovetter, "The Strength of Weak Ties," *American Journal of Sociology* 78, no. 6 (1973): 1360–1380. For a recent study that uses network analysis to explore the correspondence of imprisoned Protestants during the English wars of religion, see Ruth Ahnert and Sebastian E. Ahnert, "Protestant Letter Networks in the Reign of Mary I: A Quantitative Approach," *ELH* 82, no. 1 (2015): 1–33.

[16] See http://republicofletters.stanford.edu/publications/kircher/. The result of this research will be published in a series of articles by Paula Findlen, Suzanne Sutherland, and Iva Lelková, culminating in a book provisionally titled *The Baroque Postmaster: Athanasius Kircher between Rome and the World*.

[17] Those who are reading this article in the print issue can view this and the other figures in color either in the online issue or at http://republicofletters.stanford.edu/publications/.

Figure 1: Source locations for correspondence to Athanasius Kircher, sized by numbers of letters sent.

navigated the globe. While his network was less socially diverse than those of, say, Locke, Franklin, and Voltaire, who corresponded with broader swaths of society (and most notably, by the eighteenth century, with far more women), his letters traveled much farther.

Skeptics have challenged the rhetoric of the "republicans of letters," to invoke Daniel Roche's phrase, and questioned whether there really was *a* republic, or whether this illusory place masked a balkanized hodgepodge of more or less connected mini-republics.[18] In the context of Mapping the Republic of Letters, Claude Willan's work on John Locke (1632–1704) has used graphs and other visualizations to reveal just how disconnected the different social and national subgroups in his correspondence network were from one another.[19] (See Figure 2.) The republic that emerges from his study is not a unified network that any newcomer could join wholesale, but a patchwork of isolated communities that Locke fused together. His findings provide an empirical demonstration of the scholarly suspicion that there were really "a multitude of communities within, or rather underneath, the surface of the Republic of Letters."[20]

Mapping the correspondence networks of major Enlightenment figures underscores the limits of their geographic horizons, raising questions about what it meant to be a self-professed "citizen of the world," as many enlightened men and women of

[18] Daniel Roche, *Les républicains des lettres: Gens de culture et Lumières au XVIIIᵉ siècle* (Paris, 1998). On the national vs. cosmopolitan makeup of the Republic of Letters, see especially Lorraine Daston, "The Ideal and Reality of the Republic of Letters in the Enlightenment," *Science in Context* 4, no. 2 (1991): 367–386.
[19] See http://republicofletters.stanford.edu/publications/locke/, and Willan's article "'John Locke Likes This': An Ego-Network Analysis of Locke's Letters" (under review).
[20] See Candice Delisle, "Accessing Nature, Circulating Knowledge: Conrad Gessner's Correspondence Networks and His Medical and Naturalist Practices," *History of Universities* 23, no. 2 (2008): 35–58, here 53.
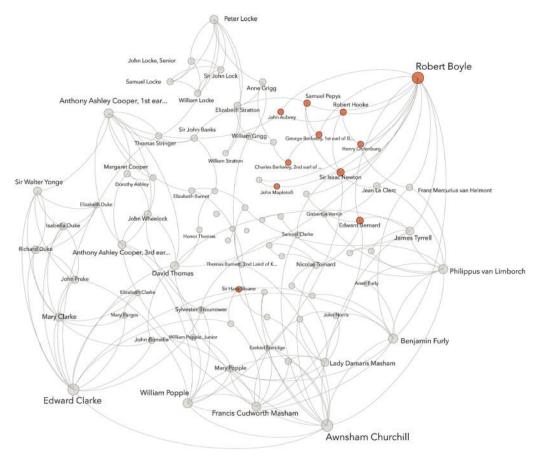
FIGURE 2: Network of Royal Society fellows (orange nodes) in John Locke's correspondence.

letters claimed to be, and in what ways overseas colonies mattered in the increasingly far-flung imperial reach of the Europe-centered Republic of Letters.[21] Caroline Winterer and Claire Arcenas—another of our research teams—have explored these two questions in the network of a figure long renowned for his cosmopolitanism and colonial status, Benjamin Franklin (1706–1790).[22] Franklin may well have been the most famous North American of the eighteenth century, but his transatlantic letters initially did not include a significant number of international correspondents; only over decades spent in the imperial capital of London did he forge a letter network that included French, German, Italian, and Scottish correspondents. (See Figure 3.) Even at the close of his "London Decades" (1757–1775), and despite trips to Scotland, the Netherlands, and France, Franklin's correspondents were overwhelmingly found at ei-

[21] Margaret C. Jacob, *Strangers Nowhere in the World: The Rise of Cosmopolitanism in Early Modern Europe* (Philadelphia, 2006); Caroline Winterer, "Where Is America in the Republic of Letters?," *Modern Intellectual History* 9, no. 3 (2012): 597–623; Winterer, *American Enlightenments: Pursuing Happiness in the Age of Reason* (New Haven, Conn., 2016).

[22] See http://republicofletters.stanford.edu/publications/franklin/; and Winterer and Arcenas's article "The Correspondence Network of Benjamin Franklin: The London Decades, 1757–1775" (under review).

FIGURE 3: Benjamin Franklin's total correspondence, with locations sized by volume of letters.

ther end of the London-Philadelphia axis. His fame may have spread across Europe, but his letters circulated chiefly in the British imperial world.

Our visualizations also provide new perspectives on murky problems of cultural transmission. As our data does not include letter content, it can tell us only so much about the circulation of ideas. But correspondence maps nonetheless raise questions that invite us to read letters and other documents with a fresh perspective. Starting with the observation that Voltaire (1694–1778) seems to have exchanged few letters with British correspondents, Dan Edelstein and Biliana Kassabova have argued in their work for Mapping the Republic of Letters that the standard narrative about the English origins of Voltaire's philosophy (and by extension of the French Enlightenment) must be revised in light of the fact that Voltaire's interest in, and admiration of, England was both qualified and chronologically restricted.[23] (See Figure 4.) England's period of cultural greatness, in his eyes, lay in the reign of Charles II, and was thus a thing of the past by the time he arrived in London. What is more, Voltaire credited the *siècle de Louis le grand* for many of the English intellectual exploits. The author of the bestselling and controversial *Letters Concerning the English Nation* had more than a few concerns, it turns out, about that nation.

As the above case studies indicate, travel—whether Kircher's religious flight from war-torn Germany, Locke's exile from England, Franklin's transatlantic voyages, or Voltaire's timely crossing of the English Channel to mitigate scandal—played a crucial role in how many citizens of the Republic of Letters extended and built their networks. One of our groups, as detailed in the second article in this *AHR* Forum, has

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[23] See http://republicofletters.stanford.edu/publications/voltaire/; and Edelstein and Kassabova's article "Where Are Voltaire's Letters Concerning the English Nation? Maps, Networks, and Intellectual History" (under review).
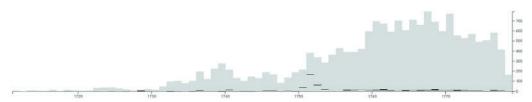
FIGURE 4: Histogram of Voltaire's correspondence, by year, highlighting English correspondence.

been mapping Grand Tour travel, and the role it played in the emergence of architecture as a profession. The research process involved transforming John Ingamells's *A Dictionary of British and Irish Travellers in Italy, 1701–1800* into an interactive database filled with detailed information about the intersecting itineraries of the men and women who traveled to Italy, and creating a prosopography of this community.[24] (See Figure 5.) By studying British architects on the Grand Tour, Giovanna Ceserani, Giorgio Caviglia, Nicole Coleman, Thea De Armond, Sarah Murray, and Molly Taylor-Poleskey illuminate how the dynamic exploration of early modern travelers allows us to identify with greater precision the role of travel in relation to professional aspirations and cultural formation.[25] Architects who completed their education in Italy often met prospective clients on the Grand Tour, and presented their studies abroad as a compelling professional credential when they returned home.

When we have presented our work, a common complaint has been that for all our investment in digital tools, data editing, and data creation, the field has not been revolutionized as a result. This criticism can be voiced with optimism ("Show us you're the greatest thing since sliced bread," in the words of one enthusiastic reviewer) or with skepticism ("So you have nothing more to show for yourselves?"). But why *should* new methods produce radically different results? We are studying the same objects that scholars have been painstakingly exploring for hundreds of years. They naturally came up with penetrating insights about the Republic of Letters without the help of digital tools. But what these tools allow us to do is to sort through, refine, confirm, or refute the different insights these historians had, as well as to formulate new ones that emerge when we step back from the details of any particular subset of a correspondence to observe its contours. This is not to embrace a positivist, cliometric vision of computational supremacy; such a vision is ill-suited for historical archives that are so shot through with uncertainty and gaps. But where possible, basic calculations are still useful and can provide correctives to sheer speculation. They also force us to look closely at the information we have, resulting in numerous silent corrections to minor errors, assumptions that have solidified into facts, and other problems that arise when we take information for granted.

The data visualizations we rely on in our research and publications do not offer clear snapshots of the past, but rather fuzzy, blurry pictures. They reveal the general shape of things, orders of magnitude, and large-scale trends; they also draw our atten-

[24] John Ingamells, comp., *A Dictionary of British and Irish Travellers in Italy, 1701–1800* (New Haven, Conn., 1997). For more on this project, see https://grandtour.stanford.edu/.
[25] See http://republicofletters.stanford.edu/publications/grandtour/; and Giovanna Ceserani, Giorgio Caviglia, Nicole Coleman, Thea De Armond, Sarah Murray, and Molly Taylor-Poleskey, "British Travellers in Eighteenth-Century Italy: The Grand Tour and the Profession of Architecture," this issue.
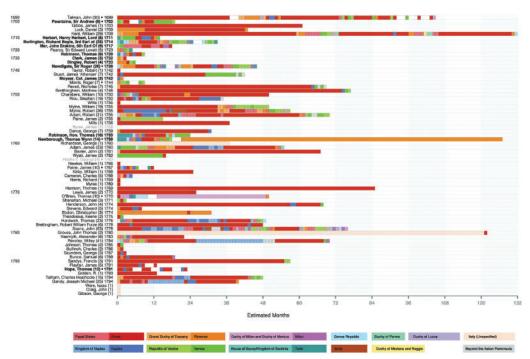
FIGURE 5: Timechart of British Grand Tour travelers in Italy in the eighteenth century.

tion to microhistories that we might otherwise have missed. The results are never definitive, and always require further verification—an absence on a map might be due only to a gap in the data. But the critical point is that they open up new avenues of inquiry and are springboards for further research.

In some instances, the computational processes in question are not complex: one could count Kircher's global missionary correspondence, Voltaire's letters to England, or Franklin's international correspondents by hand. But computational methods are good for more than just performing difficult statistical operations (though one of our projects, on John Locke, does exactly that): they can also serve to reveal elements of surprise in the data. The point is not, therefore, whether you need computational tools to count the number of Franklin's French (or Voltaire's English, or Kircher's Jesuit) correspondents, but rather that computational methods provide novel insights into your sources. We designed and developed data visualizations not to do our work for us, but rather to point to where our work lies.

WHILE OUR MAPPING PROJECT came of age at a time when historians were just starting to focus on the promises and perils of big data, it also draws on a long historiography. Indeed, the Republic of Letters has never been a small or easily contained subject. Starting in the mid-fourteenth century, early humanists such as Petrarch wrote open letters as a means of communicating ideas and shaping opinion, and also as a process of intellectual self-definition. In 1417 the Venetian humanist Francesco Barbaro provided an indelible portrait of the nature of this emerging scholarly community when

he congratulated his Florentine friend Poggio Bracciolini for unearthing a treasure trove of ancient manuscripts in the monastic libraries of Northern Europe, acknowledging the utility of Poggio's rediscovery for "this Republic of letters" (*huic litteraria Reipublicae*).[26] It is hardly coincidental that the phrase *Respublica litteraria* first appeared in a letter. In the age of great letter writers such as the early-sixteenth-century Dutch humanist Desiderius Erasmus, who, to paraphrase Lisa Jardine, delighted in making absent friends present, the idea of conversation through correspondence became the norm rather than the exception.[27]

When Elizabeth Eisenstein, in her landmark study *The Printing Press as an Agent of Change* (1979), proclaimed printing to have been a transformative development in early modern Europe, she contrasted the limits of letters to the possibilities of books in disseminating knowledge while observing that we need to know a great deal more about the Republic of Letters.[28] More recent scholarship has reexamined this issue and arrived at a different conclusion, one that emphasizes the productive and continuous interactions between writing and publishing. A world of books and journals was also a world of readers, authors, and critics, whose conversations took place not only in academies, salons, and other sites of scholarly sociability, but also through long-distance travel and communication via letters. Such letters provide us with a historical roadmap from which we can reconstruct intellectual networks across time and space.

In the 1970s, a number of scholars began to investigate the nature and meaning of the Republic of Letters. An international community of scholars has developed and defined this subject in the decades since, tracing the rise and decline of a rhetorical ideal and its connection to cultural and intellectual practices and scholarly communities.[29] But rhetoric, as Lorraine Daston cogently observed in an important essay, ulti-

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[26] The standard English translation of this letter, dated July 6, 1417, can be found in Phyllis Walter Goodhart Gordan, ed. and trans., *Two Renaissance Book Hunters: The Letters of Poggius Bracciolini to Nicolaus de Niccolis* (New York, 1974), 196–203.

[27] For an overview of these developments, see Marc Fumaroli, "The Republic of Letters," trans. R. Scott Walker, *Diogenes* 36, no. 143 (1988): 129–152; Hans Bots and Françoise Waquet, *La République des lettres* (Paris, 1997); Anthony Grafton, "A Sketch Map of a Lost Continent: The Republic of Letters," *Republics of Letters: A Journal for the Study of Knowledge, Politics, and the Arts* 1, no. 1 (2009), http://arcade.stanford.edu/rofl/sketch-map-lost-continent-republic-letters. On Erasmus, a good starting point is Lisa Jardine, *Erasmus, Man of Letters: The Construction of Charisma in Print* (Princeton, N.J., 1993), chap. 6; Constance M. Furey, *Erasmus, Contarini, and the Religious Republic of Letters* (Cambridge, 2008); Hanan Yoran, *Between Utopia and Dystopia: Erasmus, Thomas More, and the Humanist Republic of Letters* (Lanham, Md., 2010).

[28] Elizabeth Eisenstein, *The Printing Press as an Agent of Change: Communications and Cultural Transformations in Early Modern Europe*, 2 vols. (Cambridge, 1979), 1: 136–137. The relationship of Eisenstein's work to the Republic of Letters is discussed by J. L. Pearl, "The Role of Personal Correspondence in the Exchange of Scientific Information in Early Modern France," *Renaissance and Reformation / Renaissance et Réforme*, New Series / Nouvelle Série, 8, no. 2 (1984): 106–113, here 107; and April G. Shelford, *Transforming the Republic of Letters: Pierre-Daniel Huet and European Intellectual Life, 1650–1720* (Rochester, N.Y., 2007), 3.

[29] The earliest historical study of this concept may well be Annie Barnes, *Jean Le Clerc (1657–1736) et la République des lettres* (Paris, 1938). Readers interested in following the development of this subject since the 1970s should begin with Paul Dibon, "Les échanges épistolaires dans l'Europe savante du XVIIᵉ siècle," *Revue de synthèse* 81–82 (1976): 31–50; Dibon, "Communication in the Respublica litteraria of the 17th Century," *Respublica Litteraria: Studies in the Classical Tradition* 1 (1978): 43–55; Hans Bots, *Republiek der letteren: Ideaal en werkelijkheid: Rede uitgesproken bij aanvaarding van het ambt van buitengewoon hoogleraar aan de Katholieke universiteit te Nijmegen* (Amsterdam, 1977); Françoise Waquet, "Qu'est-ce que c'est la République des lettres? Essai de sémantique historique," *Bibliothèque de l'École des Chartres* 147 (1989): 473–502. The fundamental work of synthesis on this subject is Bots and Waquet, *La République des lettres*.

mately inspired questions about the reality, or lived experience, of the ideal of the Republic of Letters.[30] Taking the case of Leibniz, Maarten Ultee envisioned a social history that would explore the concrete details of intellectual membership in this imagined community, including its geography, the volume and frequency of letters, and the social positions of its participants.[31] Such questions inspired the subsequent work of a talented cadre of scholars, most notably Dena Goodman, Anne Goldgar, and Daniel Roche, who increasingly brought the methods of cultural history and gender history to bear on the subject in the late 1980s and early 1990s.[32] Simultaneously, a rejuvenated intellectual history developed by scholars such as Joseph Levine, Anthony Grafton, Peter Miller, and Laurence Brockliss focused on key participants in the Republic of Letters as a means of better understanding the practices of intellectual life from the advent of Renaissance humanism to the rise of antiquarianism and ultimately the Age of Enlightenment.[33]

Initially there were a limited number of letters, but soon the volume of letters that individuals exchanged expanded astronomically. When Jardine wondered aloud what scholars should do with the "mass of 'data' which Erasmus's voluminous correspondence provides," she asked a pertinent question: 3,162 letters to and from Erasmus survive. We can juxtapose this number to the prolific letter-writing habits of Italian Renaissance humanists, but also of learned Protestant reformers: Martin Luther's surviving correspondence numbers 4,337 letters, and John Calvin's 4,271. Ignatius Loyola, the founder of the Society of Jesus, was a veritable epistolary machine who practiced what he preached in institutionalizing letter-writing as an essential expression of religious confraternity and bureaucracy; he left behind an impressive 9,178 letters (6,381 written by him) at the time of his death in 1556.[34] While not quantitatively large by contemporary standards of big data, such numbers are filled with hidden multipliers, because each letter typically contains a great deal of valuable information—about people, places, conversations, manuscripts, publications, projects, and institutions—and offers a trail of references that invariably leads the patient researcher to

[30] Daston, "The Ideal and Reality of the Republic of Letters in the Enlightenment."

[31] Maarten Ultee, "The Republic of Letters: Learned Correspondence, 1680–1720," *Seventeenth Century* 2, no. 1 (1987): 95–112.

[32] Dena Goodman, *The Republic of Letters: A Cultural History of the French Enlightenment* (Ithaca, N.Y., 1994); Anne Goldgar, *Impolite Learning: Conduct and Community in the Republic of Letters, 1680–1750* (New Haven, Conn., 1995); Roche, *Les républicains des lettres*. For subsequent efforts to build on Goodman's early insights on the importance of gender in the Republic of Letters, a good starting point is Susan Dalton, *Engendering the Republic of Letters: Reconnecting Public and Private Spheres in Eighteenth-Century Europe* (Montreal, 2003); Antoine Lilti, *Le monde des salons: Sociabilité et mondanité à Paris au XVIIIᵉ siècle* (Paris, 2005); Dena Goodman, *Becoming a Woman in the Age of Letters* (Ithaca, N.Y., 2009).

[33] Joseph M. Levine, *The Battle of the Books: History and Literature in the Augustan Age* (Ithaca, N.Y., 1994); Peter N. Miller, *Peiresc's Europe: Learning and Virtue in the Seventeenth Century* (New Haven, Conn., 2000); L. W. B. Brockliss, *Calvet's Web: Enlightenment and the Republic of Letters in Eighteenth-Century France* (Oxford, 2002). From Grafton's considerable corpus, one might follow the trail backward from his AHA Presidential Address, "The Republic of Letters in the American Colonies: Francis Daniel Pastorius Makes a Notebook," *American Historical Review* 117, no. 1 (February 2012): 1–39; and "A Sketch Map of a Lost Continent."

[34] Jardine, *Erasmus, Man of Letters*, 149. For a good overview of some of the metrics of early modern correspondence, see Francisco Bethencourt and Florike Egmond, eds., *Cultural Exchange in Early Modern Europe*, vol. 3: *Correspondence and Cultural Exchange in Europe, 1400–1700* (Cambridge, 2007), 10–12. For an introduction to religious letter-writing and Loyola's reputation as the most prolific letter writer of the sixteenth century, see Thomas M. Lucas, *Landmarking: City, Church and Jesuit Urban Strategy* (Chicago, 1997), 131.

other terrifyingly large masses of correspondence. This is far too much to absorb at a glance or to keep in one's head, which is why scholars have often worked with discrete portions of large correspondences to get to know specific content really well rather than attempting to consider the whole.

Such numbers pale in relation to the scale of mercantile correspondence, as the case of a late-fourteenth-century merchant in Prato, Francesco Datini, illustrates all too well: his surviving papers contain approximately 150,000 commercial and familial letters. While Petrarch carefully and deliberately identified the living and the dead, the real and the imaginary, to whom he might address a well-crafted Latin letter in imitation of Cicero, Quintilian, and other great Roman epistolarians, the demands of the marketplace required a constant stream of long-distance correspondence traveling in all directions to many different kinds of people who did business together.[35] The same can also be said of diplomatic correspondence. Take the example of Isabella d'Este, the fifteenth-century marchioness of Mantua, for whom some 25,000 letters (approximately 16,000 by her) survive in an archive containing about 100,000 letters related to the totality of her activities as one of the most powerful political and cultural brokers in Renaissance Italy.[36] Such examples serve as a stark reminder of just how fundamental and ubiquitous letter-writing was to a variety of human endeavors in the premodern world. While our project has focused on the intellectual and cultural dimensions of that particular subject, we hope that the techniques we have explored and experimented with may prove useful for historians with other interests.

In the early sixteenth century, Erasmus wistfully envisioned a Christian Republic of Letters populated by scholars in communication across geographic, religious, and political boundaries. Increasingly, however, humanistic ideals of writing to someone as an expression of learned friendship intertwined with other priorities, as different cultures of letter-writing intersected and combined. Diplomats and agents made correspondence an instrument of politics, policy, and information; adventurers, missionaries, traders, and emigrants boarded mercantile vessels to parts unknown and sent letters home, waiting months, sometimes years, to receive responses from friends, family, and superiors back in Europe. Everywhere people went, letters accompanied them. Publishing letters became a lucrative editorial activity. Our project begins with this fundamental fact of the early modern world: it was a society whose patterns of increased mobility and communication were expressed in the numerical explosion of letters.

Growing curiosity about experiences, ideas, languages, and artifacts that could be acquired only through long-distance travel multiplied the number of networks and communities of scholars in pursuit of knowledge. The superabundance of information

[35] The most recent description of the Datini correspondence by the Istituto Datini can be found at http://www.istitutodatini.it/schede/archivio/eng/arc-dat2.htm. On mercantile correspondence, see especially Francesca Trivellato, *The Familiarity of Strangers: The Sephardic Diaspora, Livorno, and Cross-Cultural Trade in the Early Modern Period* (New Haven, Conn., 2009); Trivellato, "Merchants' Letters across Geographical and Social Boundaries," in Bethencourt and Egmond, *Correspondence and Cultural Exchange in Europe*, 80–103; Trivellato, "A Republic of Merchants?," in Anthony Molho and Diogo Ramada Curto, eds., *Finding Europe: Discourses on Margins, Communities, Images, ca. 13th–ca. 18th Centuries* (Oxford, 2007), 133–158.

[36] Deanna Shemek, "In Continuous Expectation: Isabella d'Este's Epistolary Desire," in Dennis Looney and Deanna Shemek, eds., *Phaethon's Children: The Este Court and Its Culture in Early Modern Italy* (Tempe, Ariz., 2005), 269–300.

so eloquently described in Ann Blair's 2010 book *Too Much to Know* was intimately connected to the increased scale and scope of scholarly correspondence in the late sixteenth and seventeenth centuries.[37] Where individuals had previously exchanged dozens or hundreds of letters, now their correspondences numbered in the thousands. Not surprisingly, the emergence of better postal systems in various regions accompanied this development.[38]

But the exponential growth of information did not end there. Between the seventeenth and the eighteenth century, the profusion of new learned institutions, the invention of journals, and the attractions of cosmopolitan centers transformed the idea of scholarly community from a humanist model of Latin men of letters to a more socially diffuse model of learned and vernacular communities of men and women writing, traveling, reading, and publishing. The Republic of Letters in this era was defined not only by the intellectual currents of the Scientific Revolution and the Enlightenment, but also by global missionary and mercantile networks, the Grand Tour, and the emergence of urban centers in the British and European colonies whose scholars both corresponded and traveled across the Mediterranean, Atlantic, and Indian Oceans. Individual correspondences that had routinely numbered in the low thousands now ballooned to tens of thousands of letters. The Aix savant Nicolas-Claude Fabri de Peiresc's famous scholarly network of the early seventeenth century, which has left us somewhere between 10,000 and 14,000 letters, and Leibniz's approximately 15,000 surviving letters exchanged with numerous correspondents between 1663 and 1716 are well-known examples of what the world of prolific letter writers now was capable of producing.[39]

While many documents pertaining to the Republic of Letters have not survived, the quantity of extant letters from these centuries, even when restricted primarily to scholarly correspondence, offers historians of the early modern period a body of material containing far more data than any one scholar, or even a team of researchers, can assimilate through traditional research methods. At the same time, letters are invaluable resources when they are brought together in a traditional edited volume or

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[37] Blair, *Too Much to Know*.

[38] On postal systems, see Wolfgang Behringer, *Im Zeichen des Merkur: Reichspost und Kommunikationsrevolution in der Frühen Neuzeit* (Göttingen, 2003); Eric R. Dursteler, "Power and Information: The Venetian Postal System in the Eastern Mediterranean, 1573–1645," in Diogo Ramada Curto, Eric R. Dursteller, Julius Kirshner, and Francesca Trivellato, eds., *From Florence to the Mediterranean and Beyond: Essays in Honour of Anthony Molho*, 2 vols. (Florence, 2009), 2: 601–623; James Daybell, "Postal Conditions," in Daybell, *The Material Letter in Early Modern England: Manuscript Letters and the Culture and Practices of Letter-Writing, 1512–1635* (London, 2012), 109–147; Richard R. John, *Spreading the News: The American Postal System from Franklin to Morse* (Cambridge, Mass., 1995). For a GIS analysis of the French postal system, see Anne Bretagnolle and Nicolas Verdier, "Expanding the Network of Postal Routes in France, 1708–1833," in Muriel Le Roux, ed., *Post Offices of Europe, 18th–21st Century: A Comparative History* (Bern, 2014), 183–202.

[39] On Peiresc's correspondence, a good starting point is Robert A. Hatch, "Peiresc as Correspondent: The Republic of Letters and the Geography of Ideas," in Brian P. Dolan, ed., *Science Unbound: Geography, Space and Discipline* (Umeå, 1998), 19–58; and recent essays by Peter Miller such as "Mapping Peiresc's Mediterranean: Geography and Astronomy, 1610–1636," in Dirk van Miert, ed., *Communicating Observations in Early Modern Letters (1500–1675): Epistolography and Epistemology in the Age of the Scientific Revolution* (London, 2013), 135–160. On Leibniz, see Ultee, "The Republic of Letters," 98; Paul Lodge, ed., *Leibniz and His Correspondents* (Cambridge, 2004); Nora Gädeke, "Gottfried Wilhelm Leibniz," in Christiane Berkvens-Stevelinck, Hans Bot, and Jens Häseler, eds., *Les grands intermédiaires culturels de la République des lettres: Études de réseaux de correspondances du XVIe au XVIIIe siècles* (Paris, 2005), 257–306.

increasingly as an online resource. Around the world, but particularly in Europe, the UK, and the United States, research projects are actively digitizing and cataloguing the surviving archives of the Republic of Letters.[40] While there is a considerable selection bias affecting whose records are being given new digital life, since most projects of this kind continue to focus on well-known figures, a host of forgotten characters are nonetheless emerging from this work: take Mlle Curton de Farges, who received a letter from Voltaire but is otherwise unknown to posterity.[41] Correspondence is diffuse and not entirely selective, after all; the act of writing a letter was possible for anyone possessing a certain degree of literacy or having access to someone who could write on his or her behalf. As such, it moves us beyond the usual criterion of selecting historical actors solely on the basis of their posthumous reputation. A great man or woman, after all, is only one node in an ego network. We have found ourselves repeatedly creating microhistories of people we did not expect to find and now wish to know.[42]

In many respects, the early modern Republic of Letters has proved to be an ideal testing ground for developing new ways of thinking about historical data. Put a different way, it is a rich source of multifaceted, if incomplete, data that traverses time and space and connects people. The Republic of Letters fundamentally relied on the exchange of words and things between people who established, and in some instances maintained, bonds of family, friendship, and patronage through letters to realize intellectual, religious, and political projects. Travel, long-distance communication, writing culture, and the production and circulation of printed matter structured many of its core activities. The Republic of Letters was not only an ideal, an imagined community in Benedict Anderson's sense, but a series of practices conducted by people who formed relationships. Human brokers, agents, gatekeepers, and go-betweens emerge from the terrifying mounds of paper that were produced. If books and journals were the culminating products of the Republic of Letters, conversation was its lifeblood— and those conversations took place as much in lively social gatherings and in more intimate dialogues (whether with people who lived nearby or with people who were brought into proximity by their travels) as they did in a form at times tangibly preserved for us: letters.

Even the earliest efforts to study the Republic of Letters confronted the difficulties of the data that this subject generates. Take Robert Mandrou's decision in 1973 to create a map of Erasmus's and Peiresc's correspondence and the diffusion of universities and Jesuit colleges in Western Europe. As Robert Hatch observed, Mandrou's Annaliste concern with the "geography of knowledge" led him to create static

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[40] Indeed, one of our case studies began life as a digital archive more than ten years ago. For Paula Findlen, Suzanne Sutherland Duchacek, and Iva Lelková's use of the Athanasius Kircher Correspondence Project, jointly hosted by the Museo Galileo and Stanford University and originally created by Michael John Gorman and Nick Wilding at the European University Institute with assistance from Findlen, and most recently updated by Sutherland Duchacek and Lelková with technical support by Glen Worthey, see Athanasius Kircher at Stanford, "Correspondence," http://www.stanford.edu/group/kircher/cgi-bin/site/?page_id=7.

[41] Letter of January 11, 1776, in Nicholas Cronk, ed., *Digital Correspondence of Voltaire*, http://dx.doi.org/10.13051/ee:doc/voltfrVF1260336a1c.

[42] Note also how in our Grand Tour case study, published in this issue of the *AHR*, a host of little-known and often forgotten architects are brought back into the fold of eighteenth-century British architecture.

portraits of a number of correspondents in different locations, while Hatch subsequently articulated Peiresc's network around people rather than places.[43] Mandrou's project was a pioneering attempt to create a historical visualization of an intellectual network, but his idea did not really bear fruit for the next few decades. In 1987, Ultee reiterated the need for developing new ways to explore this kind of historical data while he completed his analysis of Leibniz's correspondence, acknowledging the limitations of his ability to convey what he had found in words when he concluded, "Eventually a graphic presentation will clarify the links in this network."[44]

The more historians began to consider correspondence in relationship to the reconstruction of historical networks, the more urgent these questions became. By 2001, David Kronick, one of the pioneering historians of the early modern journal, noted the preliminary results of new techniques of digitizing and analyzing early modern correspondence, especially citing Urs Boschung's electronic catalogue of the voluminous correspondence of the eighteenth-century Swiss physician, naturalist, and poet Albrecht von Haller—almost 17,000 letters from nearly 1,200 correspondents—which subsequently became a highly productive case study in network analysis and visualizations by a team of researchers.[45] Haller's correspondence is one of numerous projects that have emerged in recent years in which digitization has stimulated new forms of analysis and new ways of presenting the results of these investigations.[46]

As we began our project in 2008, experiments with mapping the Republic of Letters proliferated. Robert Mayhew's account of early modern British geography demonstrates effectively how text-mining can help us understand the intellectual geography of the Republic of Letters and its understanding of physical geography.[47] Inspired by Steven J. Harris's early studies of mapping Jesuit science and Christopher Bayly's influential account of the relationship between information and empire, Simon Schaffer created a map of the "information order" of Isaac Newton's *Principia mathe-*

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[43] Robert Mandrou, *From Humanism to Science, 1480–1700*, trans. Brian Pearce (New York, 1979), 309–313; Hatch, "Peiresc as Correspondent," 29–30.

[44] Ultee, "The Republic of Letters," 103. Shelford responded to this idea by providing useful maps of Huet's Republic of Letters; *Transforming the Republic of Letters*, 9, 32, 128.

[45] David A. Kronick, "The Commerce of Letters: Networks and 'Invisible Colleges' in Seventeenth- and Eighteenth-Century Europe," *Library Quarterly* 71 (2001): 28–43, here 40; Urs Boschung, *Repertorium zu Albrecht von Hallers Korrespondenz 1724–1777* (Basel, 2002), http://www.albrecht-von-haller.ch/medien/pdf/repertorium.pdf. For a network analysis of Haller's correspondence, see Martin Stuber, Stefan Hächler, and Luc Lienhard, eds., *Hallers Netz: Ein europäischer Gelehrtenbriefwechsel zur Zeit der Aufklärung* (Basel, 2005); Florence Catherine, "La pratique et les réseaux savants d'Albrecht von Haller (1708–1777), vecteurs de transfert culturel entre les espaces français et germaniques au XVIIIe siècle" (doctoral thesis, Université Nancy 2, 2009). A full bibliography of the research emerging from this collaborative project can be found at http://www.albrecht-von-haller.ch/e/correspondence.php.

[46] To pick another rich example that has produced a considerable body of recent scholarship engaged with questions of correspondence networks and the nature of epistolary commerce, see the Clusius Project, sponsored by the Scaliger Institute of the University of Leiden, http://www.library.leiden.edu/special-collections/scaliger-institute/projects/clusius-project.html, which has digitized the correspondence of the Dutch naturalist Carolus Clusius. See Florike Egmond, Paul Hoftijzer, and Robert Visser, eds., *Carolus Clusius: Towards a Cultural History of a Renaissance Naturalist* (Amsterdam, 2008); Florike Egmond, *The World of Carolus Clusius: Natural History in the Making, 1550–1610* (London, 2010). This archive has recently been integrated into another Dutch project co-sponsored by Huygens ING whose goal is to create a complete digital archive of manuscript facsimiles, transcriptions, and biographical information. Digital Edition of the Clusius Correspondence, http://www.dwc.knaw.nl/biografie/clusius/digital-edition-of-the-clusius-correspondence/.

[47] Robert Mayhew, "British Geography's Republic of Letters: Mapping an Imagined Community, 1600–1800," *Journal of the History of Ideas* 65, no. 2 (2004): 251–276.

matica (1687) to debunk the notion that Newton was a solitary scholar untouched by a changing world.[48] Similarly, Yves Gingras explored the uses of citation and co-citation analysis, taking advantage of the digitization of Royal Society secretary Henry Oldenburg's correspondence by the Electronic Enlightenment Project at Oxford University and JSTOR's fully searchable version of the *Philosophical Transactions* to reconstruct the Scientific Revolution as a "visible map of the intellectual relations between people," arguing for the importance of combining "the usual micro-analysis of the specific content of the letters" with an ability to consider it instead as "a global corpus of data."[49] A group of French early modern historians, collaborating under the acronym CITERE, have also combined quantitative data and maps to analyze such variables as the speed and size of learned correspondence in eighteenth-century Europe.[50]

Many research questions underpinning scholarship on the Republic of Letters ultimately rest on data issues.[51] While recognizing that not everyone likes the idea of presenting early modern letters as filled with "data," worrying that it runs the risk of flattening the analysis or losing sight of the fact that these are historical documents whose creation is context-specific, we nonetheless believe that the information they contain deserves greater attention. Our experience in the Mapping the Republic of Letters project addresses a number of these questions to demonstrate how a digital and visual approach can indeed facilitate this sort of analysis. Building upon the rich historiography we have outlined above, we began with the insights gleaned from this considerable body of research. The inhabitants of the early modern Republic of Letters had elaborate visions of what their intellectual community resembled—most viewed it as a cosmopolitan, egalitarian place, and proudly highlighted their correspondents in far-flung places. Montesquieu famously satirized this self-perception in his *Persian Letters* (1721), where an astronomer boasts about corresponding with "a man in Stockholm, another in Leipzig, and another in London, whom I have never seen, and no doubt shall never see." Such descriptions parody the actual practices of the great secretaries of the Republic of Letters such as Oldenburg, who reportedly "never read a Letter before he had Pen, Ink, and Paper ready to answer it forthwith."[52] But could these descriptions really be trusted? Or was the reality of scholarly

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[48] Simon Schaffer, *The Information Order of Isaac Newton's Principia Mathematica* (Uppsala, 2008). The history of science has actively incorporated certain insights from sociologist John Law's and sociologist and anthropologist Bruno Latour's contributions to Actor-Network Theory (ANT) to develop a rich account of the role of human and non-human actors in social networks. See, for example, Steven J. Harris, "Mapping Jesuit Science: The Role of Travel in the Geography of Knowledge," in John W. O'Malley, Gauvin Alexander Bailey, Steven J. Harris, and T. Frank Kennedy, eds., *The Jesuits: Cultures, Sciences, and the Arts, 1540–1773* (Toronto, 1999), 212–240.

[49] Yves Gingras, "Mapping the Structure of the Intellectual Field Using Citation and Co-Citation Analysis of Correspondences," *History of European Ideas* 36, no. 3 (2010): 330–339, here 330 and 339; and Yves Gingras and Alexandre Guay, "The Use of Analogies in Seventeenth and Eighteenth Century Science," *Perspectives on Science* 19, no. 2 (2011): 154–191.

[50] See Pierre-Yves Beaurepaire, ed., *La communication en Europe de l'âge classique au siècle de Lumières* (Paris, 2014). The English name for this project is Communicating Europe: Early Modern Circulations, Territories and Networks.

[51] For example, see the approach taken in many of the articles in Berkvens-Stevelinck, Bots, and Häseler, *Les grands intermédiaires culturels de la République des lettres*.

[52] Montesquieu, *Persian Letters*, trans. Margaret Mauldon (Oxford, 2008), 221; Marie Boas Hall, *Henry Oldenburg: Shaping the Royal Society* (Oxford, 2002), 129, quoting Martin Lister's recollection of Oldenburg in 1698.

communication in the early modern age far more prosaic? Was the Republic of Letters genuinely cosmopolitan, or was it more regional, national, and confessional in scope? What did membership in this republic actually look like, and how might we bring different versions of this imagined community into focus by exploring well-known, concrete examples simultaneously? And how did it evolve over time and space? These were the questions that our research group set out to explore, initially without the aid of data or visualizations. But like so many scholars who came before us, we inevitably found ourselves grappling with what to do with the growing mountains of historical information about people, places, and time that lay at the center of our enterprise.

Is a big historical data approach the future or an illusion? It is easy to understand why some commentators have been predicting a "big data revolution," even in the humanities.[53] Not only are increasing numbers of texts and archives being digitized, but their accompanying metadata can now be validated and enriched via cultural heritage resources. For instance, we can begin to identify published authors across different datasets thanks to the adoption of authority files (such as VIAF), which link library records and other data sources through unique identifiers.[54] More and more libraries, including the OCLC, the Bibliothèque nationale de France, and Europeana, are also adopting Linked Open Data (LOD) models, making structured and curated data currently contained in library catalogues available for research.[55] The bibliographer's domain is fast becoming terrain for scholars to plumb and mine.

Much attention in the past fifteen years has been directed toward *text* digitization, but the production of vast stores of data—in particular, of metadata—is an equally exciting story. Anyone who has spent a few hours on Google Books can probably imagine a future in which all print material has been digitized; but imagining the future of data collection is more challenging. Ideally, if data models become reasonably standardized and well implemented, we might be able to look forward to a world in which datasets connect quickly and seamlessly, combining a wealth of discrete and useful information available to be reorganized into complex combinatorial patterns. If the print era was defined by the revolutionary technology of movable type, this coming

[53] See Mayer-Schönberger and Cukier, *Big Data*; Erez Aiden and Jean-Baptiste Michel, *Uncharted: Big Data as a Lens on Human Culture* (New York, 2013). For a similar endorsement by historians, see Guldi and Armitage, *The History Manifesto*.

[54] VIAF stands for "Virtual International Authority File" (http://viaf.org/). As the website states, this service "combines multiple name authority files [from different databases, mainly libraries] into a single OCLC-hosted name authority service. The goal of the service is to . . . increase the utility of library authority files by matching and linking widely-used authority files and making that information available on the Web."

[55] On Linked Open Data, see notably Tom Heath and Christian Bizer, *Linked Data: Evolving the Web into a Global Data Space* (San Rafael, Calif., 2011), http://www.morganclaypool.com/doi/abs/10.2200/S00334ED1V01Y201102WBE001; see also Eero Hyvönen, *Publishing and Using Cultural Heritage Linked Data on the Semantic Web* (San Rafael, Calif., 2012), http://www.morganclaypool.com/doi/abs/10.2200/S00452ED1V01Y201210WBE003. Our thanks to Glauco Mantegari for these references. The open data portal of the Bibliothèque nationale can be found at http://data.bnf.fr; for Europeana, see http://pro.europeana.eu/linked-open-data. Information about the OCLC's linked data plans (through World-Cat) can be found at http://www.oclc.org/data.en.html. Unfortunately, the process for converting MARC library data into LOD (in BIBFRAME format) is likely to take many, many years.

era could well be defined by the equally revolutionary practice of "movable data." Once set in print and locked in books, catalogues, or tables, data can now be pried loose from their original settings and made available for new arrangements. Therein lies perhaps the greatest promise of data for historians: until now, most of us have been beholden to search forms for querying library catalogues, digital corpora, and other databases. We are constrained by what the library or the archive permits us to ask. Linked data models have the potential to make data more nimble and malleable, and subject to a much wider variety of uses.

But this prospect still lies in the future, and may yet prove to be a mirage. For one thing, when considering the promise of linking data across archives, we must consider the original state of the underlying data. The metadata for the historical records used in many of our case studies were constructed for data retrieval within particular online systems, not for a research inquiry.[56] The "place of publication" field in the Bibliothèque nationale contains a number of values similar enough for us to consider, but with subtle variations: Paris appears as "Paris," "(Paris)," "[Paris]," "(Paris,)" etc. To use these data effectively, we need to carefully decode the meanings in the parentheses, brackets, and commas that may or may not be documented (for instance, when is Paris the stated but false place of publication vs. when is it the unstated but real place?). The same can be said for digitized modern print editions: content structured for publishing is effectively unstructured for the purposes of data analysis. The scholarly parsing of existing data often leads us to create our own new columns of data that serve our research agenda.

Secondly, there is also the problem of incompleteness, often of unknown proportions. To borrow an example from our research, we were fortunate to receive at an early stage of our project a large dataset from the Electronic Enlightenment Project (EEP) at Oxford University.[57] The records contained the metadata for about 50,000 letters to and from leading seventeenth- and eighteenth-century authors, including Thomas Hobbes, John Locke, Voltaire, Rousseau, David Hume, Claude Adrien Helvétius, Adam Smith, and Jeremy Bentham. Along with these metadata, we also benefited from the painstaking curatorial work of the researchers at EEP, who had included information about nationality, occupation, gender, and dates for each individual in the collection. But the data were filled with gaps and uncertainties. This was in no way the fault of EEP, which had produced as fine a database as possible (in addition to their remarkable full-text correspondence database). Rather, the data were incomplete because the historical record was incomplete. Many letters had been passed down without any indication of their source or destination locations; some were also undated. Others had vanished off the face of the earth.

This critical reading and assessment of the state of the data is common to each of our case studies in Mapping the Republic of Letters. This distinction points to a third significant methodological difference in our approach to the objects of our study. If our historical subjects had been communicating digitally, and we could have captured their exchanges and movements from a real-time live data stream, we might be able to

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[56] This is why scholarly cataloguing projects such as Early Modern Letters Online (EMLO), developed by the Cultures of Knowledge Project at Oxford University, are so important for work on early modern correspondence. See http://emlo.bodleian.ox.ac.uk/.

[57] See http://www.e-enlightenment.com/.

adopt the statistical methods favored by data scientists. But historical information does not stream forth like a Twitter feed. The datasets that we have explored, all of which were manually scrutinized, edited, and enriched by our research teams, came to us already structured, and sometimes designed for purposes contrary to our own. Most of the metadata we rely upon from these digitized archives have been framed and reframed for various uses over decades. We need to unmask their underlying assumptions in order to get down to the level of historical evidence. The role of the scholar thus becomes one of finding meaning in the mass, which in the case of historical data is often also a mess.

Our final problem is more pragmatic and has greatly preoccupied our research project: Where are the tools to support humanistic inquiry into multidimensional, heterogeneous, and incomplete datasets? To take maximum advantage of this coming data deluge, we will need new technologies to help us construct meaningful queries and then explore, filter, combine, and analyze the results.[58] We need to see the past from many different vantage points in order to understand it, and that cannot happen in front of an infinite tabular spreadsheet.[59] Visualization has proven to be an extremely effective tool for representing data and navigating data across many disciplines.[60] ArcGIS, Tableau, R, and Gephi are some of the most powerful desktop applications and programming languages for data visualization used in humanities research today. And yet the quantitative bias that defines much of the functionality of those tools does little to support the kind of qualitative analysis practiced in our case studies. We require different tools that can accommodate ambiguities, paradoxes, and contingencies to help us process historical and more generally humanistic data effectively.

Designing digital tools is a long-term, expensive, complicated process, one that typically involves working with grant officers, data scientists, programmers, and interface designers. Needless to say, we had no idea what we were getting into when we set off down this path. This phase of our collaboration arose from the growing realization that we simply could not begin to explore, to any serious degree, the questions that we wanted to pose without experimenting with different approaches to visualizing historical data. We could borrow or build a database or two, but what did we want to do with it? This became the crucial question that led us in the direction that ultimately resulted in the creation of a web-based data visualization platform, Palladio.[61]

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[58] For a similar point, see Guldi and Armitage, *The History Manifesto*, chap. 4.

[59] For a fascinating historical reflection on this problem that has inspired aspects of our own historical visualizations, see Daniel Rosenberg and Anthony Grafton, *Cartographies of Time: A History of the Timeline* (New York, 2010).

[60] Evidence of this can be found in the development of the commercial visualization software packages mentioned below, as well as in the popularity of recent books and websites on the topic from the fields of statistics, design, business analytics, and computer science. For some prominent examples, see Edward Tufte, http://www.edwardtufte.com; Manuel Lima, http://www.visualcomplexity.com/vc/; Stephen Few, http://perceptualedge.com; Alberto Cairo, http://www.thefunctionalart.com; David McCandless, http://www.informationisbeautiful.net.

[61] Palladio is a data-visualization platform that allows users to upload and analyze their data in the browser; funds for its development came from the National Endowment for the Humanities and Stanford University. It brings together much of what we learned in the design and development of prototype tools over the past six years as members of the Mapping the Republic of Letters project at Stanford University, primarily in collaboration with the Density Design research lab at the Politecnico di Milano, and in conversation with allied initiatives such as the Cultures of Knowledge project at Oxford University, as well as the Circulation of Knowledge project jointly sponsored by Huygens ING in The Hague and the Des-

Since our project has always had humanistic pursuits at heart, it is no surprise that our underlying philosophy of tool development would seek to enhance, not replace, traditional historical methods. Big data are not useful only to scholars who adopt statistical methods. The large scale also allows us to pursue traditional research in a much broader space of possibilities. When we construct visual models with data, we consider those visualizations to be powerful heuristics, not proofs. We wield our data with the assumption that they are incomplete, ambiguous, and uncertain. We visualize them to help guide us, to uncover patterns and provoke questions that we otherwise might not ever have considered. Our publications include online access precisely so that readers can explore and manipulate the data of our case studies. These use cases of Palladio allow direct insight into the process of heuristic visualizations, and on these same web pages readers can download the data to pursue their own research questions as well.[62] But we do not believe that the data in and of themselves provide answers. The interpretive work is done outside of the computer, in the decisions that go into building our datasets, in the design of the instruments we use to visualize the data, and finally in making sense of the very imprecise maps, graphs, and diagrams we produce. We still need to read those shelf-loads of books and boxes of manuscripts—in the archive or online—to make sense of our findings.

As a result of dealing with data visualizations, we found ourselves thinking anew about space. Many of the patterns that interest us, and that our visualizations help to uncover, concern geographical relations. This puts our project in dialogue with spatial history, an area in which digital research has had a great impact. But our material and questions have inspired a distinct methodology for our research. Many spatial history projects analyze the relationships between different categories of space—for instance, between spatial practice and represented space, to borrow Henri Lefebvre's terms.[63] This approach often involves comparing *layers* of space—quite literally in the case of the HyperCities project, for example.[64] By contrast, our project has been much more concerned with the relationships between different areas within a single layer of space. In fleeing Germany, Kircher was cast adrift from his native land, and his correspondence captures beautifully the essence of Jesuit mobility as well as how people maintained a strong sense of identity at a distance. Locke's exile in France belonged to one of those moments when a portion of the "English" world was on the Continent, as would later occur on a much larger scale when the Grand Tour created a world in

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cartes Centre at the University of Utrecht. See http://hdlab.stanford.edu/projects/palladio/. We count it as a success of our project that Palladio has now been used widely in a variety of projects well beyond our own within Mapping the Republic of Letters. For a recent assessment, see Graham, Milligan, and Weingart, *Exploring Big Historical Data*, 112, 268–269.

[62] See http://republicofletters.stanford.edu/publications, which hosts the online interactive visualizations, databases, and data schemas for our case studies. Note that the datasets for each case study are also stored in SDR (the Stanford Digital Repository), https://sdr.stanford.edu/collections/druid: zn653qj0117, to ensure their longevity in what might otherwise at times seem the quite ephemeral afterlife of digital projects, and where they can be accessed openly by the scholarly community.

[63] See Richard White, "What Is Spatial History?," Spatial History Lab: Working Paper, submitted February 1, 2010, http://web.stanford.edu/group/spatialhistory/cgi-bin/site/pub.php?id=29. White draws on Henri Lefebvre, *The Production of Space*, trans. Donald Nicholson-Smith (Cambridge, Mass., 1991).

[64] HyperCities: Thick Mapping in the Digital Humanities, http://hypercities.com/.

between England and Italy for multiple generations of Britons. Benjamin Franklin, remembered today as the archetypal American, in fact spent much of the last third of his life largely in England and the Continent, often doing business in which the lines between what was "British" and what was "American" were blurred to the point of meaninglessness. When we reflect on the connections among England, France, and North America in the eighteenth century, for example, we are essentially asking how an "English space" was situated in relation to a "French space," or an American one within a British world. Instead of superimposing layers, we look at a patchwork of spaces, all connected on the same plane by the human interactions that constituted the early modern Republic of Letters.[65]

The kind of spaces we study might best be described as "cultural zones."[66] Such zones exist, almost by definition, in the plural: to a large degree, they are defined relative to and in distinction from one another. Our project requires us to identify these zones spatially and conceptually, but also to reflect on their interactions.

At the geographical level, we do not place much importance on exact boundaries or even precise locations; for this reason, we have not used GIS (geographic information systems) in our visualizations, and we tend to prefer abstract maps over historical ones. We take as a given that cultural zones have fuzzy borders and can overlap: eighteenth-century Geneva, for instance, could be seen as belonging to both a Swiss Protestant and a French cultural zone. We use the term "cultural zone" rather than "cultural space" in order to stress its imprecise, often amorphous, edges. A zone also covers a large area, which is why we chose this term over "place." It can indeed capture connections between places in a given period.

Much of spatial theory, from Georg Simmel and Henri Lefebvre to David Harvey, has roots in urban studies.[67] Cities are also central to our thinking about cultural zones, but in our case we look *extra muros*. Indeed, a cultural zone can often be defined as the area affected by the dominance of a city (usually a capital). The French cultural zone radiates around Paris; in the eighteenth century, its reach could be felt as far away as St. Petersburg. The English cultural zone extended around London, and reached as far as Philadelphia and the Indian subcontinent. Rome's reputation as *caput mundi* was certainly enhanced by its role as the nerve center of overlapping global missionary networks whose reach extended to every corner of the world. Of course, capitals did not always play this role: not every region created cultural zones

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[65] On place vs. space, see Edward S. Casey, *The Fate of Place: A Philosophical History* (Berkeley, Calif., 1997); Philip J. Ethington, "Placing the Past: 'Groundwork' for a Spatial Theory of History," *Rethinking History* 11, no. 4 (2007): 465–493.

[66] The concept of "zone," to the extent that it is used in spatial theory, tends to be deployed by literary scholars in relation either to cities (see, for instance, David Bell, Jon Binnie, Ruth Holliday, Robyn Longhurst, and Robin Peace, *Pleasure Zones: Bodies, Cities, Spaces* [Syracuse, N.Y., 2001]) or to climatic "zones" (see Felicity Nussbaum, *Torrid Zones: Maternity, Sexuality, and Empire in Eighteenth-Century English Narratives* [Baltimore, 1995]). There has also been some reflection on this spatial category in postcolonial scholarship; see Imre Szeman, *Zones of Instability: Literature, Postcolonialism, and the Nation* (Baltimore, 2003). Among historians, Peter Sahlins considers zones in relation to frontiers in *Boundaries: The Making of France and Spain in the Pyrenees* (Berkeley, Calif., 1991). We use the term in the sense provided by the *Oxford English Dictionary*: "A definite region or area of the earth, or of any place or space, distinguished from adjacent regions by some special quality or condition (indicated by a defining word or phrase)."

[67] See Georg Simmel, "The Metropolis and Mental Life" (1903), in Gary Bridge and Sophie Watson, eds., *The Blackwell City Reader* (Oxford, 2002), 11–19; Lefebvre, *The Urban Revolution*, trans. Robert Bononno (Minneapolis, 2003); David Harvey, *Social Justice and the City*, revised ed. (Athens, Ga., 2009).

around a single capital city. But in these instances, cultural zones still formed primarily around a constellation of cities.

Our general focus on capitals is not meant to deny the importance of other centers in the circulation or creation of knowledge and goods.[68] For example, Rome's centrality in Grand Tour travels gains meaning only in relation to other Italian destinations—and in any case travelers could not even reach Rome without journeying through other cities and regions. But for definitional purposes, the periphery of a cultural zone is extremely hard to identify spatially (i.e., to map). The edges of a cultural zone tend to be unstable, and can vary depending on the contingencies of war, empire-building, and governmental policy. The Jesuit diaspora was constantly expanding and contracting as new opportunities emerged and others became unstable or vanished entirely. For instance, pockets of a French cultural zone emerged in London and the Dutch Republic after the revocation of the Edict of Nantes in 1685. Cultural zones are rarely demarcated by a wall, a line, or a river. At the edges, they just fade away, as other cultural zones take their place. Cities, by contrast, are much more easily localized. They anchor the cultural zone in cartographic space.

At the conceptual level, what makes these zones cultural? Here we can only point to a wide array of features, most of which have, in themselves, little to do with space. A language, a religion, a system of social hierarchy, literary and artistic tastes, fashions, food, constitutional theories, and so forth: all these features, and others, contribute to the production of a cultural zone, and each zone will be more or less determined by different features. That said, these practices and ideas are nonetheless spatial in that they prevail in a certain zone, and beyond that zone, different practices and ideas prevail. Political institutions are obviously important for establishing differences between cultural zones, but they are not sufficient: the American states remained in an English cultural zone well after independence. In other words, a cultural zone and a political sphere are not necessarily the same thing.

The arguments advanced here are mainly intended to answer questions about our methodology; they are not meant to serve as a manifesto, and there are of course slight but telling differences in how each of our case studies maps an episode in the Republic of Letters. Since every database is different, and since the needs of different scholarly agendas are best met by different technologies, we do not think it possible or even desirable to dictate a unique methodological approach for all experiments in digital history. One objective of these reflections is to encourage other scholars to venture out into these still largely uncharted waters, using what we have learned along the way as either a guide or a foil.

But we also have our own pipe dreams about the future of digital history, particularly where intellectual and cultural history are concerned. Given that our own collection of metadata was pooled from different sources, we experienced firsthand the advantages of studying historical networks from multiple angles.[69] This multiplicity can

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[68] See, e.g., Londa Schiebinger, *Plants and Empire: Colonial Bioprospecting in the Atlantic World* (Cambridge, Mass., 2004).

[69] Our largest source of metadata was the EEP; the Humanities Packard Institute gave us the metadata for the Benjamin Franklin correspondence; Stanford Libraries, for the Kircher correspondence; the

uncover networks that exist at one or two (if not six) degrees of separation. Attempting to make our databases converge has not been an explicit goal of the project, since it is not yet clear that doing so would yield any strong insights. Franklin and Voltaire never corresponded directly (and we know of only one meeting in person), but because we are in possession of the metadata for both their correspondences, we can identify everyone with whom they both corresponded.[70] Kircher and Locke had even less reason to meet, and in fact never did meet, and they certainly never corresponded, so perhaps there is nothing particularly revealing to be gained by exploring the degree to which their correspondence intersects, since they shared so little. Instead, each illuminates a largely distinctive dimension of seventeenth-century intellectual life and its political, religious, and commercial entanglements. By contrast, the Grand Tour Project thrives on identifying points of intersection that emerge as people meet in Rome, Florence, Venice, and Naples, among other places, form temporary communities forged by travel, and potentially renew their acquaintance around an architectural commission that reminds a patron and an architect that they once shared the experience of Italy together. These examples highlight the potential benefits of having overlapping metadata: it allows us to explore possible connections by following the trail.

The metadata in our own databases is heterogeneous and somewhat arbitrary; it reflects our varied interests and the availability of such information, so we have been opportunistic in selecting projects where it was already possible to do this kind of work. Its limitations also showcase, *a contrario*, what a more systematic approach could yield. Imagine a database even larger in scale than the one currently under construction by Oxford's Cultures of Knowledge project—Early Modern Letters Online (EMLO), which contains the entire Kircher database, among many others—in which all metadata relating to scholarly communication could be pooled.[71] Each person would have a unique identifier, connecting all of his or her interactions, and embedded in a much larger pool of information that spanned two hundred, three hundred, or four hundred years of intellectual activity. Add to this the possible bibliographic dimensions, with each author linked to the relevant holdings in major libraries; and throw in other assortments of metadata, such as membership in learned academies, participation in salons or clubs, university education, occupation, travels, and so on. This would indeed be a multifaceted archive for all of us to explore.

No doubt such a database is a fantasy, and we are not suggesting that it could ever exist in complete form, notably for the reasons advanced above. But a partial realization of this encyclopedia of metadata is not beyond our abilities. A pan-European re-

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data for the Grand Tour came from Ingamells, *A Dictionary of British and Irish Travellers in Italy*. For an interesting reflection on the advantages of pooling data, see Gingras, "Mapping the Structure of the Intellectual Field Using Citation and Co-Citation Analysis of Correspondences." We also warmly thank Robert Hatch at the University of Florida for generously sharing his experience constructing and working simultaneously with correspondence databases for his research on the relationship between the Republic of Letters and the Scientific Revolution.

[70] Franklin met Voltaire when the latter was initiated into a Masonic Lodge; see Nicholas Hans, "UNESCO of the Eighteenth Century: *La Loge des Neuf Sœurs* and Its Venerable Master, Benjamin Franklin," *Proceedings of the American Philosophical Society* 97, no. 5 (1953): 513–524. The list of their shared correspondents includes Jean Le Rond d'Alembert, Pierre-Jean-Georges Cabanis, Octavie Durey de Mesnières, Mme Helvétius, David Hume, André Morellet, and Anne-Robert-Jacques Turgot.

[71] The EMLO catalogue at http://emlo.bodleian.ox.ac.uk/ is a promising step in this direction.

search network, Reassembling the Republic of Letters, has just set out with a similar vision, and in fact, we can draw inspiration from the remarkable work undertaken by classicists to create a "cyberinfrastructure" that enables and encourages interoperability between digital projects.[72] However, we also need tools, developed for and by humanists, to explore and analyze these data, to make them meaningful. And even in this ideal scenario, the time will invariably come when it will be necessary to turn away from the screen, pick up a book, and try to figure out what these piles of historical information mean. That is the exercise that all of our publications seek to do. We have not attempted to map the Republic of Letters without forgetting why we began this project: because the figures who populate our project are interesting for many reasons and left behind a rich trail of documentation whose content we need to read with care if we hope that we will ever be able to understand them.

[72] See http://www.republicofletters.net/ for more information on the Reassembling the Republic of Letters project, with which Mapping the Republic of Letters is now affiliated, and which counts collaborators from more than thirty European countries, as well as from Canada and Australia. For the "cyberinfrastructure," see *Changing the Center of Gravity: Transforming Classical Studies through Cyberinfrastructure*, ed. Gregory Crane and Melissa Terras, Special Issue, *Digital Humanities Quarterly* 3, no. 1 (2009).

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