

IV.3 Chronologies of the Republic of Letters

Howard Hotson, Dirk van Miert, Alex Butterworth, Glauco Mantegari, Riccardo Bellingacci, Carlo De Gaetano, Christoph Kudella, Michele Mauri, Serena Del Nero, and Azzurra Pini

Introduction

Howard Hotson and Alex Butterworth

Every letter has a chronological as well as a geographical dimension. In fact, every letter is situated, not on one timeline, but on several. The process-based letter model (proposed in chapter II.7) outlines the temporal sequences of drafting, sending, conveying, and receiving a letter, as well as the varieties and vicissitudes of each. Letter records contain further chronological data, on the date of sending and occasionally also of receipt. The characteristics of the networks formed by letters vary over time in ways that traditional network analysis struggles to capture (ch. IV.5). The same applies to the postal and other systems for distributing letters in the first place (ch. IV.2, sect. 4). Collections of letters, in script and print, have histories that need to be mapped and narrated (ch. III.1). The movements of correspondents complicate the histories of their correspondences (ch. IV.2, sect. 3). Last but by no means least, the topics discussed in letters change over time, as do the systems for organizing those topics (ch. II.5), including the very concepts of a ‘letter’ and the ‘republic of letters’ themselves (section 4 below).

Given these multiple layers of chronology, time is perhaps the richest field for the innovative visualization of correspondences; but it is also probably the least

well developed. Unlike space, only rather rudimentary means are readily available of visualizing time. The basic convention is to depict chronology on a timeline, an axis reading from left to right, punctuated by precisely quantifiable units, normally years. The centuries-old effort to depict temporal sequence in graphic form has experimented with circles, spirals, and vertical timelines, along with trees and other natural objects, images from biblical prophecy, and more complicated diagrams.¹ More recently, critical reflections on the orientation of timelines and an agenda for their improvement have helped provoke much interesting experimentation around the visualization of complex time.² Yet, despite this conceptual work, the options for developing the basic conventions of the timeline have not been systematically explored, non-traditional alternatives remain largely uncharted, and even the recent wave of innovation has yet to inform the tools and visual languages readily accessible for routine scholarly use. Although no full census of the options available can be presented here, the examples that follow, mostly produced by design sprints and STSMs, give some impression of the solutions awaiting development.

1 Correspondence Metadata: Item-level Records

1.1 Histograms

Howard Hotson

The most familiar means of visualizing the chronology of a correspondence is the histogram, which numbers letters on the vertical axis and years on the horizontal one. A useful development of this approach, which has been implemented in *Early Modern Letters Online*, allows the user to compare incoming and outgoing letters in parallel charts, in a single chart, either with outgoing correspondence stacked on top of incoming (as below) or with each series represented by independent bars. Such visualizations provide an almost instantaneous impression of the general ‘shape’ of a correspondence’s chronological development. Only a few years ago, such an impression could only be constructed through a laborious exercise. Although commonplace today, the potential of this simple tool has yet to be systematically exploited. Why, for instance, is Constantijn Huygens’s correspondence (figure 1) divided into two quite separate peaks? And why do letters to him preponderate in some periods more than others? Do these changes represent phases in his career, or mere vicissitudes in the survival of his correspondence? How common is this kind of division? And how many other chronological ‘shapes’ do learned cor-

¹ This history is sumptuously illustrated in Daniel Rosenberg and Anthony Grafton, *Cartographies of Time: A History of the Timeline* (New York: Princeton Architectural Press, 2010).

² See the seminal contribution by Stephen Boyd Davis, ‘History on the Line: Time as Dimension’, *DesignIssues*: 28:4 (Autumn 2012): 4–17, see https://doi.org/10.1162/DESI_a_00171.

responses take? It is only when we have multiple data sets to compare that such questions even arise.

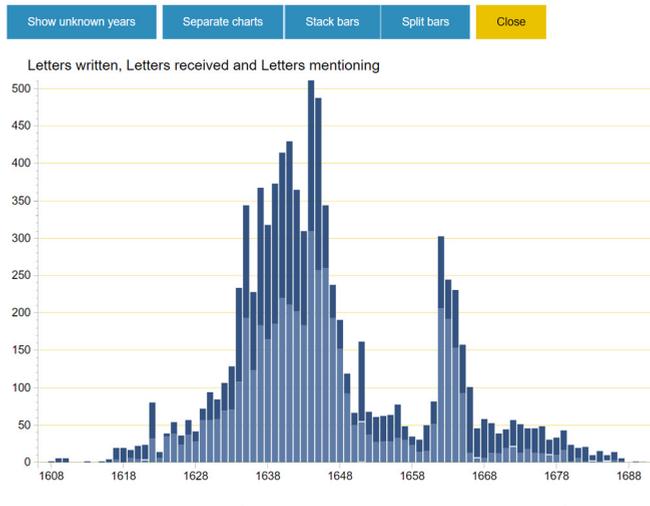


Figure 1: The correspondence of Constantijn Huygens (1596–1687)³

Even less has been done to explore the utility of this tried-and-tested mode of visualization on other kinds of readily available data. For instance, did the number of people with whom Huygens exchanged letters vary equally dramatically over time? Even when the total number of incoming and outgoing letters did not vary greatly, was he sometimes exchanging high volumes of letters with a few intimate friends and other times exchanging only a few letters with far larger numbers of people? More interesting results could be generated by graphing the results of textual analysis in a similar way. For instance, with a sufficiently large dataset it should be possible to determine whether patterns of co-citation changed over time. Another set of options could emerge from graphing the results of quantitative network analysis in similar fashion (on which see ch. IV.5). Within a stable network of overlapping correspondences, can changes in the betweenness centrality or eigenvector centrality of a given individual or cluster of individuals be meaningfully graphed in this way? Given the difficulty of capturing change within most forms of network analysis, these are possibilities which merit exploration.

³ Data derived from Jacob A. Worp, ed., *De briefwisseling van Constantijn Huygens (1608–1687)*, 6 vols., (The Hague: Martinus Nijhoff, 1911–1917) via the *ePistolarium*. Visualization on EMLO: <http://emlo.bodleian.ox.ac.uk/profile/person/69f002da-1994-418d-9cc4-d8d544d64121>, accessed 20/03/2019.

1.2 Horizontal Bar Charts: Browsing the Chronologies of a Union Catalogue

Carlo De Gaetano, Howard Hotson, Glauco Mantegari, and Azzurra Pini

Histograms – with time represented on the horizontal axis and some other measurable quantity on the vertical one – thus have many underexploited possibilities for future development. Still other options emerge from removing the vertical axis altogether and developing the horizontal timeline in other ways. A few of these options were explored in the first Como data-design sprint by a group charged with investigating new tools for browsing the multidimensional data involving people, space, time, and potentially also topics in the catalogue of early modern learned correspondence, *Early Modern Letters Online* (EMLO).⁴

Lives. EMLO has been assembled partly by bringing together catalogues of the correspondences of individual learned figures. One means of browsing such a union catalogue might begin with a series of horizontal bars running across a chronological grid. The starting and ending points of the bars would represent the birth and death dates of the individuals with their own correspondence catalogue in EMLO.⁵ When multiple bars of this kind are stacked on top of one another, the result would be a chart such as that depicted in figure 2. In each case, the name of the correspondent would be provided: clicking upon it would take the user to the EMLO catalogue page, in which more information on the individual, the correspondence, and the state of the data is provided.

Letters. Within the horizontal bars, a vertical line would represent each letter sent or, if the user chooses, letters both sent and received, perhaps distinguished by colour. Since this arrangement would produce only an approximate impression of the distribution of known correspondence throughout an individual's lifetime, clicking on a bar could produce a histogram running along the same axis, more accurately displaying the number of letters sent and received each year.⁶

⁴ See <http://emlo.bodleian.ox.ac.uk/home>, accessed 20/03/2019. Como data-design sprint, 4–8 April 2018, Project 5: 'Visualising EMLO'. Some attention was devoted to non-traditional strategies for visualizing the geographical and linguistic dimensions of the data, but the most fruitful line of development, outlined here, related to the chronological dimension: https://docs.google.com/document/d/1n4BaZ1rSa8LuLn_7ZMIb7ihDyrmzpaNf1yvetuN4oV4/edit, accessed 20/03/2019.

⁵ When birth or death dates are unknown, the uncertainty can be represented by shades of grey, with different levels of uncertainty visible by drilling down to a more detailed view. This would require a data model refined in the manner indicated in chapter II.3 to represent different kinds and degrees of uncertainty.

⁶ It should be possible to separate and stack the representations of letters sent and received and to zoom to full screen, as on EMLO: e.g. <http://emlo.bodleian.ox.ac.uk/profile/person/edb080aa-312f-4e4b-ac3d-0cf4f1eb7a67>, accessed 20/03/2019.

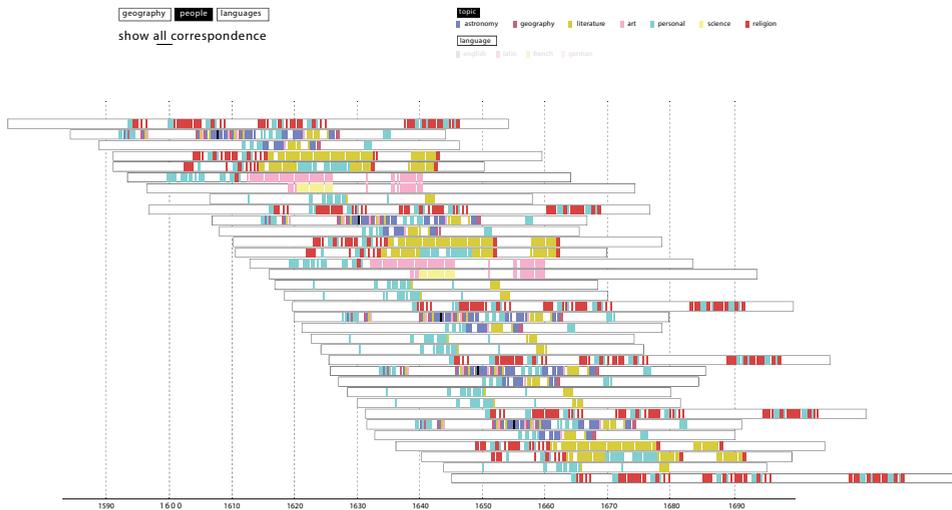


Figure 2: Horizontal bar chart for browsing a union catalogue of learned letters

Groups. While the initial view might include all the correspondences in the union catalogue, the user would be able to select clusters of overlapping correspondences for closer study in a variety of ways. After selecting a principal correspondent, one option would be for the system to select automatically all the other figures who exchanged substantial numbers of letters with him or her, whether or not they were provided with separate catalogues of their own within EMLO. These automatically selected correspondences might initially be ranked in terms of the number of letters exchanged with the principle correspondent. The user would then be able to refine this automatic selection in a variety of ways: by delimiting a narrower chronological period, geographical region, or topical field, for instance; or by manually selecting specific correspondents for closer study.

Topics. An additional refinement would colour-code letters by main topic of discussion. Since one letter can discuss multiple subjects, the topics in any given letter would need to be ranked in importance to generate a first overview; but all the topics in the letters could appear sequentially with the right selecting and filtering of topical categories. This option would obviously depend on the availability (1) of a standard system of categorising topics (such as the method outlined in ch. II.5); (2) of an epistolary data model enhanced to accommodate these topics; and (3) of large numbers of epistolary records categorised in this manner, which would also allow users to isolate and analyse correspondence on individual topics. In a system including machine-readable full texts of letters, topic modelling might eventually populate the topical data field automatically, while calculating the number of words devoted to each topic as a way of ranking them in importance.

Conversations. A more easily implemented refinement would allow users to highlight conversations between the correspondents selected. The example below, for

instance, shows how a conversation thread between two individuals might be highlighted as the user hovers over a particular letter within it. Although this particular representation would require metadata indicating which letters responded to which, a simpler version could highlight the letters exchanged without inferring the sequence.

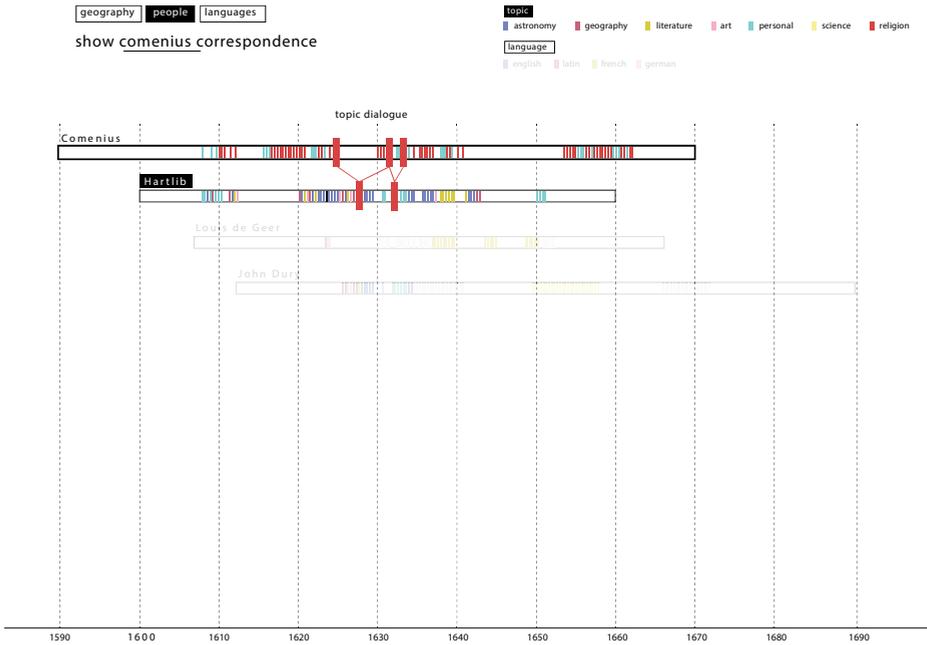


Figure 3: Indicating exchange of letters within a horizontal bar chart

Conclusion. Tools of this kind, for browsing correspondence metadata, are obviously quite different from tools for presenting the fruits of analysis in published visualizations. Like several of the proposals outlined in this volume, this section therefore represents a small illustration of the potential of data interaction design to enhance scholarly processes in the first instance and to enhance scholarly end-products only as a result.

1.3 ‘Maps with Memory’: Capturing Chronology in Cartographic Form

Alex Butterworth, Howard Hotson, Christoph Kudella, Michele Mauri, and Serena Del Nero

One-dimensional timelines reading from left to right are a natural starting point for data interaction design in this field, but not an inevitable end point. The use of colour opens up the possibility of indicating temporal sequences on two-dimensional visualizations such as maps. This possibility may hold a key to overcoming the limitations of more traditional static and dynamic maps.

Static maps normally display all the correspondence of a lifetime as if it had taken place simultaneously. Although invaluable in providing an introductory overview of a correspondence, this mode of visualization fallaciously implies that the chief correspondent maintained contact with all of his contacts and their places simultaneously, and overlooks the possibility that a correspondence may have changed shape dramatically over the course of a lifetime.

Dynamic visualizations, on the other hand, cycling through a lifetime one year at a time, have the opposite disadvantage: they visualize a sequence of momentary states, typically retaining no impression of past transactions and no anticipation of future ones, in a manner that users cannot easily synthesise into a comprehensible image or narration.

Hence the need to experiment with means of creating ‘visualizations with memory’, that is, maps or other visuals that retain some fading indication of previous movements or transactions while distinguishing recent ones and highlighting current ones. More abstractly stated, the question is: how can visual conventions be devised to represent two or more network states, simultaneously and comparatively – that is, what is happening ‘now’ and what happened previously – within the same map?

Experimenting with answers to this question was the task set for the third group within the second data-design sprint convened by the Action in Como in the Spring of 2017. The group addressed this challenge by means of a case study of the ego-network of Desiderius Erasmus (1466?–1536) of Rotterdam, thanks to the meticulously curated catalogue of his over 3,000 letters contributed by Christoph Kudella.⁷ Erasmus is traditionally regarded as the defining figure of the ‘Erasmian humanism’ of the immediately pre-Reformation era. His was perhaps the most genuinely pan-European correspondence in the whole history of the republic of letters, penetrating deep into both the Iberian peninsula and east-central Europe as well as England, the Low Countries, France, the Germanic lands, and Italy. His career peaked at exactly the moment when Luther’s Ninety-Five Theses began a

⁷ This data was created as part of his doctoral dissertation: Christoph Kudella, ‘The Correspondence Network of Erasmus of Rotterdam: A Data-driven Exploration’, Unpublished PhD Thesis, University College Cork, 2017.

process that led to the polarisation of Europe into antagonistic confessional blocks. As the focus for the case study, the eleven-year period between 1508 and 1518 was chosen, which saw his mobility peak alongside his prospects, influence, and the range of his correspondence, just before the Reformation controversy tore his humanist circles apart.

As Kudella's research had already shown, visualizing such a correspondence in the traditional manner is unsatisfactory for several reasons. One is that Erasmus's network changed shape dramatically in the course of his lifetime. Another is that Erasmus's constant movement makes any traditional map of his correspondence difficult to interpret. Of several possible responses to this problem, the group chose to explore a strategy that allowed some of the chronological development of a network to be captured in a cartographical representation, and the same set of data to be visualized in a variety of different ways while providing ready access to the underlying metadata and, potentially, even the letter texts.

Traditional cartographic representations aggregate multiple letters into a single symbol or icon, normally a circle, which expands or contracts in size depending on the number of letters it represents. The alternative mode of visualization explored here disaggregates these large circles in order to convey more information about the individual letters that they represent.

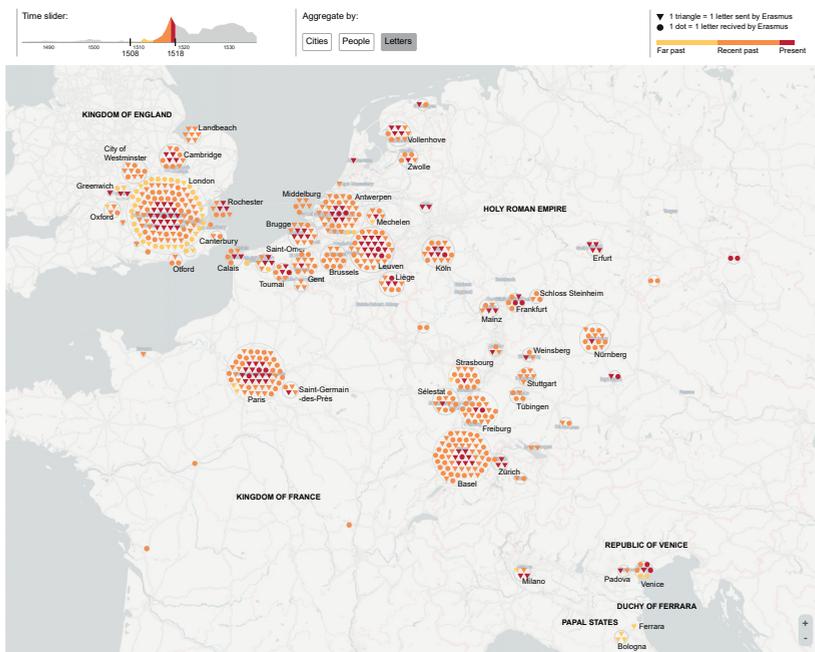


Figure 4: Mockup visualization of Erasmus's correspondence, 1508–18

In the mode of visualization used in figure 4, each individual letter is represented by a single *icon*, which is distinguished by its shape, order, and colour. The *shape* of the icons distinguishes letters sent from letters received by the principal correspondent: a circle represents one letter sent to Erasmus, and a triangle (the regular polygon most different from a circle) represents one letter sent by Erasmus. The *order* of icons is chronological: new letter-icons appear at the centre of these roughly circular clusters, displacing older ones, which spiral outward in anti-clockwise fashion. The *colour* of a letter-icon indicates how recently it was sent. Discrete shades are used instead of continuous colour gradients, because they allow comparison between places. In this case, the most vivid colour (red) indicates the most recent interval (1518); orange represents a longer, intermediate middle interval (1514–17), and the least vivid colour (yellow) represents the first half of the full interval (1508–13).⁸ The size and number of these intervals, indicated by the legend that runs along the top of figure 4, could be changed at will by the user in a number of ways.⁹

Such an arrangement reveals considerably more about this decade of Erasmus's correspondence than the more traditional view. For instance, although Erasmus exchanged a similar number of extant letters during this decade with Basle (57) and Paris (55), and with Antwerp (38) and Leuven (37), the red icons indicate that his liveliest contact had recently shifted from Basle to Paris and from Antwerp to Leuven. Likewise, although Erasmus exchanged a similar number of known letters with Brussels (12) and with Bruges (14), the correspondence with Bruges appears to be active and ongoing in 1518, while that with Brussels is mostly passive and less recent, insofar as we can judge from extant correspondence. London is the only city with which Erasmus was demonstrably in frequent epistolary contact throughout this decade, but closer inspection reveals that the nature of this contact has changed: most of the letters in the earliest period (in yellow) were sent *to* Erasmus; all but one of the letters from 1518 (in red) were sent *by* Erasmus; and in the middle period (in orange) incoming and outgoing correspondence was equally balanced. Selecting a location might also produce a histogram showing all letters exchanged with that place, as well as those sent or received by Erasmus while he was resident there. To place the time-span selected in the context of the entire life, users could select a visual mode in which hair-thin circles appear around each place showing the size of the cluster of *all* the letters to and from there ex-

⁸ Distinguishing letters individually in this way could also facilitate new functionality. For instance, mousing over a letter-icon might highlight the precise date in the timeline, the location of Erasmus at the time of sending, and all the other letters sent by or to that correspondent. Clicking on a specific letter-icon might reveal its metadata in a pop-up box, which could click through in turn to the letter text, translation, or image.

⁹ The user would ideally be able to restructure the timeline for further study in three different ways: (1) by *moving pointers* along the timeline, to define a rough period; (2) by *manually inputting* precise start and end dates into boxes provided; or (3) by *selecting major events* from the life of the main correspondent from a list derived from the prosopographical metadata. These events might include major changes of place (e.g. Erasmus moves to Basle), career-changing events (e.g. Erasmus publishes the *Adagia*), or events in the wider world (e.g. the publication of Luther's Ninety-Five Theses).

changed with Erasmus over his lifetime. Rendering the data more transparent in this manner is, of course, a means of raising fresh questions as well as answering them. For instance, does this demonstrable shift represent a change in the pattern of Erasmus's correspondence with London, or in the pattern of the survival of his letters as he grows in fame during this crucial decade? The answer might be revealed by considering whether the yellow letters were sent to the relatively obscure Erasmus by more prominent figures and therefore deemed worthy of preservation.

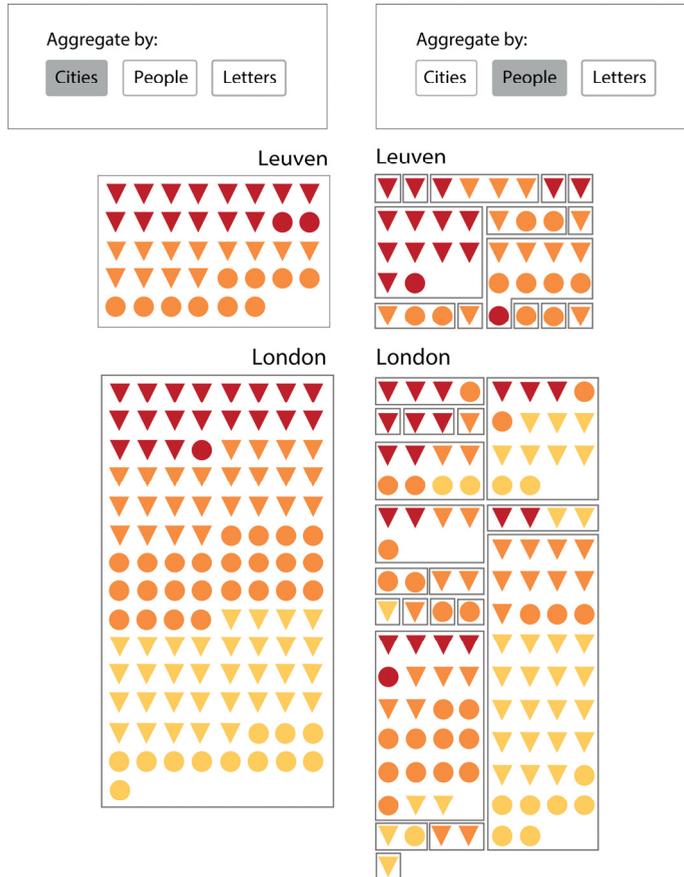


Figure 5: Erasmus's correspondence with London and Leuven, 1508–18, visualized in two different modes

In figure 4, the letter icons are arranged in a spiral in order to approximate the geometry of more conventional maps of correspondence. Figure 5 explores two other arrangements in which the letter icons are arranged in a rectangular cluster. In the left-hand pair, the letters to and from a given city are grouped together in a single large box, with the most recent in the top left and the oldest letter within the

time frame in the bottom right. This results in coloured bands giving a sense of the history of Erasmus's surviving correspondence with this place during the time-span selected. Again, the results are instructive. During the first half of the decade, Erasmus corresponded with London but not with Leuven; but in the second half of the decade, he sent not only forty-eight letters to London but also thirty-eight to Leuven. In 1518, sixteen letters were exchanged each with Leuven and London. At this point users could opt to use a larger number of colours to display smaller intervals of time, to see whether more differences of this kind were revealed.

Another option would be to change the manner in which the letters to or from a given city were clustered. In the right-hand pair in figure 5, the same icons have been regrouped into smaller boxes in the manner of a tree diagram, with each box containing icons for the letters exchanged between Erasmus and a single individual, again arranged chronologically, with the most recent letters in the top left and the oldest in bottom right.¹⁰ This differentiates the two cases even more clearly. About 65 per cent of the London letters (75/113) were exchanged with just three people (Thomas More, John Colet, Andrea Ammonio), and most of this correspondence occurred early in the decade. In the second half of the decade, Erasmus's correspondence has become atomised: about 40 per cent of the letters from 1514-17 (20/48) are from exchanges consisting of only one or two letters during the entire decade. The Leuven correspondence is similarly atomised: the thirty-eight letters are exchanged with fourteen different people in Leuven, averaging only 2.7 letters per person in this entire decade.¹¹ Again, various interpretative possibilities emerge: is this a shift in the actual pattern of Erasmus's correspondence, or in its pattern of survival, as Erasmus's growing fame leads more recipients to preserve his letters?

Another advantage of this system of representation is that it might be instructively animated. Better still, arrows in the header strip might allow users to move the entire timeline forwards or backwards one year at a time with a single click. As the system advanced year by year through the lifetime of the correspondent – from 1508–18 to 1509–19 and so on – individual letter icons would appear at the centre of the spirals, while others disappear from its periphery. A further symbol icon could track the movement of Erasmus himself, with the same colour scheme used to indicate his pathway through previous locations within the selected time frame. Expanding the interval captured in the timeline and increasing the number of col-

¹⁰ Once again, these boxes would provide a ready means of drilling down into the underlying data. Mousing over a person-box could reveal a histogram showing the chronology of their lifetime correspondence with Erasmus, with the selected period coloured in the same way as the timeline. Clicking on a person-box could also highlight other places from which that individual exchanged letters with Erasmus during the period being studied and the locations of Erasmus when the individual letters were sent.

¹¹ Clustering letter-icons in this way might also assist users in drilling down into the underlying data. For instance, selecting an individual person-box might reveal other locations of the individual during the time-span selected; a bar graph, displaying all letters sent to/received by this individual with Erasmus throughout the selected timespan (as highlighted within the entire correspondence); and the location(s) of Erasmus recorded in the metadata of these letters.

oured divisions within it would smooth the passage from one year to another and facilitate the perception of longer-term changes in the structure of the correspondence, which could then be studied in more detail with this and other means. The result would be a mode of visualization essentially midway between static visualizations (which do not represent change) and animated visualizations (which do not represent stasis).

This method of representing places as clusters of individual letters also provides a possible solution for another well-known problem. In a more traditional map of correspondence, when the density of data in a particular area is high, the circles representing all the letters to and from individual places overlap and occlude one another. In this alternative visualization mode, when two clusters of letter icons overlap, the clusters might merge to form a single, larger cluster. These merged clusters could be distinguished visually from single place icons, for instance, by a darker external border, or by being divided internally in the manner of a tree diagram. When users zoom in, these merged clusters could resolve into separate clusters for each place.¹²

This mode of visualization will nevertheless probably work best for relatively modest number of letters – hundreds rather than thousands. For that reason, the default cartographic option is likely to remain the kind of conventions made familiar by *Palladio*, in which the number of letters is indicated by size of circles, overlapping where necessary, with directionality indicated by curved edges. In the case of Erasmus, this initial mode would reveal crucial features of the correspondence, such as its remarkably pan-European scope and its extreme complexity especially in the Rhineland corridor. Users would then need a number of other modes of visualization in order to explore various features of this complex data set in more detail.

2 Correspondence Metadata: Collection-level Records

Riccardo Bellingacci, Carlo De Gaetano, Dirk van Miert, and Glauco Mantegari

Another dimension of epistolary chronology relates, not to individual letters or the networks formed by them, but to the collections in which they were preserved. As noted in section 3 of chapter III.1, the history of collections of manuscript letters needs to be better understood in order for their contents to be interpreted correctly; and the chronology of collecting could often provide the framework for such histories. Such collection-level chronologies would track when particular collections were assembled, or how long it took, focusing on the activities of figures like Zacharias Conrad von Uffenbach or Count Otto Thott.

¹² The viability of this solution can be studied here: <http://glammap.net/glamdev/maps/1>, accessed 20/03/2019.

Far easier to assemble is evidence of the chronology of collections of letters preserved in print. As discussed in section 2 of chapter III.1, printed letter collections are clearly situated in time by year of publication. This data can be mapped and graphed to reveal where and when printing epistolographies was popular. But printed collections typically also have one principal author, whose dates of birth and death are usually known. Relating the dates of death to publication dates will indicate whether a collection of letters was published during an author's lifetime or posthumously. In the latter case, it is easy to calculate how many years elapsed before an individual's correspondence was published. This provided the impulse for a small-scale research project within the COST Action. The basic data for the project was provided by the 1,874 titles of books holding printed letters assembled (as of June 2016) in *Epistolaries of the Republic of Letters* (EROL). The first data-design sprint in Como experimented with two types of visualization to enhance EROL.

The first experiment used *Palladio* to visualize the geography of printed letter collections, which could be dynamically mapped across time. The timeline showed that the majority of these books were published between the mid-seventeenth and mid-eighteenth centuries. This is unsurprising, since the bibliographies on which EROL was based at that time were focused mostly on that time period. But the graph also yielded more interesting granular information: within the time frame 1600–1750, which is evenly represented in the data set, the heyday of letter printing was in the first quarter of the eighteenth century. To make the resulting visualization even more interesting, the bar for each year was divided into segments, with each segment indicating a particular city. Hovering the mouse pointer over a segment lit up that city in the bars of the other years. This particular graph showed that Paris was a major centre for publishing letter collections throughout the early modern period, but that it ceased to be so for the second half of the eighteenth century. Alternatively, it would have been easy to add a facility for clicking on a location and yielding a timeline for the printing of epistolographies in that city, revealing when the printing of letters was popular in that particular place. Needless to say, such functionality could also be repurposed for other categories of print publication.

The second and more complex question regarded changes in sociocultural practices within the republic of letters. During the Renaissance, letters were regarded as a literary genre. Printed collections of letters had the status of major literary works and were often meticulously edited for publication by the authors themselves. By the eighteenth century, this literary status had been replaced by the conception of correspondences as the preserved discussions of leading men of science and letters. Such collections could often be prepared posthumously by sons or followers of the luminary in question. An obvious research question was therefore when the transition between these two different conceptions took place. One way to help pinpoint this was to see when posthumous editions began to outnumber those completed during the author's lifetime.

A quick manual count of EROL in its early stages gave rise to the hypothesis that posthumous publication increased from the start of the seventeenth century onwards and became a major genre of publication in the course of that century. The task was to find a type of visualization that would reveal the answer to this question in a concise and clear way.

We explored this type of chronology by using the so-called RAWGraph's parallel coordinates. This visualization disproved our intuition that, from the start of the seventeenth century, the humanist practice of publishing one's own letters (as initiated by Petrarch) gave way to a practice in which publication of correspondence was left posthumously to sons and students.

Figure 6 suggests that letter collections tended to be published shortly prior to the death of the author. This probably represents the intentions of the authors, conscious of their approaching end of life, to publish their letters and memoirs. It may also signal a change in the strategies of authors. Erasmus had famously 'constructed his charisma in print' when he was in the midst of his career in an attempt to control his image in the minds of contemporaries.¹³ People like Justus Lipsius followed the same strategy. This strategy was gradually replaced, however, by the desire to control the image of posterity: Of course letter-writers since Petrarch had cared for their posthumous reputations, but big-data analysis makes it possible to transcend the individual examples and generalise.

A second observation can also be derived from this visualization: the passage of time sees an increase in the publication of books of authors who had died at least a century before the publication of their correspondences. This trend starts from the nineteenth century onwards, but more data will be needed to establish whether this trend can be confirmed. If so, it suggests that publication practices were becoming more historicist and less a strategy of active image-control.

¹³ Lisa Jardine, *Erasmus, Man of Letters. The Construction of Charisma in Print* (Princeton: Princeton University Press, 2015).

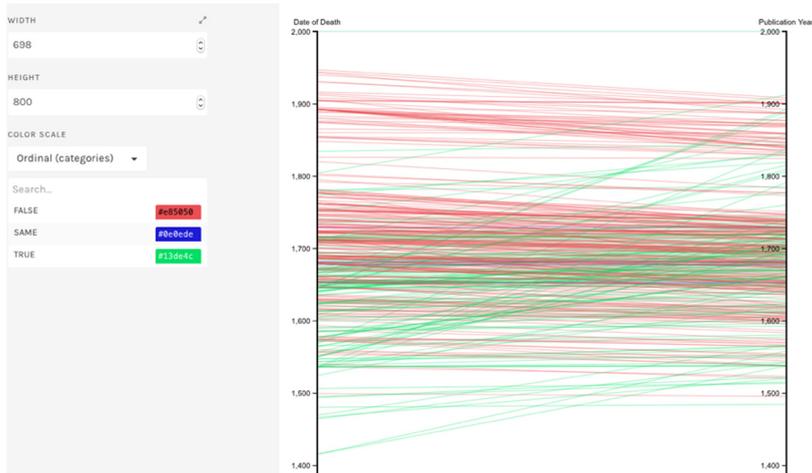


Figure 6: Use of ‘parallel coordinates’¹⁴ to show relation between date of death of an author and the date of his the publication of their correspondence (highest segment, from 2000 to 2000, is a dummy variable). Red segments are epistolaries published within the lifetime of the principal correspondent; green segments are published posthumously.

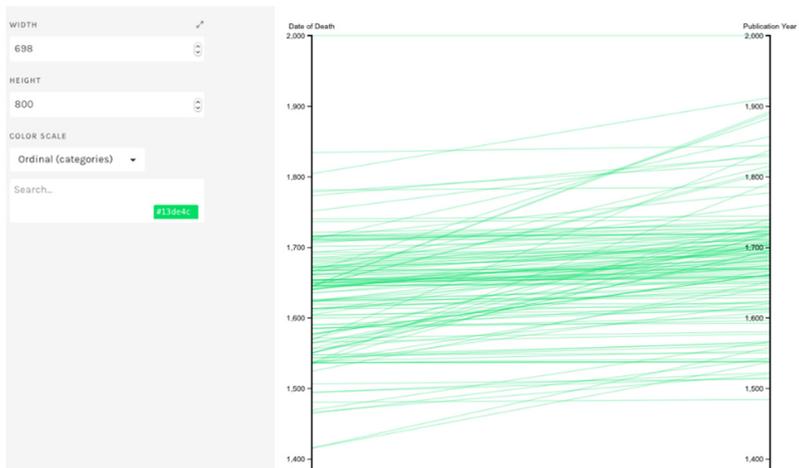


Figure 7: Only posthumous publications

¹⁴ RAWGraphs: <http://rawgraphs.io/about/>, accessed 20/03/2019.

3 Prosopographical Data

Howard Hotson

Entire systems of intellectual exchange also move at several different chronological tempos. Postal systems have already been discussed by Alexandre Tessier in chapter IV.2. An excellent example of long-term evolution is provided by the animated map of the United States postal service in Tessier's figure 14. Two short-term postal chronologies track the time taken for a letter to travel from one place to another: the prescriptive chronology, based on regulations governing mature postal systems, indicates the time that *should* be required in principle, while a descriptive chronology, based on recorded dates of sending and receipt, indicates how long it actually takes in practice. A rather different cartographic representation of chronology is provided by what Tessier calls 'Minard diagrams' (such as that reproduced in his figure 12), which are based on the time taken to reach a whole network of places from a given point.

Mapping systems of learned exchange on the basis of correspondence metadata, however, is a perilous as well as laborious enterprise, because postal communication is so informal, capricious, episodic, and vulnerable to vicissitudes. In any case, the republic of letters was created by far more than just letters and needs to be charted with reference to the voluminous documentation of other forms of exchange as well. As discussed further in chapter IV.4 below, university records provide a rich and stable basis for mapping the evolution of long-term and large-scale patterns of intellectual exchange. An obvious point of departure is provided by the matriculation records kept meticulously in many universities in this period, which provide a mass of reasonably homogeneous and representative data running along a chronological axis.¹⁵

An obvious a case study for exploring the utility of matriculation data for tracking change over time is provided by the most tumultuous moment in the history of the densest concentration of universities in early modern Europe: namely, the universities of the Holy Roman Empire in the midst of the 'Thirty Years' War (1618–48).¹⁶ Within the Empire, each prince and imperial free city wanted their own institutions of higher education, adapted to serving their political, economic, and religious needs without exporting students to enrich their neighbors by studying elsewhere. The result was a proliferation of university and sub-university institutions without parallel in Europe (see ch. IV.4, figures 1–2), which was mir-

¹⁵ For a useful guide to this genre of sources, see Matthias Asche and Susanne Häcker, 'Matrikeln', in Ulrich Rasche, ed., *Quellen zur frühneuzeitlichen Universitätsgeschichte. Typen—Bestände—Forschungsperspektiven* (Wiesbaden: Harrassowitz, 2011), 243–67.

¹⁶ For full documentation of the following discussion, see Howard Hotson, 'Catchment Areas and Killing Fields: Towards an Intellectual Geography of the 'Thirty Years' War', in Peter Meusburger, Michael Heffernan, and Laura Suarsana, eds., *Geographies of the University* (Dordrecht: Springer, 2018), 135–92, see https://doi.org/10.1007/978-3-319-75593-9_4.

rored by the rapid and sustained growth in student numbers. Between 1540 and 1620, student numbers grew eightfold in eight decades, placing the universities of the Empire at the centre of a gigantic catchment area which extended from Scotland via Scandinavia to the Baltic, south through Poland-Lithuania to Hungary-Transylvania while also attracting students from the Swiss Confederation to the south.

The Thirty Years' War, struck central Europe at the very apex of this boom, raising a long list of questions which have never been properly answered at either the domestic or the international level. How did the chronology of academic destruction and recovery unfold over the course of three decades? Can its effects on individual institutions be grouped together to understand its broader impact on whole regions and confessions? How did the disruption at the center of this huge catchment area affect the long-term development of neighboring university systems, the shifting patterns of international academic migration between them, and the intellectual influences communicated by them?

These questions can also be used to test a methodological thesis: namely, that matriculation data allow the impact of the war to be quantified in meaningful fashion, dated with some chronological precision, and therefore analysed comparatively between institutions in a manner which can produce sound generalisations regarding the differentiated impact of the war on whole confessions and regions. Investigating this thesis also helps illustrate the limitations of standard means of visualizing chronology when dealing with such complex data and the challenge of devising more suitable forms of data interaction design.

For illustrating the impact of the war on matriculations at a single university, the familiar histogram proves its value (figure 8). An obvious illustration is provided by Heidelberg, the first German university to be affected by the war. In the opening decades of the seventeenth century, Heidelberg was the most international university in the Reformed world. Yet, by accepting the crown of St Wenceslas from the rebellious Bohemian estates in 1619, the Elector Palatine Friedrich V provoked a massive Catholic reprisal which ruined Heidelberg for a generation. As early as 1620, Heidelberg's rate of matriculation was cut in half, as Spanish forces occupied the far bank of the Rhine; it halved again in 1621, after Friedrich's forces were defeated at the Battle of the White Mountain, and again in 1622, by September of which year the city, the university, and the fabled electoral library were in Catholic hands. After Maximilian I of Bavaria was granted hereditary status as the new Elector Palatine, Heidelberg reopened briefly as a Catholic institution, until Heidelberg fell to the Swedish army under Gustavus Adolphus in 1632. Attempts to reopen the Protestant university were in turn aborted by the Swedish defeat at Nördlingen in 1634. In short, it was not until the Peace of Westphalia restored a fragment of Friedrich V's lands to his son that the new elector, Karl Ludwig, could refound the once great university in 1652 virtually *de novo*, but with only a fraction of the magnetism it had enjoyed before the war.

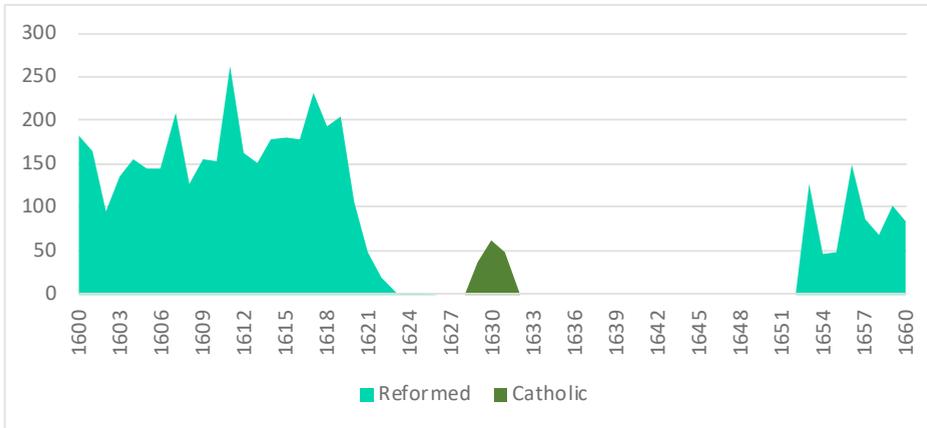


Figure 8: Matriculations in Heidelberg, 1600–1660

The general shape of this complicated narrative and most of the episodes within it are eloquently represented by a simple histogram of annual matriculations (figure 8). The problem is that there were over 30 other universities in the Holy Roman Empire in this period, for most of which the matriculation registers survive. Charting the fortunes of each of them in analogous fashion confirms the sensitivity of matriculation data as a barometer of military pressure. The difficulty is finding ways of aggregating the data from individual records in a manner which builds up similarly revealing impressions of the fortunes of clusters of universities.

One solution is to stack multiple histograms in the manner illustrated in Figure 9. Here Heidelberg (again in dark green), is embedded along with the other main Reformed institutions of higher education in the region. Marburg (represented by light green), having been Calvinised as recently as 1605, was regained by the Lutherans in the immediate aftermath of the sack of Heidelberg. The Reformed Landgraf of Hesse-Kassel established a new university to replace it in his *Residenzstadt* (in yellow), which remained very small until Marburg was restored to Hesse-Kassel in 1652, the same year in which Heidelberg reopened. The academy in Herborn (in blue), a university in all but name, was undermined by military occupation, plague, the departure of its international students, and restitution of the former monastic lands which provided finance. Just outside the boundaries of the Empire, Basel (in dark blue) was also affected by the disruption, not only of the immediate vicinity in 1634, but also of the academic trade route which had supplied it with international students. The mode of visualization employed in Figure 9 sacrifices the clarity with which these individual fortunes are depicted in order to tell the aggregate story in a clear and compelling way.

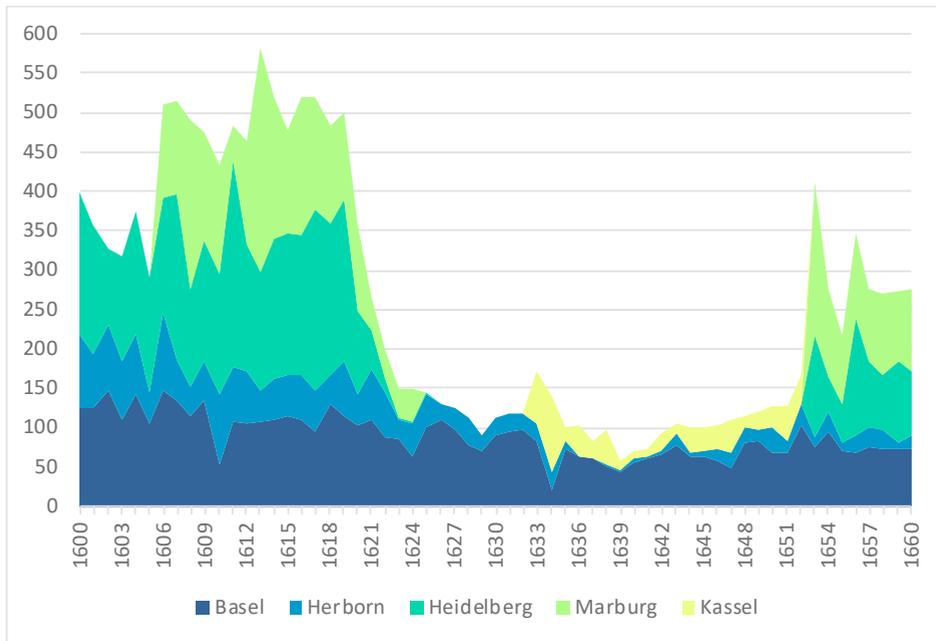


Figure 9: Matriculations in Reformed universities, 1600–1660

For relatively coherent data sets such as these, a further simplification is also revealing. In Figure 10, these same four German Reformed universities are plotted as a single light green line, which retains the same shape (aside from the absence of Kassel). The darker green line aggregates in similar fashion the combined annual enrollments of the three oldest Dutch universities: Leiden, Franeker, and Groningen. The two lines roughly mirror one another, suggesting that the stories of these seven institutions form a single, larger Reformed university system. The Dutch figures leap by over three quarters during the first five years of the war while the German Reformed numbers are cut by over two thirds. As the German Reformed line then gently settles to its low point during the second half of the war, the Dutch line also levels out, gradually peaking during its final decade. Enrollments in Leiden, Franeker, and Groningen fall sharply at the conclusion of the conflict, without losing much of their strength in the longer term, while the German ones bounce back with the re-establishment of Heidelberg and Marburg in 1652, without regaining their pre-war level. Meanwhile, between 1621 and 1652 the total number of annual matriculations in this system as a whole (indicated by the thin blue line) fluctuates within a very narrow band.¹⁷

¹⁷ The main disruption to this system comes rather from Utrecht, which was raised to university status in 1636, and grew strongly after 1643, adding well over one hundred matriculations per year by the end of the war. But the new university's matriculation register is very unreliable for this period, averaging only five enrolments per year in some quinquennia and nearly 200 in others. Its arrival also

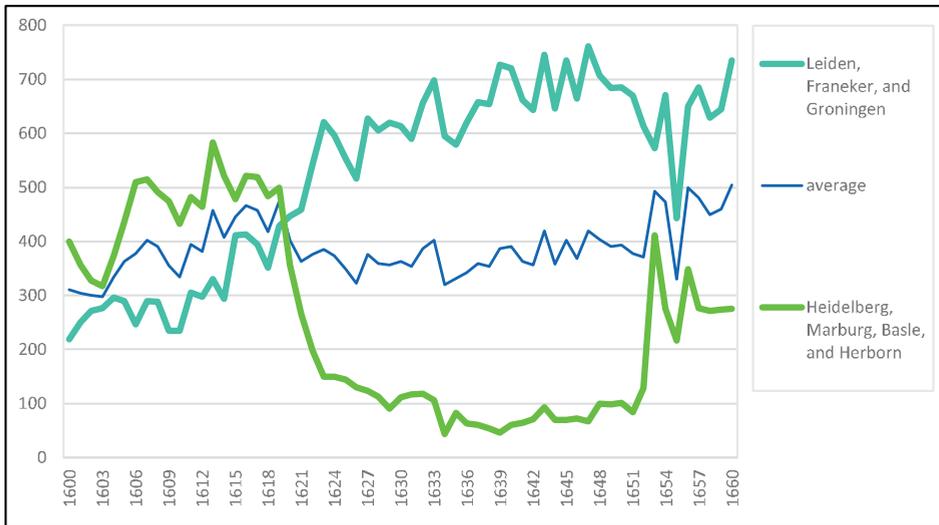


Figure 10: Matriculations in German Reformed and Dutch universities, 1600–1660

In pursuit of still more general impressions, further simplification is required. One option is illustrated by figure 11. In order to examine the relative growth or decline of different clusters of universities, this graph uses the pre-war size of each university as a baseline. More specifically, this graph expresses the aggregate matriculations of each cluster of universities, not in absolute terms, but as a percentage of their level during the five-year period 1616–1620. Matriculation levels below the 100 percent line are smaller than they were in 1616–1620, while those above the line are larger.

Replotted in this way, the collapse of German Reformed matriculations (not counting the bi-confessional Frankfurt an der Oder but including Basel) follows a trajectory reminiscent of the previous two figures. The main difference is that the use of five-year intervals softens both the precipitous decline in the 1620s and the meteoric if partial recovery after 1652.

heightens the need to distinguish matriculation rates from student numbers, since individual students increasingly matriculated in more than one Dutch university (as they had done previously in the German Reformed university system in its heyday).

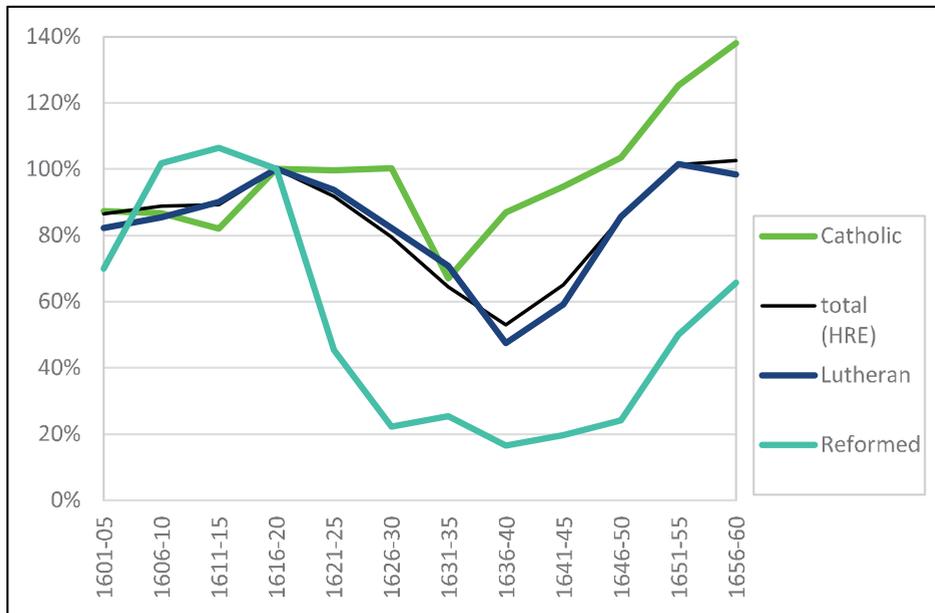


Figure 11: Three main confessions within the Holy Roman Empire compared. Quinquennial percentages of matriculations in 1616–1620

Catholic enrolments within the Empire provide a stark contrast. They were essentially unaffected by the war until 1630, when the invasion of the Swedish armies under Gustavus Adolphus differentiated their fortunes markedly. Five Catholic universities in the path of this onslaught – Würzburg, Mainz, Ingolstadt, Dillingen, and Freiburg im Breisgau – saw their numbers plummet in 1630–31, after which they recovered slowly. Meanwhile, the gentle growth of Vienna, Graz, and Salzburg accelerated, as students fled the warzone to areas free of marauding armies. The relatively sheltered northwestern corner of the Empire fell between these two extremes: Cologne’s gentle growth before and after the war was interrupted only by a period of stasis during it, and Leuven was almost unaffected. All told, aside from the sudden shock of the early 1630s, Catholic universities in the relative safe havens to the northwest and southeast managed to absorb the students displaced from the southwest, leaving overall numbers surprisingly unaffected by the war. Finishing the war marginally stronger than they began it, the Catholic figures for the Empire as whole then rose sharply during in the first post-war decade to a level 38 percent higher than their status ante bellum.¹⁸

¹⁸ Due to its large and relatively stable size, including Leuven flattens the curve (after 1616–20) without transforming its overall shape. The missing data for Douai would disrupt this curve, since the university was radically affected by a French invasion from the south.

In the northeastern quarter of the Empire where Lutheran universities predominated, the impact of war was felt in an even more differentiated fashion, as the main theatre shifted from place to place. Helmstedt suffered worst during the Lower Saxon phase of the war; Rostock and Greifswald during the Swedish landing; the giant Saxon universities after the failure of the Peace of Prague; and Frankfurt an der Oder was hammered twice: once in the latter 1620s and again in the latter 1630s. Due to the huge size of these northeastern universities, their aggregated matriculations closely track the trajectory of the Empire as a whole. This means that the decline of this region was far more gradual than that of the southeast and its recovery in the final years of the war was more rapid but also only partial.

Two significant methodological results can be derived from this brief survey. On the positive side, matriculation registers within the Holy Roman Empire appear to provide a sensitive barometer of the pressure of military events on local universities and on the confessions organized around them. A relatively small and easily assembled data set – containing only 2160 data points over a sixty-year period – provides a surprisingly revealing impression of the impact of three decades of conflict across most of the Empire. On the negative side, standard modes of visualizing time are not really suited to tracking the changes implicit even within this relatively small data set. Simple spreadsheets and the graphs generated by them reveal the shape of simple data series with ease; but when dozens of different data series are involved, the researcher needs to be able to toggle easily between many different views in order to form an accurate overall impression. The primary difficulty in this case is not that this humanistic data is highly nuanced, uncertain, or incomplete: merely that there is too much of it to be readily captured by off-the-shelf visualization tools.

Such tools will be even less well adapted to exploiting the full potential of hundreds of thousands of individual matriculation records. Even the most basic of these records typically include the matriculant's place of origin as well as name and date. In some cases, this is supplemented by other information, including age, social status, and subject of study. The indexes of many of the German registers translate both surnames and place names from Latin to German, thereby providing the basis for comprehensive, bi-lingual authority files for university-educated people and the places from which they came. Simple algorithms can provisionally link records of the same student matriculating in multiple universities during the course of a *peregrinatio academica*, with the process of inference and degree of certainty recorded on the system. For the late medieval period, a major collaborative project has been supplementing such basic data with further archival records to create a *Repertorium Academicum Germanicum*, a detailed prosopography of all the graduated scholars of the Holy Roman Empire between 1250 and 1550. The result, published as an online database and atlas, will provide comprehensive 'who's who' of late

medieval scholars in the region.¹⁹ To date, nothing similar exists for the post-Reformation period.

Once coherent bodies of data have been assembled, they will need to be analysed in many different ways. Analyses of the origins of students at individual universities merely requires the digitization of a single register. Analyzing the records of competing clusters of universities will show how catchment areas wax and wane in response to political, confessional, and military events, as well as the foundation of competing institutions in the region. Alternatively, the destinations of students from an individual city, territory, or region could be displayed, in order to understand how these shifted over time. A third data view could reconstruct the routes followed by students who visited more than one university in the course of their *peregrinatio academica*, revealing how academic trade routes shifted, in some cases dramatically, as military conflict moved from one theatre to another. Those matriculation registers which systematically record social status, age, or subject of study will allow even more complicated, multi-dimensional analysis. Such a data set would provide the starting point for multiple, comparative studies of academic mobility, such as that undertaken by Mikkel Munthe Jensen for Scandinavian professors in the eighteenth century (ch. IV.4 below).

Understanding the movements of hundreds of thousands of students between thousands of places of origin and dozens of different institutions against the background of complicated physical, political, and confessional geography and constantly changing military events will require a much richer variety of interactive, dynamic, animated, multi-dimensional, full color visualizations designed to allow both expert and non-expert users to explore all the dimensions of the data at a variety of different tempos and scales. This represents an ideal arena for future collaboration between historians, data analyses, and experts in data interaction design.

¹⁹ Rainer C. Schwinges, 'Das Repertorium Academicum Germanicum (RAG). Ein digitales Forschungsvorhaben zur Geschichte der Gelehrten des alten Reiches (1250-1550)', in Rüdiger vom Bruch, Martin Kintzinger, Oliver Auge, and Swantje Piotrowski, eds., *Professorenkataloge 2.0. Ansätze und Perspektiven webbasierter Forschung in der gegenwärtigen Universitäts- und Wissensgeschichte* (Stuttgart: Steiner, 2015), 215–32; and most recently: Kaspar Gubler and Rainer C. Schwinges, eds., *Gelehrte Lebenswelten im 15. und 16. Jahrhundert* (Zürich: vdf Hochschulverlag AG an der ETH Zürich, 2018): <http://www.rag-online.org/>, accessed 20/03/2019.

4 Textual Data

Dirk van Miert

The chronologies discussed above relate mostly to metadata: to letter records, to bibliographical records, to prosopographical data, and to data on the origin and development of postal systems themselves. Yet letters are designed to convey messages primarily in textual form; and this opens up a vast new realm for investigation; or rather it positions the traditional preoccupation of scholarship with the texts of letters in a new framework, and potentially supplies it with new tools and approaches. Chronologies of the topics contained in texts are a traditional focus of conceptual history. What large digital corpora and text-mining techniques offer is automated means of determining the changing frequency with which certain terms, topics, or names were mentioned in the available letters (see also ch. IV.6).

The potential of this approach has recently been illustrated by a comparison of the use of certain terms and their changing semantic fields in the works of Kant, Fichte, and Schelling. For instance, in Kant's works the word 'experience' (*Erfahrung*) is associated with 'matter', 'space', and 'object', whereas Fichte used the term more frequently in relation to 'nature' and 'essence'. Schelling is the first to use the word 'experience' in relation to 'empiricism' (*Empirismus*), a term that does not occur in the semantic fields of 'experience' in the texts of Kant and Fichte. The overall suggestion is that the notion of 'empiricism' gains ground only in Schelling's philosophy.²⁰ There are several caveats to such conclusions: these results are based on the use of the available texts, which include other texts as well as correspondence. Moreover, these texts are not tied to dates, so the chronological dimension of this comparison is a crude one, based on the simple fact that Kant was the oldest of the three philosophers and Schelling the youngest.

Such trajectories can be visualized in several conventional ways, such as histograms of occurrences per year; but the DensityDesign Research Lab in Milan has developed several more appealing visualizations. One of these is the 'streamgraph', which traces the chronology of the frequency of key concepts in Kant's work. Figure 12 gives a fragment of this visualization, which is developed through Minerva, 'a web tool for supporting philosophical historiography research'.²¹

²⁰ Tom Giesbers, Timmy de Goeij, Daniel Meijer, Dirk van Miert, Peter Sperber, and Paul Ziche, 'Mining for Associated Words in Philosophical Texts', *Schelling-Studien. Internationale Zeitschrift zur klassischen deutschen Philosophie* 2 (2014): 215–31, at 221.

²¹ Paolo Ciuccarelli and Valerio Pellegrini, 'Minerva – Data visualization to support the interpretation of Kant's work', posted on 6 August 2013 at <https://densitydesign.org/2013/08/minerva-data-visualization-to-support-the-interpretation-of-kants-work/>, accessed 20/03/2019.

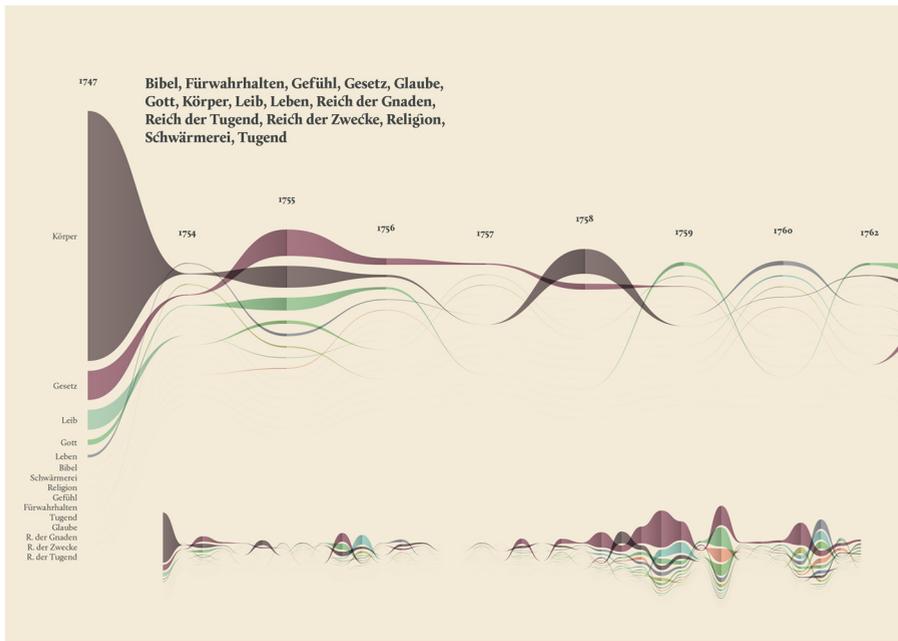


Figure 12: Streamgraph of several key concepts in the oeuvre of Immanuel Kant

As Paolo Ciuccarelli and Vallerio Pellegrini point out, “The streamgraph has been figured out as the most effective visual model, since its ability to show the evolution of lemmas (in quantitative terms) across the works (and the time) and, at the same time, to compare them work by work”.

Whereas such visualizations work well for individual concepts, the chronology of semantic fields would require a more complex graph, perhaps with changing colours indicating the entry and exit of certain concepts in the set of words associated with a key term. It is imaginable, for example, that the word *merita* (services) is a loyal satellite to the republic of letters, but the history of the word ‘God’ in the semantic field of the ‘republic of letters’ shows fluctuations across time.

With precedents such as these in mind, the ERC *Consolidator* project SKILL-NET has undertaken to trace the chronology of the concept ‘republic of letters’ itself. When, where, and by whom was this phrase used most frequently? Applying conceptual history to the term ‘republic of letters’ promises to reveal when the idea of a virtual transnational scholarly community appealed to individual scholars and perhaps the trajectory of its rise and fall within the broader intellectual community as a whole. The prospects for answering that question with reference to correspondence are particularly appealing: if the individual texts constituting the corpus to be mined have been assigned metadata including years (or even specific dates, in the case of letters), places, and authors, the overall geographical trajectory of the ‘republic of letters’ can be traced throughout time, and the chronology of its use

within specific time frames can be mapped, for example by considering one author's use of the term throughout his career. Moreover, such questions can be answered in absolute terms and also in relative ones, compensating for the varying numbers of letters available. Different vernacular translations of the term and the history of their use can be compared, and the interrelation of terms can be measured.

Like most fresh scholarly undertakings, however, such an inquiry is more difficult than it initially seems. Two challenges currently beset such a project. The first is to create a clean corpus of texts provided with rich metadata. Even in the case of one such corpus, the *ePistolarium*, it proved impossible to chart the career of the 'republic of letters', since the *ePistolarium* was not built with an eye to conducting conceptual historical research. The first step is therefore to repurpose the corpus of the *ePistolarium* to do just that, and then to enrich it with other readily available digitized texts of letters, or even of printed treatises and scholarly journals.

A second challenge is that a concept that consists, not of one word, but of at least two and possibly three, is less easy to locate than one would anticipate. Taking into account spelling variants, word order, and different endings, the Latin phrase *respublica litteraria* theoretically could appear in at least 192 different variants. The best-known form of the expression is no doubt *respublica litteraria* (learned republic). Sometimes the variant *respublica litterarum* (republic of letters) is mentioned in secondary literature: this form is common in English, Dutch, Spanish, and Italian, but far less so in Latin. However, letter-writers occasionally speak of a *respublica litteratorum* (republic of the learned) or even a *respublica litterata* (literate republic or republic versed in letters): this variant is suggested by the variant term, *orbis literatus* (the literate world), which also frequently occurs in the letters. Moreover, the word *respublica* can be split into two separate words, *res publica*, or abbreviated as *resp.*; in each variant, the radix *lit(t)era-* can occur with single or double 't' and the word order can be reversed. Fortunately, the theoretically possible formats *res litteraria publica* and *publica res litteraria* do not appear in the *ePistolarium*.

This proliferation of variants renders the search for material for a conceptual history of this term difficult. Ideally, a machine should be able to deal with a complex combination of wildcards and double quotes, such as: "re*publica* lit*er*ar*" OR "lit*er*ar* re*publica*". Moreover, *respublica litteraria* is by no means the only Latin term used to capture this basic concept: within the *ePistolarium*, the phrase 'learned world' (*orbis litterarius, -tus, -torum*) occur eleven times, the collocation 'all the learned men' (*omnes litteratores*) another ten times; and both of these are susceptible of generating multiple variants in turn.

To compound difficulties further, the corpus of correspondence in the *ePistolarium* is multilingual; and this forces the researcher to translate the word into several vernaculars and negotiate the spelling variants which proliferate in the early modern period, such as Republic(k) with 'c' or 'k', or differences such as *Gelehrtenrepublik* and *gelehrte Republik*. In fact, the *ePistolarium* contains one instance of 'Republic of Letters' and one of 'Commonwealth of Learning' (despite the fact that

there are very few English letters in the corpus), seven usages of the phrase *république des lettres*, and one of the Italian *repubblica letteraria*. The most surprising result is the small number of French hits: 26.5 per cent of the corpus is in French (32.8 per cent in Latin). Although 37.1 per cent of the corpus is in Dutch, the term *republiek der letteren* does not feature in any of these Dutch letters, but the words *geleerde wereld*, learned world, do occur.

Fortunately, for the purposes of big data analysis, not every occurrence of a term must be detected in order to produce significant results. In the 20,020 letters in the *ePistolarium*, the majority take the form *respublica lit(t)eraria*; the format *respublica literatorum* is found only once, and the word *respublica* is never separated, at least not in combinations denoting the republic of letters. Surprisingly, the wellknown variant *respublica literarum* is used only once. The form *respublica litteraria* occurs in two further letters, but those are in Italian, and constitute a spelling variant of *repubblica letteraria* (which occurs once, in another Italian letter by the same author). Note that some variants are neutralised by editorial decisions to expand the abbreviation *resp.* or to standardize the use either of single or of double ‘t’.

If all of these variations are included, only forty-four uses of the phrase were detected in the 20,020 letters in the *ePistolarium*. This number is unexpectedly small. It suggests that the idea of a republic of letters was not a vital concept for some of the people we like to regard as self-aware citizens of this virtual community. As in the case of published letter collections, one would want to organize the occurrences chronologically and by author, although with so few hits, an automated visualization is likely to overshoot the target. Hugo Grotius is a case in point. A universal scholar who corresponded in three languages, a widely travelled diplomat, an irenicist as well as a polemicist, and often compared with Erasmus, Grotius is typically regarded as an exemplary citizen of the republic of letters. Yet he used the concept only once, in an official letter to the States General in which he underscored his own services to the commonwealth of learning. In the correspondence of Joseph Scaliger, however (which is not included in the *ePistolarium*), the term ‘republic of letters’ occurs fifty-eight times between 1576 and 1609, evenly distributed between twenty-seven letters to Scaliger and thirty-one letters from Scaliger. Already, these two contrasting examples raise important questions. Was the concept more popular, for instance, around 1600 than around 1650? These few results suggest how much fundamental work remains to be done before we can understand the chronology of the republic of letters as an idea as well as a reality. In order to map the trajectories of key concepts in the history of learning through an automated chronological visualization of any kind, larger bodies of clean textual data and reliable metadata will be required.