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Using Multi-Layered Networks to Disclose Books in the Republic of Letters

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Abstract

This paper highlights the importance of books as dynamic actors within the Republic of Letters by means of multi-layered visualizations of epistolary networks. In the past decade, it has become increasingly common to make use of networks to study shifts in early modern scholarly exchange. Originally, almost all of these studies employed a single-layered network where one node of the graph represents a correspondent, and an edge between a pair of nodes corresponds to a letter exchanged between them. However, reducing the complex society of the Republic of Letters to a network in which actors are connected by one single type suggests a static uniformity that barely takes into account the multi-faced dynamics of epistolary exchange. In addition to letters, the Republic of Letters was tied together primarily by means of books. Therefore, this paper intends to discuss an approach that integrates both letters and books in a unified, dynamic multi-layered network representation. To this end, the epistolary network of the Dutch philologist Nicolaas Heinsius (1620-1680) with the Florentine Medici court, focusing in particular on the correspondence of the librarian Antonio Magliabechi (1633-1714), serves as a case study to illustrate the applicability of multi-layered networks in historical network research.

1 Introduction*

Many authors have stressed the importance of books as an integral part of the Republic of Letters.[1] Books held the scholarly network together for they fostered the advancement of learning – the ideal aim of the Republic of Letters. This is especially true considering the fact that books were an important medium for the circulation of knowledge as well as the output *par excellence* of scholarly collaboration. Franz Mauelshagen stated that 'an exchange of objects was directly associated with the interactive potential of correspondence networks. Even though many objects of exchange did not belong to letters or to the text of a letter, they have to be looked upon as an essential part of correspondence.'[2] Mauelshagen pointed out that objects functioned as a medium through which social relationships were sustained and mutual trust was build. Books, for example, were often sent as gifts that could encourage reciprocity in the form of a response or a counter-gift. In this respect, the communication through objects is reciprocal, like is also the exchange of letters. In addition, most of the letters we now only encounter as sheets of paper in the archive, were actually packaging notes to parcels – of books, drawings, poems, natural specimena, and other letters. Similar theses are adopted by Dirk van Miert who made clear that 'a letter should never be studied in isolation, but always as part of a larger apparatus of sources:

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1 The Republic of Letter was, simply, a learned community of corresponding scholars. The term was already in use in the early sixteenth century and it remained active until the nineteenth century. The term was used by early modern scholars to represent an ideal of a intellectual community that transcended religious and political beliefs. On the Republic of Letters see Constance M. Furey, Erasmus, Contarini and the Religious Republic of Letters (Cambridge: Cambridge University Press, 2008); Christiane Berkvens-Stevelinck, Hans Bots, and Jens Häseler, eds., Les grands intermédiaires culturels de la république des letters: études des réseaux de correspondances du XVIe aux XVIIIe siècles (Paris: Honoré Champion, 2005); Francisco Bethencourt and Florike van Egmond, eds., Communication and Cultural Exchange in Europe, 1400–1700, vol. 3, Cultural Exchange in Early Modern Europe (Cambridge: Cambridge University Press, 2007); Hans Bots and Françoise Waquet, eds., La république des lettres (Paris: Belin-De Boeck, 1997).

2 Franz Mauelshagen, "Networks of Trust and Imagined Community of the Learned," The Medieval History Journal 6:1 (2003): 18.

notebooks, drawings, commonplace books and printed treatises'[3] and Anthony Grafton, who illustrated that the Republic of Letters 'existed, first and foremost, as a palimpsest of people, books, and objects in motion'.[4] Without letters, and the accompanying reciprocal exchange of books and other gifts, there would be little to hold such an extensive, geographically separated society together.

So, books and letters cannot be studied and analyzed seperately from each other. Nevertheless, as Daniel Stolzenberg has pointed out, recent studies concerning early modern communication tend to minimize the importance of printed books.[5] In his article, he discusses the importance of books as a medium of communication in the scholarly network of the Jesuit scholar Anthanasius Kircher (1602-1680). He concludes:

> "Correspondence lends itself to social network analysis in a way that books complicate. (…) A correspondence network can be converted into a database and then analyzed and visualized by existing methods and software. To create an analogous map that would capture how information was disseminated through printed books would be vastly more complicated and imprecise, if indeed it is even possible."[6]

Stolzenberg presents here an evident gap in digital scholarship but not any practical implementation of filling it. Therefore, this article takes up Stolzenberg's challenge, offering insights in the practical possibilities for representing books within the early modern scholarly network. As we will see in the next paragraph, almost all of the studies to date are based on a single-layered view of the Republic of Letters, where a node represents a correspondent and its incoming and outgoing edges correspond to the exchange of letters. However, in addition to looking at the Republic of Letters as if it was a single entity, I propose a different approach that integrates both books and letters in a unified, dynamic multi-layered network representation. By doing so, I intend to show how books played a decisive part in building, continuing and influencing relationships through networks. In this article the

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3 Dirk van Miert, "Concluding observations," in Communicating Observations in Early Modern Letters (1500-1675): Epistolography and Epistemology in the Age of the Scientific Revolution, ed. Dirk van Miert (London/Turin: The Warburg Institute-Nino Aragno Editore, 2013), 243.

4 Anthony Grafton, "A Sketch Map of a Lost Continent: The Republic of Letters," Republic of Letters: A Journal for the Study of Knowledge, Politics, and the Arts 1 (2009): 12.

5 Daniel Stolzenberg, "A Spanner and his Works: Books, Letters, and Scholarly Communication Networks in Early Modern Europe," in For the Sake of Learning: Essays in Honor of Anthony Grafton, ed. Ann Blair et al (Leiden: Brill, 2016).

6 Stolzenberg, "A Spanner and his Works: Books, Letters, and Scholarly Communication Networks in Early Modern Europe", 171.

emphasis will not be on a quantitative analysis, but on a qualitative approach that allows us to explore and create datasets and visualize and interact with them in various network configurations.

To illustrate the pitfalls of studying early modern correspondence in isolation from print, I will use the example of the lively epistolary exchange between the Dutch protestant scholar Nicolaas Heinsius (1620-1681) and the Florentine Medici court. In particular, the correspondence of Nicolaas Heinsius will shed light on the activities of the Florentine librarian Antonio Magliabechi (1633-1714), who maintained an extensive correspondence network in the Dutch Republic.

The cases of Heinsius and Magliabechi will be used to give a concrete example of how books in correspondence networks can be analyzed in more complex visualizations, without compromising the legibility and transparency of the graphs. In addition, it shows how the approach of distant reading, which is complementary to close reading of the detailed content of each letter, helps to better describe and understand the circulation of knowledge in the Republic of Letters.

The article is organized as follows: in the first paragraph a general overview of the field will be given, highlighting the many projects and studies that have started to interpret relations among early modern scholars using digital technology and social network analysis. Studies of this sort, which rely mostly on single-layered representations, only cover a subset of all the possible networks in the Republic of Letters. This article, then, proposes an alternative method to single-layered networks that allows us to integrate both print and correspondence into the same network: multi-layered networks. In the second paragraph, I will discuss the creation of a multi-layered network structure and the various advantages and constraints for that structure. This discussion is followed by a case study of the epistolary networks of Nicolaas Heinsius and Antonio Magliabechi in order to explore its potential in the wider context of historical network research.

2 Mapping the Republic of Letters: a single-layered approach

This paragraph provides a basic overview of the field, notwithstanding the novelties and innovations that this relatively new domain has brought about, there are still many points of continuity and improvement. In the past decade, early modern historiography has seen a proliferation of digital network projects that have started to map sections of the Republic of Letters. Within this relatively small field, the best-known projects – including *Six Degrees of Francis Bacon* of the Carnegie Mellon University, *Mapping the Republic of Letters* of Stanford University, *Circulation of Knowledge/ePistolarium* of the Huygens Institute in Amsterdam and *Cultures of Knowledge* of Oxford University – all

focus on connections between early modern scholars. Typically, these projects employ a single-layered network, a formula that has presented us already with stimulating new insights in historical research. It has highlighted, for instance, the crucial role of information-brokers. Such people, despite publishing little or nothing, kept the community together by putting scholars in contact, furnishing them with material for their research and communicating the latest literary news. Moreover, the *ePistolarium* tool enables the user to visualize not only the traditional correspondence networks, but also co-citation networks. In this, they build further on the work of Yves Gingras who demonstrated the importance of co-citations to map the evolution of cited persons in correspondence networks. Co-citations appear when two persons are mentioned together in the same letter; if the number of these co-citations is high, that is if they are cited together in many letters, it suggests that there is a strong link between these persons.[7] This method provides, according to Gingras, 'a global representation of the evolving conversation going on in the Republic of Letters and in intellectual and scientific fields'.[8] Building on this definition, an even more detailed picture can be provided if, in addition to cited persons, also cited books are aggregated in epistolary networks. This allows, for example, for an analysis of co-citational pairs of person and books. That means that if certain persons are often referred to together with certain publications (whether they contributed to them or not), this may provide evidence that there is a link between these as well. In addition, as highly cited individuals give us a clue about the actors involved, their emergence and disappearance over time, highly cited books can indicate the themes of interest of scholars, the number of books involved and their dissemination over time. This, however, will be the subject of analysis in the next paragraphs.

Another significant research that draws from social network analysis has been conducted by Mark Granovetter who has discussed "the strength of weak ties" in connecting distant scholarly communities. According to this pioneer of network analysis, weak ties function as bridges between distinct tightly-knit communities for a faster distribution of ideas across the entire network.[9] When two scholars have a strong tie they generally know the same people and have access to the same information. Weak ties, on the other hand, move in different circles and are thus a greater source of new ideas and information. Consequently, a network that has more weak ties is more likely to be dynamic

7 Yves Gingras, "Mapping the Structure of the Intellectual Field using Citation and Co-citation Analysis of Correspondences," History of European Ideas 36 (2010). See also Marcus Gmür, "Co-citation analysis and the search for invisible colleges: A Methodological Evaluation," Scientometrics 57:1 (2003).

8 Gingras, "Mapping the Structure of the Intellectual Field", 330.

9 Mark S. Granovetter, "The Strength of Weak Ties," American Journal of Sociology 78:6 (1973).

and innovative. Granovetter's concept of weak ties has been very successful in both the social sciences and in historical studies. An example of this success is given by David Lux and Harold Cook who have claimed that 'the success of the natural philosophy in the Dutch Republic depended on the proliferation of weak ties'.[10] They suggested that the nature of the weak ties indicates why scholars in the Dutch Republic were capable of doing excellent natural philosophy without having to be formally associated to a scientific society. While societies were characterized by its strong and robust ties between individuals – a closed circle – weak ties opened up the network to strangers, which required a minimal level of personal relationship. Without weak ties holding the network together, the network would dissolve and disappear.[11] In this respect, it is worth mentioning the article of Ruth and Sebastian Ahnert. By means of network visualizations, they were able to understand why, despite the systematic executions of protestants during the reign of Queen 'bloody' Mary I of England (1516-1558), it was impossible to restore the catholic faith. The protestant religion persisted for the disappearance of key figures did not affect and fragment the protestant network, whose infrastructural backbone was held together by few well-connected figures that continued the flow of ideas.[12]

Many of these networks only partially cover the exchanges of knowledge that are attributed to the Republic of Letters. In the Republic of Letters knowledge was not just transferred by letters, but by a variety of objects, mainly books. A step in this direction is provided by Dan Edelstein and Glauco Mantegari, who, in the context of the project *Mapping the Republic of Letters* of Stanford University, visualized the places of Voltaire's publications – including data on false, fictitious, and unknown imprints – on a geographical map.[13] By comparing data on publications that were illegally published with networks observed in letters, they could notice, for example, to what extent Voltaire's correspondence was related to complications in the printing of his editions. Although a geo-spatial representation of objects presents itself as a promising tool, it does not say anything about the distribution and circulation of the books themselves.

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10 David L. Lux and Harold Cook, "Closed circles or open networks? Communicating at a distance during the scientific revolution," History of Science 36:112 (1998).

11 See also Daniel Margócsy, "A Long History of Breakdowns: A Historiographic Review" (abstract for Breaking Scientific Networks Conference, Davis, April 25, 2014, accessed January 5, 2017, http://www.breakingscientificnetworks.info.

12 Ruth Ahnert and Sebastian E. Ahnert, "Protestant Letter Networks in the Reign of Mary I: A Quantitative Approach," ELH 82: 1 (2015).

13 "Voltaire's places of publication (1712-1800), accessed December 28, 2016, http://republicofletters.stanford.edu/case studies/voltairepub.html.

If we want to consider books as active participants in the scholarly network, an approach that consists of multiple overlapping networks may be a valuable aid. In this, I build further on the concept of "deep networks" as proposed by Charles van den Heuvel who, inspired by the term "deep maps" coined by David Bodenhamer, introduced the concept of "deep networks" to discuss the potential of hybrid combinations of networks.[14] In the next paragraph, we look at the advantages and limitations of these deep networks, examining how they function and what kind of questions can be addressed with them.

3 From one-layered networks to multi-layered networks

Complex multi-layered structures have received much attention from the community of sociologists, but in historical research the implementation of multi-layered networks is relatively unexplored.[15] The reason why multi-layered networks are predominantly used in social sciences is because it presents a more accurate description of real systems. The complexity reached by the society calls for an approach that takes into account a whole series of different networks in order to understand the bigger picture of its functioning. Research based on single-layered networks would, on the other hand, entail a simplification of the real-world, ignoring the evolving complexity of present-day society. This, of course, applies to both past and present; the only difference is that the past presents us with more fragmentary and uncertain data. Consequently, historical sources render full data integration impossible. The question, then, is how we can reconcile the incompleteness and complexity of historical sources with the required precision of digital technologies.

The use of multi-layered networks is a powerful tool to tackle both complexity and fragmentation in historical data. When creating networks using relational data, we are often confronted with situations where we lack information about the details of their multi-layered structure. In such situations, an approach that allows us to integrate and combine data from

14 Charles van den Heuvel, "Mapping Knowledge Exchange in Early Modern Europe Intellectual and Technological geographies and Network Representations," International Journal of Humanities and Arts Computing 9:1 (2015): 95. See also Scott Weingart, Nils Spelt and Charles van den Heuvel, "Circles of Confidence in Correspondence: Modeling Confidentiality and Secrecy in Knowledge Exchange Networks of Letters and Drawings in the Early Modern Period." Nuncius 31:1 (2016).

15 See, for instance, Antonios Garas, ed., Interconnected Networks (London: Springer, 2016); Mika Kivelä et al., "Multilayer networks," Journal of Complex Networks 2 (2014); Stefano Boccaletti, "The Structure and Dynamics of Multilayer networks," Elsevier Physics Reports 544:1 (2014).

different sources may offer a more complete picture of the network in question. When the name of a book is mentioned in a letter, for example, it is the underlying data that makes the citation interesting. This is especially true in times of censorship where scholars had to be careful when sharing detailed information with others. With regard to these troubled times, questions that book-citations in letters might raise are: What was the religious conviction of the author of the book? Was the book enlisted on the Index of Prohibited Books? Is it a theological treatise on faith or rather a book on natural history?

In answering these questions, we have to look at how different types of nodes work together in the network. Single-layered networks can only support one type of node per network. This means that we can either connect books to other books, the sender and the receiver and persons that are co-cited together, but it difficult to connect senders and books in the same network, let alone connect the author to a book that is cited in a letter. An explorative approach that assists the step-by-step creation of multi-layered networks might constitute an important step to understand these more complex relations between different node types.[16]

The creation of multi-layered visualisations will become clear in the following visualizations, which are created by means of the tool *nodegoat*.[17] Starting from a single-layered network, a letter exchange between two correspondents can be visualized as follows. In fig. 1, the yellow node represents the sender, the purple node the receiver and the light-blue nodes represent four letters exchanges between 1673 and 1674. Although these kinds of representations present us with a clear picture of the structure of the scholarly network – by highlighting the volume and intensity of the correspondence – it still hinders a more systematic exploration of the content of these letters. Letters constitute often a rich array of node types: mentioned people and books all connect to each other via a complex network (fig. 2).

16 On the complications of k-partite networks see Shawn Graham, Ian Milligan and Scott Weingart, Exploring Big Historical Data: the Historian's Macroscope (London: Imperial College Press, 2016), 208-211.

17 The tool nodegoat, developed by LAB1100, is a web-based data management, network analysis and visualization environment (http://nodegoat.net from LAB1100, http://lab1100.com). On the possibilities of this tool, see Pim van Bree and Geert Kessels, "Trailblazing Metadata: a diachronic and spatial research platform for object-oriented analysis and visualisations" (paper presented at the conference Cultural Research in the Context of Digital Humanities, St Petersburg, October 3-5, 2013.

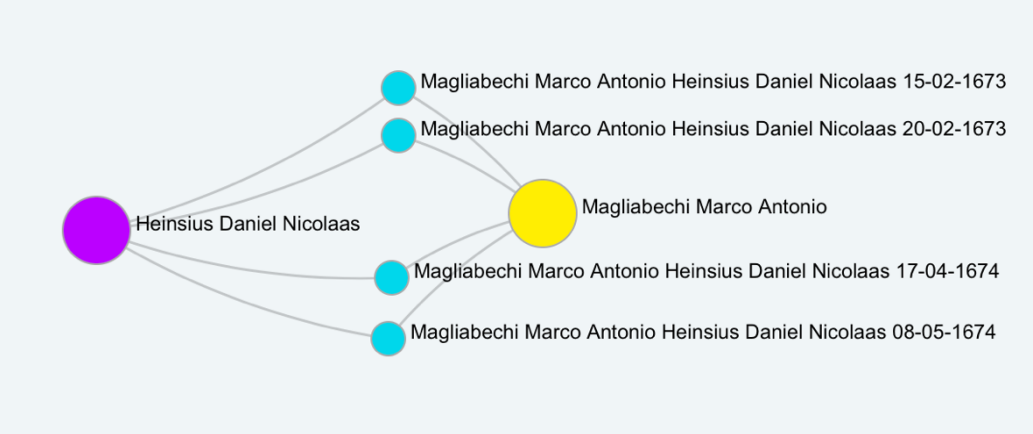

Figure 1. Epistolary Network Magliabechi-Heinsius. Sender: yellow; receiver: purple; letters: light-blue.

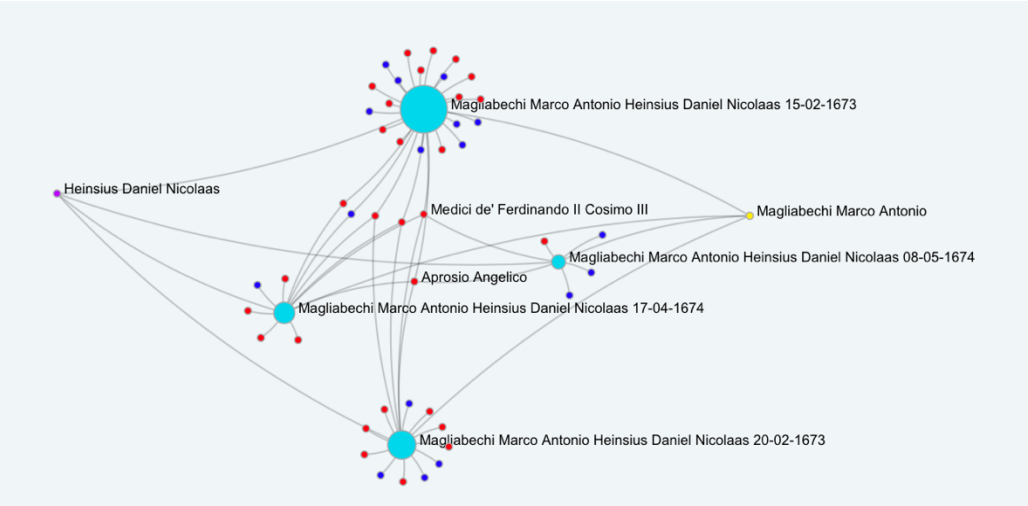

Figure 2. Episolary network Magliabechi-Heinsius. Sender: yellow; receiver: purple; letters: light-blue; cited books: dark-blue; cited persons: red.

Fig. 2 is generated from the same network as the previous representation, only now enriched by data on books (dark blue) and persons (red) that are cited in these letters. Overlap in data shows us books and persons that are mentioned repeatedly in more than one letter and the amount of them mentioned per letter. To reveal more information about the network, every node in the network is defined by its biography or, in the case of books, by its publication history. As such, a cited book in a letter is related to information about the printer, the author, the subject and whether the book was enlisted on the Index. This information enriches the network for it does not necessarily derive from the content of the letter, but from the intrinsic network of the content itself. These data are registered as attributes or metadata of the nodes, providing pieces of contextual information that complete the network.

So, the cited books, for their part, can lead to a range of different kinds of nodes and edges that all play a fundamental role in its circulation. When new data are added the overlap of the multi-layered network changes, resulting potentially in new answers and other questions (fig. 3):

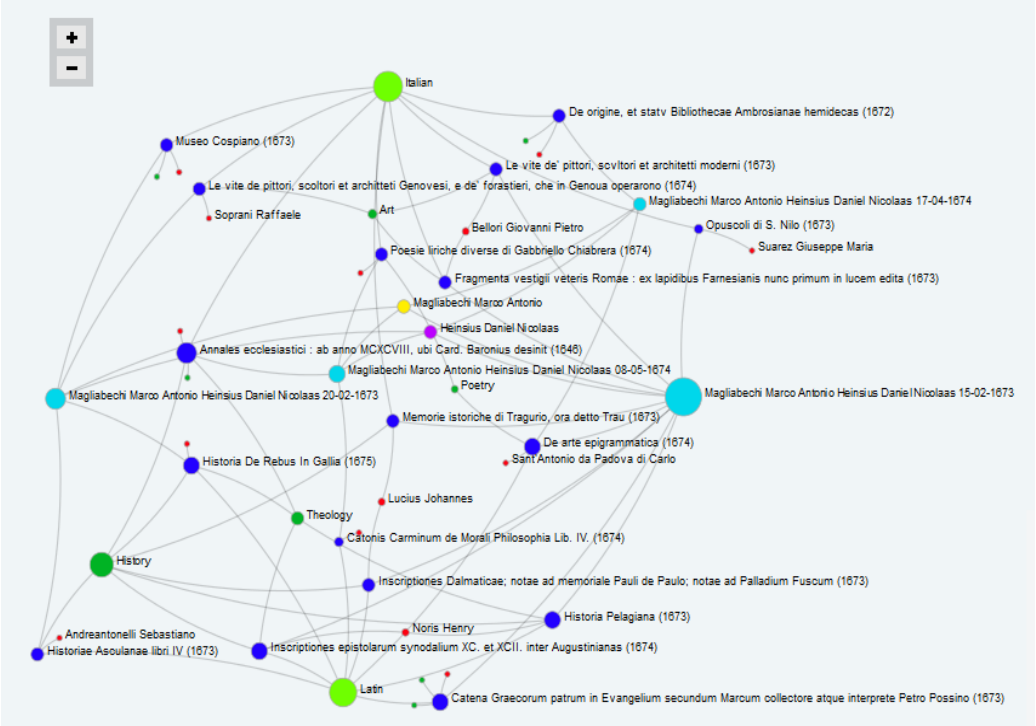

Figure 3. Epistolary network Magliabechi-Heinsius. Sender: yellow; receiver: purple; letters: light-blue; cited books: dark-blue; authors: red; subject: dark-green; language: light-green.

Figure 3 shows a complex, multi-layered network that consist of layers of several networks combined together in one interface, in which nodes appear in at least one of these layers. Within each layer, the nodes are instances of the same type, while the networks correspond to different categorical connections between those nodes, which are represented by different colors. As such, the sender (yellow) and the receiver (purple) form the first network as they wrote letters to each other (light-blue) in which books are mentioned (dark-blue) written in a language (light-green) by an author (red) on a certain subject (green). The multi-layered network enables to analyze these configurations at the same moment and how its interaction on different layers change over time. Consequently, the multi-layered network costitutes a dynamic network in which nodes appear and dissappear along the timeline.

It can be debated whether complexity should be added to a network that in the first place is intended to simplify our perception of society. When the network graph grows in its complexity, it becomes more difficult to analyze the network in terms of network metrics. In explaining the usability of bimodal networks, Scott Weingart pointed out that 'more categories lead to a richer understanding of the diversity of human experience, but are incredibly unhelpful when you want to count things'.[18] In other words, by creating a dataset with a large variety of nodes, it becomes harder to capture the meaning and the structure of the graph. Nevertheless, an approach that allows us to explore a dataset in various, overlapping configurations enhances the legibility of the network. Nodegoat is designed to propose interactive visualizations, rather than to assist statistical analysis. Instead of focusing on algorithms, it functions as a navigational tool with which we can add, remove, filter and visualize historical data in various configurations in order to explore more complex questions.

In multi-layered networks each different layer represents an isolated, but, interconnected network from the set of networks that describe the whole set of correspondence. This implies that every layer can be analyzed separately, or in hybrid combinations with other networks, making it possible to add, edit and to remove data where needed. This continuous process of interaction with data allows for more critical readings and levels of interpretation. Consequently, this approach stands close to methods of "digital hermeneutics". Digital hermeneutics, understood as the encounter between classic hermeneutics and digital technology, has challenged the way we interpret historical sources, and, on some level, also ourselves. On facing this challenge, Capurro writes:

> "The task of hermeneutics in the digital age is twofold, namely to think digital and at the same time to be adressed by it. The first task leads to the questions about the impact of the digital code on all kind of processes, in particular societal ones. (…) The second task refers to the challenge of the digital with regard to the self-interpretation of human beings in all their existential dimensions, particularly (…) their understanding of history, their imagination, their conception of science, their religious beliefs."[19]

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18 Scott Weingart, "Networks Demystified 9: Bimodal Networks," The Scottbot Irregular, January 21, 2015, https://scottbot.net/networks-demystified-9-modality/.

19 Rafael Capurro, "Digital Hermeneutics: an Outline," All & Society 25:1 (2010). Accessed January 14, 2017, http://www.capurro.de/digitalhermeneutics.html. See also Geoffrey Rockwell and Stéfan Sinclair, Hermeneutica. Computer-Assisted Interpretation in the Humanities (Cambridge/London: The MIT Press, 2016).

An approach that allows the researcher to combine multiple networks of data in a continious process of interaction, self-awareness and interpretion, may bring these tasks closer.

As multi-layering brings classic hermeneutics and digital technology together, the same applies for close and distant reading. Because multi-layering helps us to curate data step by step it allows us to move easily between close and distant reading, mixing traditional historical research with network analysis. The approach of distant reading aims to visualize or map the structure of more letters by applying digital tools. Close reading, on the other hand, is the in-depth reading of the content of the letter, which is also known as the equivalent of traditional research methods.[20] Both methods have their strengths and weaknesses; with close reading one often tries to hypothesize overarching theories from a very limited sample of letters while with distant reading one may identify overlapping data based on a larger set of letters, but it often results in a loss of the contextual information that a close reading can reveal. Ideally, historical research should switch smoothly between distant and close reading that are complementary, rather than contradictory:

> "The important next step is combining the distant and the close reading, mixing traditional historical research with the newer quantitative studies. The combination holds the promise of a new historical synthesis, a longue durée history more firmly grounded in the sea of as-yet-disconnected micro- and meso-histories we often find ourselves trudging through".[21]

Thus, both readings should interact to strengthen historical interpretations. I would like to call this combination "disclose reading" whose implementation will become central in the next paragraph on the role of books in the epistolary network of Nicolaas Heinsius.

4 Networks of Books in the Correspondence of Nicolaas Heinsius

In this paragraph the life and career of Nicolaas Heinsius (1620-1682), and the way his Italian network of contacts and books functioned, will be discussed. Nicolaas Heinsius is predominantly remembered for his magnificent library and his philological studies of editions of Ovid, Claudian, Flaccus and Virgil. He was the son of the famous poet and Leiden classicist Daniel Heinsius (1580-1655) whose name guaranteed, to a large extent, the fortune and respectability of Nicolaas in the scholarly community. Heinsius

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20 Franco Moretti, Close Reading (London/New York, Verso, 2013).

21 Scott Weingart, "The Networked Structure of Scientific Growth," The Scottbot Irregular, February 22, 2012, http://www.scottbot.net/HIAL/index.html@p=12050.html, 29.

profited from the recommendations made by his father and his circle of friends throughout his stays in Italy, securing him admission to libraries, private collections and courts.

In 1646, Heinsius went for the first time in Italy to collate ancient manuscripts of Roman texts in the most prominent libraries of Florence and Rome. Like his two predecessors, the Dutch philologists Johannes Fredericus Gronovius (1611-1671) and Isaac Vossius (1618-1689), who were subsequently in Florence in 1641 and 1643, Heinsius preferred Florence to other Italian cities. In Florence, he visited the *Biblioteca Medicea Laurenziana* where he consulted important manuscripts of, amongst others, Flaccus, Virgil and Ovid, which appear to have been implicitly used in his later revised editions. During the summer of 1652 Heinsius returned to Italy, this time in the service of Queen Christina of Sweden (1626-1689), to find and buy rare manuscripts for Christina's private library.[22]

During his stays in Florence, Heinsius took part in the intellectual life of the city, expanding his elaborate network of learned and literary contacts all over Italy. He was made member of the famous *Accademia della Crusca* by prince Leopoldo de' Medici (1617-1675) and was elected president of the *Accademia degli Apatisti*, both literary academies in Florence where he was responsible for proposing linguistic problems for discussion.[23] After his visits, Heinsius continued to correspond with most of the learned men he had met, becoming, in Gregorio Leti's (1630-1701) words, "one of the most prominent men of letters of the Universe".[24]

Through these exchanges, Heinsius kept abreast of the latest scholarly publications, works in progress, controversies and discoveries in Italy. This information about books, also called "news of the Republic of Letters", often amounted to bibliographical reports containing detailed lists of publications which had recently appeared from the press. Despite the circulation of literary journals, which began to appear in Europe at the beginning of the seventeenth century, the circulation of these letters remained by far the most important medium of access to literary knowledge. Heinsius used this information

22 On Heinsius role as book scout for Queen Christina of Sweden, see Frans F. Blok, Nicolaas Heinsius in dienst van Christina van Zweden (Delft: Ursulapers, 1949): 127-184. Remarkably, however, apart from this study, no other major study has so far been devoted to his varied scholarly and cultural activities.

23 Henk Th. Van Veen and Andrew P. McCormick, Tuscany and the Low Countries; an introduction to the sources and an inventory of four Florentine libraries (Florence: Centro Di, 1985): 29-30.

24 Gregorio Leti to Nicolaas Heinsius, n.d., Leiden University Library (UBL), Special Collections, Bur F 7: "Uno de' maggiori letterati dell'Univero".

primarily to gather material for his own studies, as is illustrated by a letter the Florentine scholar Lorenzo Panciatichi (1635-1676), wrote to him in 1674:

> "I take the opportunity to send you a brief rapport about a newly discovered sepulcher in Rome, knowing that you will appreciate this literary news for it is correlated with your edition of Ovid, which is so eruditely commented upon by Your Illustrious Lordship for the benefit of the entire Republic of Letters".[25]

More important, as can be also read from this passage, Heinsius' books were conceived as precious contributions to the Republic of Letters. Consequently, the fame of his editions often guaranteed him an entrée in a new correspondence network. This is corroborated by a letter the librarian of the Medici family, Antonio Magliabechi, wrote to Heinsius in 1671:

> "Many years I have nurtured the desire to dedicate myself to be a servant of the pen, which deep in my heart I have always been. From being a little child, I don't know how, I was fortunate to have your beautiful Latin poetry at hand. I was never tired of reading them, always discovering new beauties within them"[26]

These passages alone attest the important role of books in the correspondence of Nicolaas Heinsius. Likewise, a representation of his network should take this into account. In the following visualisation, both books and letters are integrated in a unified, temporal network. The reconstructing of this network required a combination of archival work and computational methods. The 159 letters that form the basis of this visualisation are all extent in the University Library of Leiden. The letters are written by 23 Florentine scholars between 1648 and 1675. In fig. 4, cited books in the letters (light-blue) written by Heinsius' Florentine correspondents (red) are shown in dark-blue and Heinsius' publications are shown as black nodes. What emerges from this data is a large network that consists of 437 nodes and 701 edges.

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25 Panciatichi to Heinsius, April 18, 1674, UBL, BUR F 7, f. 3: "Piglio ardine d'inviarle una breve relazione d'un nuovo sepolcro scoperto adesso a Roma, sapendo quanto le siano grate queste nuove letterarie in correlazione col suo Ovidio che con si gran benefizio di tutta la Republica Letteraria è stato da V.S.Ill.ma così eruditamente illustrato".

26 Magliabechi to Heinsius, October 9, 1671, UBL, BUR F 7: "Che sono molti anni che nutrivo un ardentissimo desiderio di dedicarmele servidore con la penna, come le sono stato sempre col cuore, da quel tempo, che essendo piccol fanciullo, per mia buona sorte, mi capitarono non so come alle mani, le sue bellissime, e Latinissime Poesie, le quali non mi sazziavo di leggere, scoprendo sempre in esse nuove bellezze".

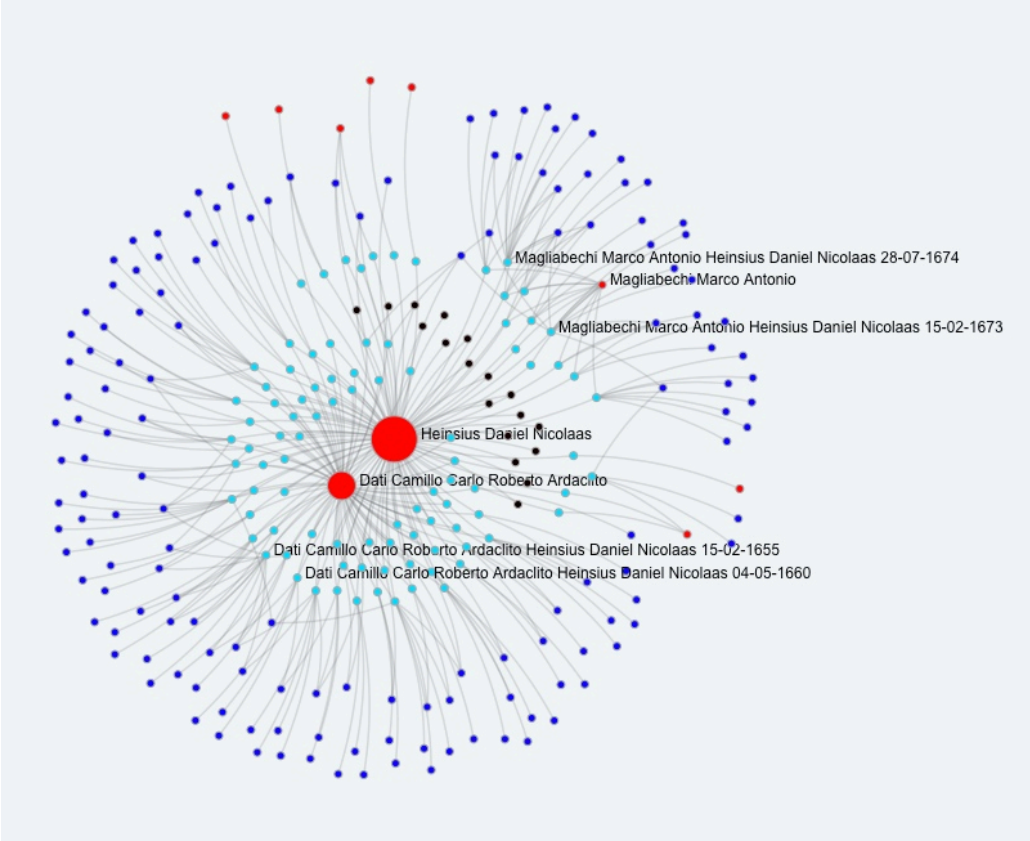

Figure 4. Eistolary Network of Heinsius and his Florentine contacts (1648-1675). In these years, Heinsius received letters (represented in light-blue) from 9 contacts which are shown in red. In these letters, books were mentioned which are shown in dark-blue. The visualisation is dominated by the books mentioned in the correspondences from Dati and Magliabechi.

The visualisation immediately reveals an apparent structure: Heinsius relied mainly on the intermediation of two Florentine scholars, Carlo Dati (1619-1676) and Antonio Magliabechi to receive books and news about the latest publications from Italy. Covering a period of about 30 years, the consecutive correspondence of Dati and Magliabechi sheds light on almost the entire career of Heinsius.

Enriching this network with Heinsius' publications, which were retrieved automatically from the Short Title Catalogue of the Netherlands, reveals Heinsius' *modus operandi* in gathering information and material for his publications.[27] The temporal dimension of the network shows when the books relevant for the research of Heinsius were mentioned in relation to his own publications (fig. 5).

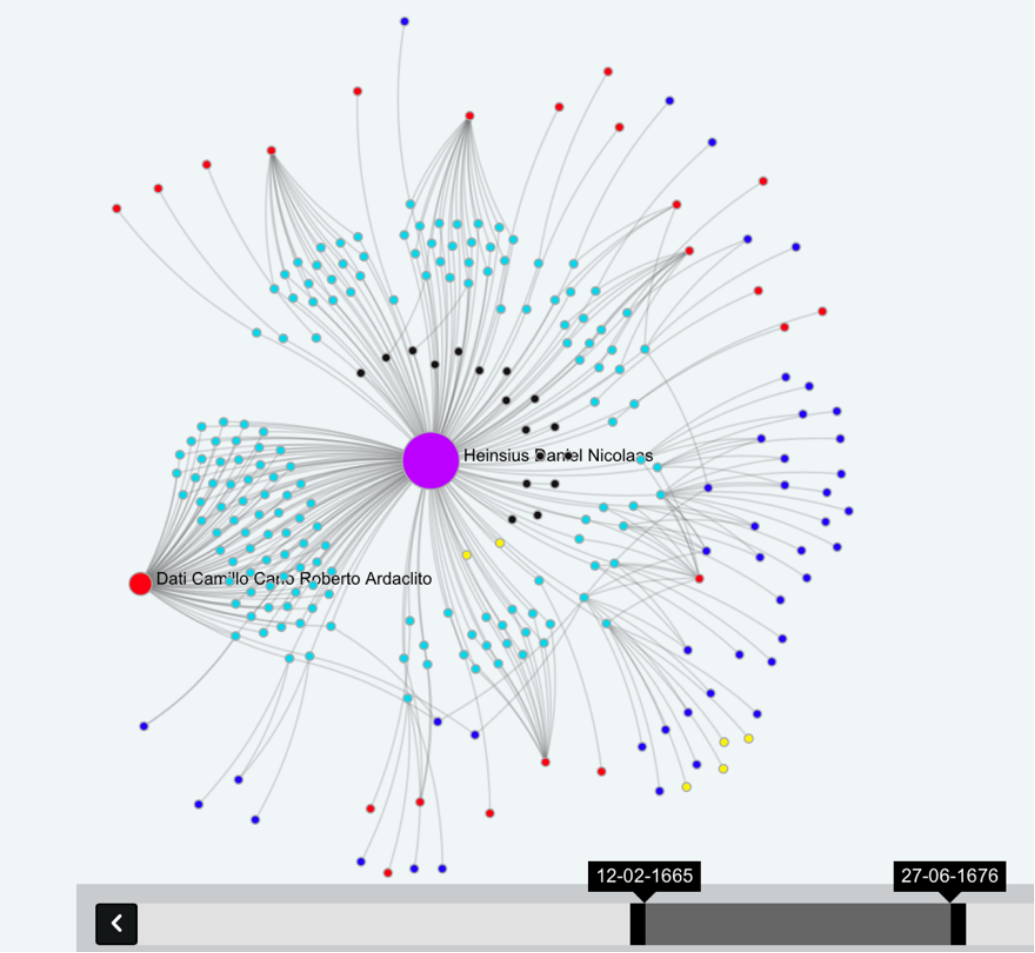

Figure 5. Epistolary Network Heinsius-Magliabechi-Dati. Sender: red; receiver: purple; letters: light-blue; cited books: dark-blue; Heinsius' publications: black; Editions Flaccus: yellow

27 The Short Title Catalogue of the Netherlands (STCN) is the Dutch bibliography for the period 1540-1800. "Short Title Catalogue of the Netherlands," accessed January 14, 2017, http://picarta.nl/DB=3.11/. Data from the STCN can be retrieved using SPARQL ("Virtuoso Sparql Query Editor," accessed January 14, 2007, http://openvirtuoso.kbresearch.nl/sparql.

Consider Heinsius' editions of Flaccus, for example, which were published in 1680 and, posthumously, in 1702. Figure 5 shows that, besides these two editions (the two yellow nodes in the center), four other editions were previously mentioned in a letter written by Magliabechi (four yellows nodes at the bottom of the visualisation). This highlights that Heinsius started to collect his material many years before its publication. While a temporal multi-layered visualisation in which both letters and books are combined highlights these connections, a close reading of the letter in question corroborates this:

> "Concerning Valerio Flacco, commented by Batista Pio, Your Illustrious Lordship does not have to search for it anymore, because I have it among my books. I will definitely send the book to you, not only because you need it, but also because you preserve it forever in your library, begging you to thank me for receiving this gift."[28]

5 The Decline of the Italian Book Network

The study of Heinsius' network can help us gain a better understanding of the rise and fall of Italy's publishing industry in the late seventeenth century. Towards the 1670s, Florence gradually lost the central position, both culturally and politically, it had occupied in the previous centuries. When Leopoldo de' Medici, founder of the scientific *Accademia del Cimento* and above all, a great collecter of books, left Florence for Rome in 1667, the cultural and intellectual life of Florence went downhill. Moreover, the death of important scholars, also correspondents of Heinsius, as Carlo Dati, Andrea Cavalcanti (1610-1673) and Lorenzo Panciatichi, contributed to the cultural decline of the Grand Duchy of Tuscany in the second half of the seventeenth century.

Heinsius' Florentine correspondents lamented continuously the scarcity of books that circulated in Florence. All Dati, who once provided Heinsius with numerous lists of books and discoveries, could say was that "in Florence one does little, even nothing".[29] The same expression can be found in Magliabechi's letter to Heinsius, dated 28 July 1674:

> "To fill this paper, I will notify some literary news from our Italy, which, however, I write to you with more tears than ink. They are of little consideration

28 Magliabechi to Heinsius, January, 5, 1671, UBL, BUR F 8, f. 1: "Circa al Valerio Flacco col Comento di Batista Pio, V.S.Ill.ma non ne cerchi più, poiché io l'ho tra miei Libri, onde lo manderò infallibilmente non perché ella se ne serva solamente, mà perche in eterno lo conservi nella sua Libreria supplicandola vivamente a farmi grazzia di riceverlo in dono".

29 Dati to Heinsius, October 13, 1674, UBL, BUR F 7, f. 58: "Qui in Firenze si fa poco, o niente".

because, as Your Illustrious Lordship knows well, nobody studies here on the true path."[30]

The correspondence network between Heinsius, Dati and Magliabechi confirms this: the thriving network of books (dark-blue) and letters (light-blue) that characterised the earlier years of Heinsius' career drastically declined after the 1665s, and dissapeared almost altogether after the death of Carlo Dati in 1676 (fig. 6):

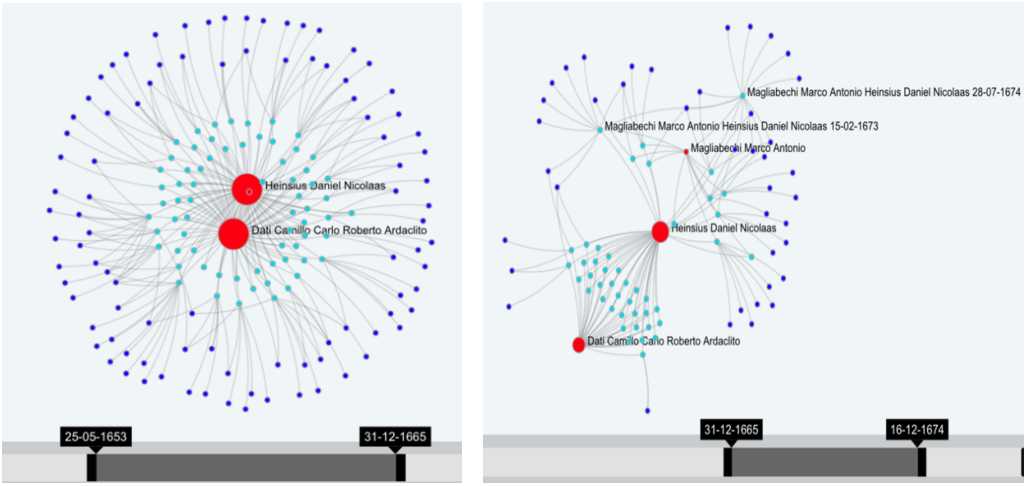

Figure 6. Epistolary Network Heinsius-Dati-(Magliabechi) 1653-1665 (left). Correspondents: red; letters: light-blue; cited books: dark-blue.

What remained of the once abundant flow of news from Italy, was a series of letters written by Magliabechi who tried to uphold the position of Florence in the Republic of Letters. While the librarian did not write anything himself, he served the scholarly community by circulating literary news, ideas and books. In the next paragraph we will take a closer look at Magliabechi's role as an 'information-broker' to have a better understanding of his significance for Heinsius and the Dutch scholarly community.

30 Magliabechi to Heinsius, July 28, 1674, UBL, BUR F 8: "Per empiere questo foglio, le avviserò qualche notizzia Letteraria della nostra Italia. Per lo più saranno cose di pochissima considerazzione, poiché come V.S.Ill.ma sa, il che scrivo più con le lacrime, che con l'inchiostro, qua non ci è si può dire alcuno che studi per la vera strada".

6 The Power to Command Knowledge

Despite the many difficulties in the Grand Duchy of Tuscany, Magliabechi continued to distribute as much as news and books he could because he had firmly embedded himself in a vast epistolary network throughout Europe. Rather than depending on the local Florentine and Italian market to obtain books, Magliabechi received and circulated news from the far corners of the European Republic of Letters. His correspondence, amounting to over 22.000 surviving letters in the National Library of Florence, took off in Paris in 1652, when he started to exchange letters on a regular basis with the French scholars Gilles Ménage (1613-1692) and Emery Bigot (1626-1689). They introduced him to other scholars in France, Germany and the Dutch Republic. Consequently, his network grew in importance as more scholars joined the network, and around 1675 his network began to evolve even more rapidly, until reaching its maximum extension around the 1690s. At that date, his network spanned 12 different countries, including more than 250 correspondents, most of which were residing in Paris and in Amsterdam.

By receiving, storing, and circulating recent knowledge of books and including in his network experts in different fields and from different countries to whom he could turn for help, Magliabechi was able to provide answers to many questions from scholars very quickly. Consequently, scholars from all over Italy sent their publications to Magliabechi who was able to inform other scholars about their work. This key role of Magliabechi, as an information broker between Tuscany and the Dutch Republic, becomes clear from the following visualisation (fig 7).

Fig. 7 consists of 264 letters (light-blue) written by Magliabechi to his Dutch correspondents between 1652 and 1714 (left). These letters are all extent in various libraries in the Netherlands (Leiden University, Royal Library of the Hague, Amsterdam University, City Archive Utrecht, Utrecht University). In addition, this visualisation contains the already discussed 159 letters written to Heinsius from his Florentine correspondents (right). The 12 letters between Magliabechi and Heinsius, written between 1671 and 1675, are represented in the center of this representation.

At a glance, fig. 7 reveals that many of the cited books (dark-blue) in the network have few, or even only one or two edges. In other words, Magliabechi rarely spoke of the same book in more letters and to different scholars. Consequenly, each letter is a unique source of literarly news. This clear pattern suggests that the spreading of literary news was a very organized, well-connected system. The letters of Magliabechi were often

read by more than one person, and sometimes even published in a scholarly journal.[31] Dutch scholars forwarded Magliabechi's letters to fellow scholars all over the Dutch Republic.

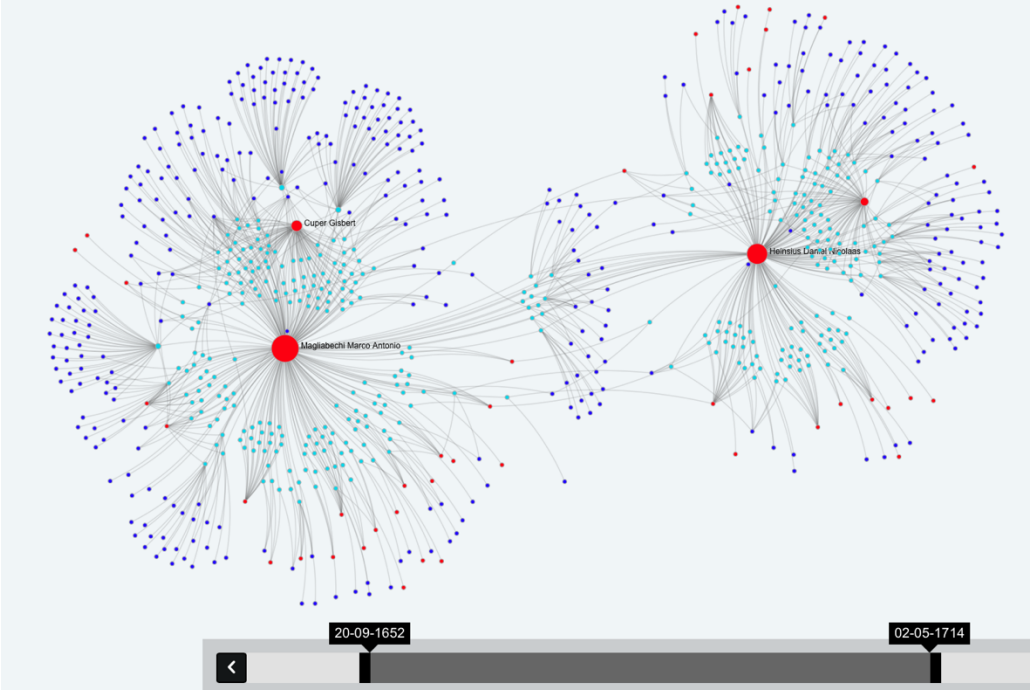

Figure 7. Epistolary Networks of Magliabechi (left) and Heinsius (right). Correspondents: red; letters: light-blue; cited books: dark-blue.

Consequently, they took note of Magliabechi communications with great interest. This becomes apparent from a letter Magliabechi wrote to a collegue of Heinsius, the historian Gisbert Cuper (1644-1716):

> "Knowing that Spanhemio [Ezechiel Spanheim (1629-1710)] and Your Illustrious Lordship are good friends, I have included here a letter for him. I leave the letter

31 Pieter Rabus published Magliabechi's letters to Leeuwenhoek as 'Italiaansch Boeknieuws' (Italian Book News) in the Boekzaal van Europe in 1695, which was the first scientific journal published in the Dutch Republic (Matilde van Rijnberk, "De briefwisseling tusschen Leeuwenhoeck en Magliabechi," in Nederlands Tijdschrift voor Geneeskunde 81 (1937).

> open, because the literary news are identical to those I wrote to Your Illustrious Lordship."[32]

If we pay attention to Magliabechi's overall communication strategy, including data on the subject of the books, one notices that Magliabechi adjusted his literary reports to each of his correspondents (fig. 8). To the scientist Antonie van Leeuwenhoek (1632-1723), for example, he communicated only about books on the natural sciences (shown as yellow nodes) while to Nicolaas Heinsius he discussed merely ancient poetry, philological and historical works (shown as dark-blue nodes). Fig. 8 underlines Magliabechi's knowledge on every possible subject, ranging from latin and greek literature to astronomy and mathematics, again highlighting the success of Magliabechi as an important information broker in the Republic of Letters.

That books could lead to the creation of an epistolary network, is highlighted by means of the following visualisation (fig. 9) that provides a more detailed picture of the correspondence between Magliabechi and Heinsius. In fig. 9, multiple layers provide information on the authors (red), subjects (green) and dedicatees (pink) of all the cited books (dark-blue) in the letters (light-blue) between Heinsius and Magliabechi in the years 1671-1674. It appears that two of the 37 books that Magliabechi mentioned in his letters were dedicated to him: the *Inscriptiones epistolarum synodalium* from the Medici's theologian Henry Noris (1631-1704) and the *Prolusionum et epistolarum III* written by the archeologist Ottavio Ferrari (1607-1682).

Authors, even unfamiliar with Magliabechi, praised his name in the dedications and acknowledgments of their publications. Consequently, Magliabechi enlisted the names of the book in his literary reports, and occasionaly sent the books when requested by his correspondents, that were read by a large part of the Dutch scholarly community, including Heinsius:

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32 Magliabechi to Cuper, October 5, 1704, Royal Library of the Netherlands (KB), The Hague, Bijzondere Collecties, KW 72 D 12, ff. 68-70: "Sapendo che tra V.S.Ill.ma e il signore Spanhemio, passa grande amicizzia, mi ardisco ad inviarle l'inclusa mia Letterina, per esso. La mando aperta, benché le novità Letteraria, sieno le medesime, che scrivo in questa mia, a V.S.Ill.ma".

"Mr. Ferrari has brought to light the third part of his Prolusioni, e Lettere. The following is the title of the Book: Octavij Ferrarij Prolusionum et Epistolarum Pars tertia. Accessit Panegyricus Ludovico Magno Francorum Regi dictus. Editio secunda. Patavij typis Petri Mariae Frambotti 1674. in 4. Although I do not know this mr. Ferrati at all, I was surprised to see my name mentioned on page 148, and with much praise."[33]

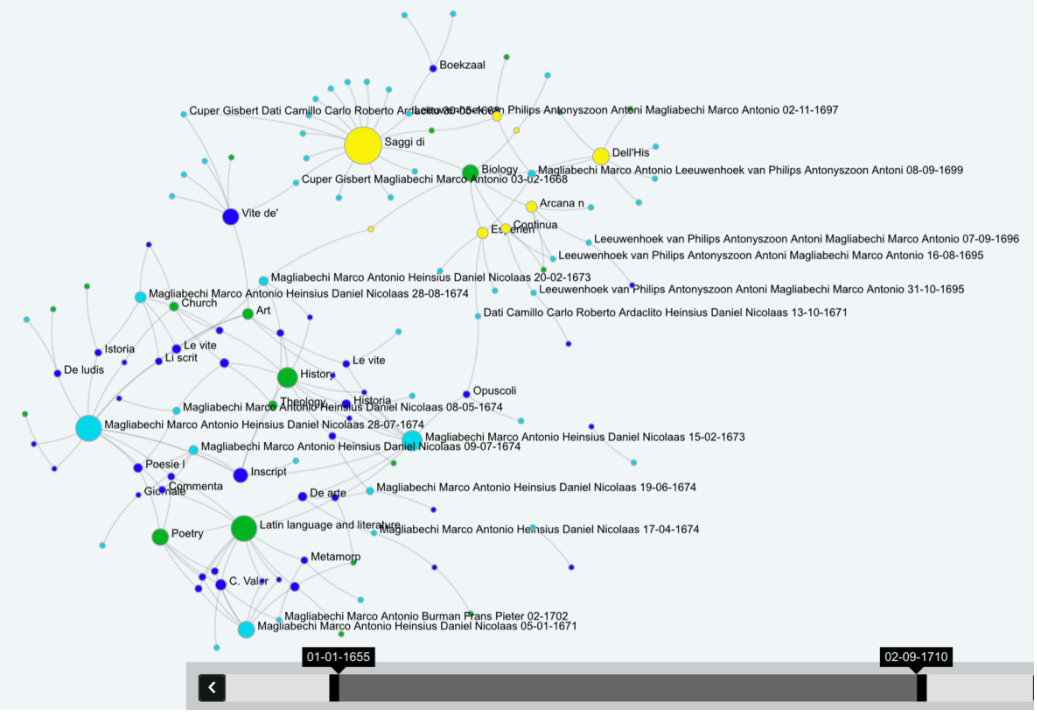

Figure 8. Epistolary network Magliabechi-Heinsius and Magliabechi-Leeuwenhoek. Letters: light-blue: cited books: dark-blue; subject: green/yellow.

33 Magliabechi to Heinsius, June 19, 1674, UBL, BUR F 8, f. 5: "Il Signor Ferrari ha data in luce la terza parte delle sue Prolusioni, e Lettere. Il seguente è il titolo del Libro.Ocatvij Ferrarij Prolusionum et Epistolarum Pars tertia. Accessit Panegyricus Ludovico Magno Francorum Regi dictus. Editio secunda. Patavij typis Petri Mariae Frambotti 1674. in 4. Io non conosco niente il detto Signor Ferrari, onde son restato non poco maravigliato, nell'avermi da esso veduto a carte 148 nominato, e con gran lodi."

In this way, Magliabechi opened a window to Italy, connecting Dutch and Italian scholars through the books in his literary reports. Vice versa, it were not only Italians who dedicated their books to Magliabechi. In 1695, the Dutch scientist Antonie van Leeuwenhoek dedicated his Latin version of the *Arcana Naturae Detecta* to Magliabechi "in order that scholars both in Italy and elsewhere may become aquainted with my trifling labours".[34] The practice of book dedication clearly illustrates a general habit of scholars to get admitted into an epistolary network: Leeuwenhoek started a correspondence with Magliabechi after his dedication.

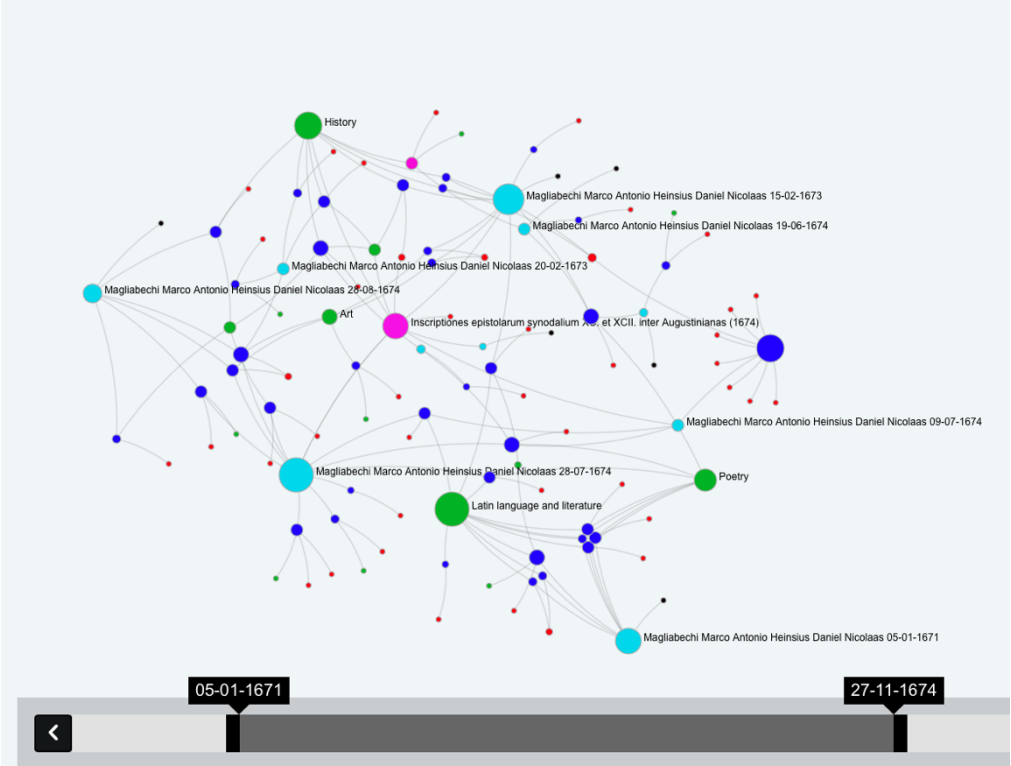

Figure 9. Multi-layered network Magliabechi-Heinsius. Letters: light-blue; cited books: dark-blue; subject: green; authors: red; dedications to Magliabechi: purple, prohibited books: black.

34 Leeuwenhoek to Magliabechi, August 16, 1695, in Lodewijk C. Palm, ed., Alle de brieven van Antoni van Leeuwenhoek. The collected letters of Antoni van Leeuwenhoek, XI, (1695-1696), Lisse: N.V. Swets & Zeitlinger, 1983, accessed January 12, 2017: http://www.dbnl.org/tekst/leeu027alle11_01 /leeu027alle11_01_0007.php: "Quum autem reliquae a me scriptae epistolae nunc etiam Latino idiomate sint impressae (ut Viri Docti, cum in Italia, tum alibi, participes reddantur vilium meorum laborum, qui in exteris regionibus pluris fiunt, quam sperare unquam sustinueram) mihique visum fuerit eas Celeberrimo Tuo nomini inscribere."

Vice versa, books could endanger the epistolary network when placed on the *Index Librorum Prohibitorum*. In fig. 9 prohibited books are shown as black nodes. Magliabechi often asked his correspondents not to share the contents of the letter with others, especially if the contents contained delicated information on books that were not allowed to circulate. There is, for example, a letter of 1699, in which Magliabechi asked his correspondent to print a profane work of one of his friends. To keep this secret, he had to "tear up this letter immediately after reading it, because no single soul, at any time, may ever see this letter, as I write to you in extreme secrecy and confidentiality."[35] So, prohibited books could ostacolate and endanger the relationship between correspondents. For example, The *Sant'Ufficio* could take advantage of this information and hinder the circulation between the correspondents. In addition, unauthorized circulation may betray the confidence of the sender, resulting in the break-up of their network. The representation of prohibited books may highlight these dynamics. For now, this is still in its early stages, but further research may (or may not) confirm this.

7 Conclusion

Because of the hybrid nature of epistolary networks and the lack of earlier studies that are undertaken to represent this complexity, this article proposed an interactive approach to deal with multiple kinds of data. In studying the networks that held the Republic of Letters together, we are often confronted with situations in which multilayering can be useful. The Republic of Letters was not a single community that merely consisted of corresponding scholars but costituted a dynamic society in which all kinds of objects were exchanged.

Amongst these objects, early modern scholarly correspondence revolved mostly around books. Books dominated the content of letters in the shape of literary reports – or "news from the Republic of Letters" – that informed scholars about the most recent publications, debates and works-in-progress. These literary reports, for their part, shaped and influenced new publications. We saw, for example, how Heinsius used his correspondence with Magliabechi as a means to collect material for his latin editions. This was possible because multilayering allowed us to integrate both letters, cited books and Heinsius' own publications in the same network, identifying as such the possible sources and ideas Heinsius used in preparing his own work.

Books were not only a source of information, but they have to be considered as active nodes in the network for they could both establish and

35 Magliabechi to Huguetan, 1699, UBL, Pap 15.

impede relations between correspondents. We saw, for instance, that dedications and the fame of one's publications could often guarantee an entrée in a network. A case in point was illustrated by one of the first letters Magliabechi wrote to Heinsius in which he expressed his admiration for Heinsius' latin poetry, speaking of how he would be honoured to become his "servant of the pen". Another example included Leeuwenhoek's dedication of the *Arcana Naturae Detecta* to Magliabechi which resulted in a regular correspondence between the two shortly after the dedication.

In a similar fashion, books could impede and endanger networks when, for example, placed on the Index of Prohibited Books. The mentioning of a prohibited book in a letter may result in a conflict between correspondents when discovered by influential authorities as the *Sant'uffizio*. Multi-layered networks, which can include both data and metadata about publications, can highlight how dangerous publications interact with letters over time. I have left the exact outcome open for now but further research may provide a precise answer to these dissolving networks.

The visualizations and observations in this article, taken together, aimed to show not only what we can discover about the epistolary networks of Nicolaas Heinsius and Antonio Magliabechi but also, more generally, how multi-layered networks can transform the way we interact with historical data. Multi-layering enhances the interoperability of data, allowing the user to explore the network from multiple configurations and changing perspectives. This interactive building of hybrid networks mediates between traditional hermeneutics and digital technology, between close and distant reading.

The two methods for distant and close reading are in continuous interaction with each other. While distant reading will uncover how relations are represented and constructed, sometimes reinforced and sometimes transformed, close reading focuses on the specific features that have influenced those dynamics. Vice versa, one could identify several interesting angels for in-depth research and comparison of processes occurring in societal developments directed by a richer version of the properties of the networks (for instance, which names and objects are co-cited in letters). In other words, distant reading makes it possible to find the right places where to close-read. This brings us back to the title of this article – Mapping the book: using multi-layered networks to *disclose* the Republic of Letters – which silently underlines the paramount importance of this combined methodology in historical research: disclose reading.

References

Ahnert, Ruth and Sebastian E. Ahnert, Protestant Letter Networks in the Reign of Mary I: A Quantitative Approach, in: *ELH 82(1)*, 1-33.

Berkvens-Stevelinck, Christian, Hans Bots, and Jens Häseler, *Les grands intermédiaires culturels de la république des letters: études des réseaux de correspondances du XVIe aux XVIIIe siècles*, Paris 2005..

Bethencourt, Francisco and Florike van Egmond, *Communication and Cultural Exchange in Europe, 1400–1700, vol. 3, Cultural Exchange in Early Modern Europe*, Cambridge 2007.

Blok, Frans F., *Nicolaas Heinsius in dienst van Christina van Zweden*, Delft 1949.

Boccaletti, Stefano, The Structure and Dynamics of Multilayer networks, in: *Elsevier Physics Reports* 544(1) (2014), 1-122.

Bots, Hans and Françoise Waquet, *La république des lettres*, Paris 1997.

Bree, Pim van and Geert Kessels, Trailblazing Metadata: a diachronic and spatial research platform for object-oriented analysis and visualisations, Paper presented at the conference Cultural Research in the Context of Digital Humanities, St Petersburg, October 3-5, 2013.

Capurro, Rafael, Digital Hermeneutics: an Outline, in: *All & Society* 25(1 (2010)): 35-42. http://www.capurro.de/digitalhermeneutics.html.

Furey, Constance M., *Contarini and the Religious Republic of Letters*, Cambridge 2008.

Garas, Antonios, *Interconnected Networks London*, London 2016,

Gingras, Yves, Mapping the Structure of the Intellectual Field using Citation and Co-citation Analysis of Correspondences, in: *History of European Ideas* 36 (2003), 330-339.

Gmür, Marcus, Co-citation analysis and the search for invisible colleges: A Methodological Evaluation, in: *Scientometrics* 57(1) (2003), 27-57.

Grafton, Anthony, A Sketch Map of a Lost Continent: The Republic of Letters, in: *Republic of Letters: A Journal for the Study of Knowledge, Politics, and the Arts* 1 (2009), 1-18.

Graham, Shawn, Ian Milligan and Scott Weingart, *Exploring Big Historical Data, the Historian's Macroscope*, London 2016.

Granovetter, Mark S., The Strength of Weak Ties, in:*American Journal of Sociology 78(6) (1973)*, 1360-1380.

Heuvel, Charles van., Mapping Knowledge Exchange in Early Modern Europe Intellectual and Technological Geographies and Network Representations, in: *International Journal of Humanities and Arts Computing* 9(1) (2015), 96-114.

Kivelä, Mika et al., Multilayer networks, *Journal of Complex Networks* 2: (2014),203–271.

Lux, David L. and Harold Cook, Closed circles or open networks? Communicating at a distance during the scientific revolution, in: *History of Science* 36(112) (1998), 179-211.

Margócsy, Daniel, *A Long History of Breakdowns: A Historiographic Review*, Abstract for Breaking Scientific Networks Conference, Davis, April 25, 2014. Accessed January 5, 2017. www.breakingscientificnetworks. info.

Mauelshagen, Franz, Networks of Trust and Imagined Community of the Learned, in: The Medieval History Journal 6(1) (2003), 1-32.

Miert, Dirk van, Concluding Observations on Communicating Observations, in: *Communicating Observations in Early Modern Letters (1500-1675): Epistolography and Epistemology in the Age of the Scientific Revolution*, edited by Dirk van Miert, London 2013, 223-247.

Moretti, Franco, *Close Reading*, London/New York 2013.

Rijnberk, Matilde van, De briefwisseling tusschen Leeuwenhoeck en Magliabechi, in: *Nederlands Tijdschrift voor Geneeskunde* 81 (1937), 3146-3159.

Republic of Letters Stanford, *Voltaire's places of publication (1712-1800*), Accessed December 28, 2016. http://republicofletters.stanford.edu/case studies/ voltairepub.html.

Rockwell, Geoffrey and Stéfan *Sinclair, Hermeneutica. Computer-Assisted Interpretation in the Humanities*, Cambridge/London 2016.

Stolzenberg, Daniel, A Spanner and his Works: Books, Letters, and Scholarly Communication Networks in Early Modern Europe, in: *For the Sake of Learning: Essays in Honor of Anthony Grafton*, edited by Ann Blair et al., Leiden 2016, 157 – 172.

Veen, Henk Th. van and Andrew P. McCormick, *Toscany and the Low Countries: an Introduction to the Sources and an Inventory of Four Florentine Libraries*, Florence 1985.

Weingart, Scott, Nils Spelt and Charles van den Heuvel, Circles of Confidence in Correspondence: Modeling Confidentiality and Secrecy in Knowledge Exchange Networks of Letters and Drawings in the Early Modern Period, in: *Nuncius* 31(1) (2016), 78-106.

Weingart, Scott,. Networks Demystified 9: Bimodal Networks, in: *The Scottbot Irregular* (2015). https://scottbot.net/networks-demystified.

Weingart, Scott, *The Networked Structure of Scientific Growth*. http://www.scottbot.net/HIAL/index.html@p=12050.html.