

NA+DAH 2020 White Paper

Modeling Networks in Gothic Manuscripts, 1250-1350

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Introduction

Before the European development of movable type printing in the 1450s, books had to be written by hand. These handwritten books, known as manuscripts, were meticulously copied on parchment (prepared animal skin). They were also often illuminated, or adorned with figures and designs executed in gold leaf and tempera paint, as a mark of the patron's wealth and the social value of the text. In the early Middle Ages, manuscript production occurred within the monastery. By the thirteenth century, however, a robust commercial sector of manuscript production and illumination had developed across Europe to serve the growing demand of universities and lay elites. "Modeling Networks in Gothic Manuscripts, 1250–1350" employs social network analysis to provide new perspectives on illuminated manuscripts and the artists who produced them.

This project draws its data from two published catalogs of medieval manuscripts: Alison Stones's four-volume catalog *Gothic Manuscripts, 1260-1320* (2013-2014) and Lilian M. C. Randall's *Images in the Margins of Gothic Manuscripts* (1966).¹ Using artist attribution data from Stones's catalog, we model a network of artists and workshops that collaborated on or contributed to manuscripts together in thirteenth- and fourteenth-century France. The iconographic data from Randall's catalog form the basis of a network of artistic contact and connections through similar or recurrent imagery in the borders of multiple illuminated

¹ Alison Stones, *Gothic Manuscripts 1260–1320* (London: Harvey Miller, 2013–2014); Lilian M. C. Randall, *Images in the Margins of Gothic Manuscripts* (Berkeley: University of California Press, 1966).

manuscripts from France, Flanders, and England. Together, these two datasets provide two separate but intersecting perspectives on artistic practices and regional exchange in late medieval Europe, a period for which written documentation about artistic activity is scarce.

At the end of the first convening, we had hoped to present preliminary findings from the marginalia network at a panel featuring new perspectives on the borders of illuminated manuscripts in July 2020 at the International Medieval Congress at Leeds. We had further aimed to build on this presentation to draft and submit an article for publication by the end of December 2020. Although the conference was cancelled, we still aim to have an article manuscript submitted by the end of the calendar year. We hope to present our paper at the next IMC-Leeds, in July 2021.

Research Investigation

Research Questions

We started our project with three main research questions. First, what was the relationship between artistic contact (attested by manuscripts with multiple artist attributions) and the transmission of artistic ideas in medieval French manuscript workshops? Second, do formal networks made up of connections between workshops and manuscripts reflect specific regional trends in manuscript production, which have played a prominent role in art historical analysis of medieval manuscript illumination in France and beyond? Third, how did networks of manuscript production change over time, and which workshops or illuminators played the largest roles in shaping these changes? We planned to study these through a comparison of networks modeling

artistic contact and iconographic connections between manuscripts. We also sought to examine the genre of the printed catalog itself as a tool that has shaped the study of medieval manuscripts.

Over the past year, these questions have remained central to our project, but our project has gained a new emphasis on what factors shape (or fail to shape) how networks of manuscript production and consumption were structured—topography, transportation networks, religious and political affiliations, linguistic affinities, economics, gender, culture, taste, etc. Some of these topics were difficult to address earlier in the project when our data was primarily based on stylistic attributions, but become necessary to consider as we incorporate analysis of the iconography of manuscript margins. With the comparison of the workshop contact network and the marginal iconography network, and through analysis of the subset of manuscripts shared between them, we aim to reconsider the core art historical concepts of style, influence, and regionalism that, in different ways, define and proscribe each dataset.

Our reading of network analysis studies across the disciplines have raised further research questions of a disciplinary scope that may be the basis of a longer-term project. How can art historians apply network-analytic approaches from other disciplines (in particular Sociology)? How can we develop an approach to network thinking that fosters interdisciplinary dialog between Art History and other fields?

Current Activity

We have completed the digitization of our two primary datasets, which have both undergone several rounds of data cleaning. While we may return to cleaning, we have begun to collect “ground truth” observations on a random sample of fully digitized manuscripts in order to

contextualize conclusions based on the marginal iconography network. We have also begun to analyze the data in this network using the statistical programming language R and a variety of specialized code libraries. Because we cannot simply find more medieval manuscripts to test the hypotheses we formulate based on these networks, and to avoid over-fitting our conclusions to our data, our exploratory analysis uses only one-fifth of the iconographic data (2646 pairs of marginal motifs and manuscripts), and employs diverse analytical approaches to formulate hypotheses that we can test with the remaining four-fifths of the data.

Methodology: Network Analysis

Because the art historical literature on network analysis methods is limited, we have turned for methodological inspiration to the disciplines of Biology, Archaeology, and Sociology. Our data is bipartite, so we have started exploring bipartite methods that are typically employed by ecologists studying predator/prey or plant/pollinator networks. This approach permits us to investigate whether there are discernible groups of manuscripts based on shared marginal iconography. We project this network to a unimodal model using similarity metrics borrowed from Archaeology. As archaeologists have pointed out, sociological studies currently offer the most robust theorizations of how network structures shape and are shaped by the production and consumption of material and visual culture.² Work on prestige and mobility in artist-gallery networks provides a starting point for reconsidering our network of workshop interactions.³ Other sociologists have analyzed the network properties and effects of cultural consumption in

² Barbara J. Mills, "Social Network Analysis in Archaeology," *Annual Review of Anthropology* 46, no. 1 (2017): 390.

³ Katherine Giuffre, "Sandpiles of Opportunity: Success in the Art World," *Social Forces; a Scientific Medium of Social Study and Interpretation* 77, no. 3 (1999): 815–32.

late-twentieth-century America, which can form an ethnographic basis for theorizing phenomena that we observe in our manuscript-based networks.⁴ Our challenge, then, is to find ways to meaningfully relate findings based on these varied methods to existing art historical scholarship on medieval manuscripts in France, Flanders, and England.

We have found that the complexity of the manuscripts as dynamic objects is persistently difficult to model as either nodes or edges in a network. Some researchers may be capable of offering highly specific localizations, attributions, and dates, while those working on lesser studied manuscripts may be justifiably reluctant to do so. Static data-models of dates and localizations fail to reflect later alterations to earlier books, which are common. These challenges are not specific to network analytical approaches, but they do inform our selection of methods.

Since we are interested in the networks of artistic exchange implied by the presence of shared motifs, rather than individual motifs as such, we plan to model our marginal iconography network as a unipartite, temporal network of manuscripts. The edges in this projection are weighted using a similarity metric calculated from the quantities and proportions of overlapping motifs in any given pair of manuscripts, known as the Brainerd-Robinson coefficient.⁵ Over the past three decades, this similarity metric has emerged as a disciplinary standard in Archaeology, where it is used to model networks based on shared cultural styles and technologies in the absence of direct observations of socio-cultural interactions.⁶ We have also explored R packages

⁴ Noah P. Mark, “Culture and Competition: Homophily and Distancing Explanations for Cultural Niches,” *American Sociological Review* 68, no. 3 (2003): 319–45; Omar Lizardo, “How Cultural Tastes Shape Personal Networks,” *American Sociological Review* 71, no. 5 (2006): 778–807.

⁵ W. S. Robinson, “A Method for Chronologically Ordering Archaeological Deposits,” *American Antiquity* 16 (1951): 293–301; George W. Brainerd, “The Place of Chronological Ordering in Archaeological Analysis,” *American Antiquity* 16 (1951): 301–313;

⁶ Matthew A. Peeples, “Finding a Place for Networks in Archaeology,” *Journal of Archaeological Research* 27, no. 4 (2019): 477.

for working directly with the bipartite network, which can be time-consuming to use but provide unique insights into its structure.⁷

Although there are differences in how we analyze the two different networks, one approach that spans both is to compare scholarly localizations (based most often on stylistic criteria) to the communities observable based solely on network structure. This bears directly on our research question regarding how geography affected manuscript production. We find network communities by applying modularity algorithms to both the bimodal data and unimodal projections.⁸ In order to investigate how networks of manuscript production changed over time, we model both of our networks as temporal networks.⁹ We then use network metrics like betweenness centrality, eigenvector centrality, and forward reach to identify key workshops/artists and associated manuscripts. These key nodes or groups of nodes form the focal points of case studies, allowing us to engage more concretely with existing art historical scholarship.

Our findings regarding regionality and temporality will shape our approach to answering our overarching question about the relationship between artistic contact and the transmission of artistic ideas. From a network-analytic perspective, comparing two different networks with different sets of nodes and edges presents a methodological challenge that we are just beginning to address. Rather than attempting to compare apples and oranges, we may model this subset as a bipartite network with one set of nodes based on workshops and another set of nodes based on

⁷ We have found the R package Bipartite to be especially helpful, if slow, for working directly with the bipartite data. <https://cran.r-project.org/package=bipartite/>.

⁸ M. E. J. Newman, "Modularity and Community Structure in Networks," *Proceedings of the National Academy of Sciences* 103, no. 23 (2006): 8577-8582.

⁹ Alexander Brey, "Temporal Network Analysis with R," *The Programming Historian* 7 (2018), <https://doi.org/10.46430/phen0080>.

manuscripts with marginal imagery, or, if possible, on specific occurrences of marginal images attributed to those workshops. While we are exploring options for network-analytic approaches to this question, we also anticipate that historical and art historical research, spurred and focused by the findings of our other two questions, will play a larger part in answering it.

Methodology: Art History

At the outset of our project, conceptualizing our workshop contact network presented a methodological challenge. We initially hypothesized that it would allow us to model aspects of the transmission of artistic ideas in thirteenth- and fourteenth-century France. It soon became clear that these contact manuscripts, which contain the distinguishable contributions of multiple illuminators or workshops, reveal the limits of contact-based, “simple contagion” model of stylistic transfer.¹⁰ Art historical conceptions of “influence” likewise fail to fully capture the phenomena reflected by our networks. The historian of medieval sculpture Kirk Ambrose’s reevaluation of the term within medieval art history provides some intriguing possibilities for network analysis. Ambrose argued that, in the concept of influence put forward by thirteenth-century Italian theologian Thomas Aquinas, “the artist is only one node within a broad network that might encompass myriad causes, from economic to geographic to social.”¹¹ Still, we remain unsatisfied with the lack of agency ascribed to the artist or workshop, even in this more expansive concept of influence. Early in our project we had considered approaching manuscript illuminators and workshops as “communities of style,” in contrast to the “communities of

¹⁰ Damon Centola, *How Behavior Spreads: The Science of Complex Contagions*, (Princeton: Princeton University Press, 2018): 35–37.

¹¹ Kirk Ambrose, “Influence,” *Studies in Iconography*, Special Issue: Medieval Art History Today—Critical Terms, 33 (2012): 198.

practice” that archaeologists and anthropologists have typically emphasized.¹² Because one of our networks is based on iconographic, rather than stylistic, evidence, however, this framework has proven less useful than it initially appeared.

The statistical distribution of theme frequencies suggests another framework for considering marginal images: as a shared visual language that spanned multiple communities in northern Europe. While most studies of marginal images tend to focus on the changing meanings of individual motifs,¹³ the social function of marginal imagery,¹⁴ or the different rhetorical modes through which viewers interpreted marginalia,¹⁵ our quantitative and network-based approach is closer to corpus linguistics or “distant reading.”¹⁶ Scholarship by Lucy Freeman Sandler and Alison Stones, among others, has challenged outdated notions of national styles, and our networks can reveal at a granular level how the polycentric visual cultures of northwestern Europe and their “multiple stylistic tendencies interacted and even contended with each other.”¹⁷

Preliminary Findings

Our findings from the analysis of the workshop contact network revealed a network shaped by regionality, with revealing inter-regional connections. The region of Reims especially emerged

¹² Marian H Feldman, *Communities of Style: Portable Luxury Arts, Identity, and Collective Memory in the Iron Age Levant* (Chicago: University of Chicago Press 2014). For a network analysis project informed by communities of practice, see Diane Harris Cline and Eleni Hasaki, “The Connected World of Potters in Ancient Athens: Collaborations, Connoisseurship, and Social Network Analysis,” *CHS Research Bulletin* 7 (2019), <http://www.chs-fellows.org/2019/03/19/connected-world-of-potters/>.

¹³ Lilian M. C. Randall, “The Snail in Gothic Marginal Warfare,” *Speculum* 37:3 (1962): 358-367.

¹⁴ Michael Camille, *Image on the Edge: The Margins of Medieval Art* (Cambridge, MA: Harvard University Press, 1992).

¹⁵ Lucy Freeman Sandler, “The Study of Marginal Imagery: Past, Present, and Future,” *Studies in Iconography* 18 (1997): 1-49.

¹⁶ Franco Moretti, *Distant Reading* (London: Verso, 2013).

¹⁷ Lucy Freeman Sandler, “Illuminated in the British Isles: French Influence and/or the Englishness of English Art, 1285-1345,” *Gesta* 45:2 (2006): 187.

as an important mediator between trends in Paris and the outlying regions of the north and east. This mediating role allows us to ask new questions about the artistic output of Reims' manuscript workshops, perhaps contextualizing their eclectic blend of styles. Intriguingly, the trends emerging from our analysis of the marginal iconography data seem to tell a different story. After preliminary mapping of the iconographic data, northern France and Flanders appear as the center of a manuscript culture that stretches north to East Anglia, south to Paris, with only a few outlying connections in northern England and southern France.

The different geographies of these networks reflect differences in the history and historiography of marginal imagery relative to illuminated manuscript production more generally. Randall's catalog crossed national boundaries to include manuscripts produced in France, Flanders, and England as a product of economic and cultural exchange across the English Channel.¹⁸ Stones's scope, meanwhile, was limited to modern France. Neither catalog includes the robust manuscript production centers of Germany, for example, where Cologne and the Rhine valley had close links to the productions of Metz and Verdun in modern-day France. Stones called attention to these absences in the introduction to her catalog, addressing the nebulous nature of "France" as a concept in the thirteenth and early fourteenth centuries and highlighting "border regions," particularly to the north and east, as the sites of "dynamic interaction between 'France' and its neighbors, producing stylistic diversity and originality independently of Paris."¹⁹ One ongoing challenge in this project is to consider these networks as shaped not only by historical circumstance, but also by the structures of modern scholarship, particularly the genre expectations of the catalog.

¹⁸ Randall, *Images in the Margins*, 9.

¹⁹ Stones, *Gothic Manuscripts, Part One*, 1:18–19.

Our analysis of the iconographic network is still in its very early stages. Exploratory analysis suggests that temporal proximity alone is not highly correlated with iconographically similar marginalia in a given pair of manuscripts. That is, the choice of specific iconographic motifs is only slightly determined by which combinations of themes are in fashion at any given moment. As the project progresses, we will continue to make exploratory analyses on sample subsets of the data to compare with analyses of the full data set. We will also have to consider gaps in the marginal iconography network, revealed by our ground-truth sample. In light of the pragmatic challenges facing a single scholar producing a functional printed catalog of a prolific and often repetitive artistic phenomenon in the era before internet access to digitized facsimiles, these absences are unsurprising and even unavoidable.²⁰

The next substantial task on the horizon is the analysis of the manuscripts that appear at the intersection of our two networks. We have found that a total of 20 manuscripts appear in both our style-based workshop network (n=102) and our iconographic marginalia network (n=240). This number is smaller than we had hoped for, but it is more than enough for an article-length study.

Project Management Updates

Successes and Challenges

Since the first NA+DAH convening concluded in August 2019, weekly virtual meetings and two in-person research sprints have kept progress on track for the most part. Lillian Randall graciously agreed to allow us to conduct a phone interview with her in August 2019, which

²⁰ Randall explicitly addressed the impossibility of completeness and discussed some of her selection criteria, *Images in the Margins*, 15.

provided valuable insights into the research, writing, and reception of her catalog. We remain incredibly grateful to Drs. Randall and Stones for their generosity with their time and insights, and their support for our pursuit of this project. Jessica Daniel, our undergraduate research assistant, was efficient and highly accurate in her digitization of the Randall data, which she completed just before her graduation from Eastern Connecticut State University in December. Since we both work at primarily undergraduate-serving institutions, it was exciting to be able to include students at this level in part of the research process. In celebrating Jess's graduation, though, we are also seeing how working with undergraduates limits the longevity of any research relationship.

Our paper proposal, "Networked Borders: A Computational Analysis of Images in the Margins of Gothic Manuscripts," was accepted to the International Medieval Congress at Leeds for July 2020 (we now plan to give this paper at the meeting scheduled for July 2021). Although libraries are closed due to the pandemic, both of us have access to essential publications at home. Maeve had secured internal grant funding to attend and present work at IMC-Leeds, which she has repurposed for the purchase of essential reference works.

The challenges we have faced include computational obstacles, methodological stumbling blocks, and the fuzzy data woes familiar to digital humanists. Some of the network analysis algorithms employed by biologists studying small bipartite networks of species are very computationally demanding, taking weeks or months to complete matrix calculations on a reasonably powerful laptop. In general, working with high dimensional, sparse data seems to reproduce many of the same technical challenges as working with natural language processing or

implicit user feedback. Because many aspects of our data follow power laws, rather than normal Gaussian distributions, the assumptions required by common statistical tools are not fulfilled.

Collaboration

Since we have not lived or worked in the same state for several years, we have already developed strong practices for virtual collaboration. We rely on weekly virtual meetings to check in about progress, set goals, and handle project-related correspondence. We could benefit from setting aside monthly or bimonthly meetings for high-level project management discussions, which tend to get subsumed by lower level discussions in our weekly meetings. For major pushes forward in research and writing, we have relied on face-to-face meetings, over a week or long weekend, once or twice a year. These have been extremely valuable, and we are considering ways to hold similar “research and writing sprints” virtually. We are highly motivated by speaking deadlines, so finding ways to present our research in fall will help us both carve out the time for research and writing necessary to complete the article.

Looking Ahead

As we consider moving forward with our project, we have questions for the other NA+DAH teams. What strategies have you found to be effective for explaining network-analysis-based projects to people who hold your career in their hands (colleagues in art history; tenure and promotion committees; funding agencies, etc.)? For those of you producing public-facing tools, how do you see these parts of your projects differing from the equivalent scholarly projects of the past (if any equivalents exist)?