ABSTRACT

Title of dissertation: MODELING THE NETWORK OF DUTCH AND FLEMISH PRINT PRODUCTION, 1550-1750

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The production of artistic prints in the sixteenth- and seventeenth-century Netherlands was an inherently social process. Turning out prints at any reasonable scale depended on the fluid coordination between designers, platecutters, and publishers; roles that, by the sixteenth century, were considered distinguished enough to merit distinct credits engraved on the plates themselves: *invenit*, *fecit*/*sculpsit*, and *excudit*. While any one designer, plate cutter, and publisher could potentially exercise a great deal of influence over the production of a single print, their individual decisions (Whom to select as an engraver? What subjects to create for a print design? What market to sell to?) would have been variously constrained or encouraged by their position in this larger network (Who do they already know? And who, in turn, do their contacts know?)

This dissertation addresses the impact of these constraints and affordances through the novel application of computational social network analysis to major databases of surviving prints from this period. This approach is used to evaluate several questions about trends in early modern print production practices that have not been

satisfactorily addressed by traditional literature based on case studies alone: Did the social capital demanded by print production result in centralized, or distributed production of prints? When, and to what extent, did printmakers and publishers in the Low countries favor international versus domestic collaborators? And were printmakers under the same pressure as painters to specialize in particular artistic genres?

This dissertation ultimately suggests how simple professional incentives endemic to the practice of printmaking may, at large scales, have resulted in quite complex patterns of collaboration and production. The framework of network analysis surfaces the role of certain printmakers who tend to be neglected in aesthetically-focused histories of art. This approach also highlights important issues concerning art historians' balancing of individual influence versus the impact of *longue durée* trends. Finally, this dissertation also raises questions about the current limitations and future possibilities of combining computational methods with cultural heritage datasets in the pursuit of historical research.

MODELING THE NETWORK OF DUTCH AND FLEMISH PRINT PRODUCTION, 1550-1750

by

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Dissertation submitted to the Faculty of the Graduate School of the
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Dedication

To my family, and to Chong.

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I want to thank Arthur Wheelock for his constant guidance during all my time at Maryland. He welcomed this novel dissertation with an open-minded skepticism that not only made this project stronger, but strengthened my own confidence as a scholar. Meredith Gill, Anthony Colantuono, Renée Ater, and Jennifer Golbeck also offered crucial insight and critique as part of my dissertation committee, and I offer my sincere thanks for all the time they devoted to it.

I gratefully acknowledge the Smith Family, without whose funding I would never have been able to develop the premise for this project, much less follow through on it. Their generosity not only funded my graduate fellowship at the University of Maryland, but also established the Michelle Smith Collaboratory for Visual Arts, a physical and intellectual space that afforded me the latitude to explore computation in the study of the art history in a way that could never have happened through traditional graduate seminars alone.

Travel and research grants from the University of Maryland Graduate School, the Office of the President, the College of Arts and Humanities, and the Department of Art History and Archaeology have provided crucial support for this dissertation. External grants from the Kress Foundation, the Getty Foundation, the Association for Computing and the Humanities, and the Alliance of Digital Humanities Organizations also facilitated the development of my research. I would also like to thank the libraries staff at the University of Maryland and the National Gallery of Art for all their assistance. I owe a special thanks as well to Ellen Prokop and the Frick Art Reference

Library for providing me with access to the Montias Database of 17th Century Dutch Art Inventories, which were essential to the fourth chapter of this dissertation.

There is the official dissertation committee that comes with every dissertation, and then there is the shadow committee: those friends and colleagues who don't appear on any paperwork, but who provided ever-present sounding boards for ideas, sources of thoughtful advice, and fonts of moral support. Paul Jaskot has shared his time and intellect freely. I owe him my immense gratitude for all our lengthy, searching, and genial discussions about the future of art history. Members of the Maryland Institute for Technology in the Humanities have also promoted this work unceasingly, and provided helpful advice in this an other endeavors. Among their number, I owe particular thanks to Ed Summers, Neil Fraistat, and Matt Kirschenbaum. I also want to express my special gratitude to Quint Gregory, whose provocative ideas, sage advice, and infectious enthusiasm for all things experimental and untested provided a constant source of encouragement not only for this dissertation, but for all my years at Maryland.

Finally, I owe more thanks than I can say to Qiongyu Huang for tirelessly reading proposals, shooting down bad arguments, and being a continual source of support throughout.

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Introduction

In 1567, the wood block cutter Willem van Parys was put on trial at an Antwerp court for producing, on behalf the publisher Hans van Bauhuysen, a print that was critical of the Spanish Inquisition. Van Parys and Van Bauhuysen were not the only parties summoned; the print's designer, Hans Van Schille, as well as the printer Gilles Coppens van Diest were also to be put on trial. Being the only member of the group to respond to the summons, Van Parys defended himself by turning on his colleagues. He argued that he did not even know the nature of the blocks he was cutting. The designs, according to Van Parys, were always partial sections of an image; no sooner would he return one completed wood block to Van Bauhuysen, than the publisher would send new partial designs for him to cut. In other words, his labor was so compartmentalized from that of the designer, printer, and publisher, that he could not be held responsible for the offending prints.[1]

This anecdote is a striking reminder that many prints in the sixteenth and seventeenth centuries were produced within an interconnected and highly professionalized system. If this was not always a system of intimate collaboration, it was, at least, one of interdependence. Johannes Stradanus' 1588 image of a copperplate printing shop underlines the diverse types of specialized labor required to produce artistic prints and

1. Guido Marnef, "Repressie en censuur in het Antwerps boekbedrijf," *De zeventiende eeuw* 8 (1992): 222, 228; Jan van der Stock, *Printing Images in Antwerp: The Introduction of Printmaking in a City: Fifteenth Century to 1585*, Studies in Prints and Printmaking 2 (Rotterdam: Sound & Vision Interactive, 1998), 143–144.

illustrations.[2] (Figure 1) Turning out prints at any reasonable scale depended on the fluid coordination between designers, platecutters, and publishers. By the sixteenth century, these roles were considered distinguished enough to merit distinct credits engraved on the plates themselves: *invenit*, *fecit/sculpsit*, and *excudit*. It is the long-term evolution of these patterns of coordination between 1550 and 1750, and the motivators for that evolution, that comprise the subject of this dissertation.

Figure 1: Jan Collaert I after Johannes Stradanus, "The Invention of Copperplate Engraving", in *Nova reperta*, published by Philips Galle, c. 1600. Engraving, 27 x 20 cm. The Metropolitan Museum of Art, The Elisha Whittelsey Collection, The Elisha Whittelsey Fund, 1949.

2. For detail on the specific printmaking equipment and actions Stradanus depicts here, see Ad Stijnman, "Stradanus' Print Shop," *Print Quarterly* 27, no. 1 (2010): 11–28.

Research on the long-neglected logistics of print publication and distribution in the early modern Low Countries has blossomed over the past two decades, a flourishing that Ger Luijten outlined in a 2011 review of trends in the study of printmaking in the Low Countries.[3] Luijten concluded this same review with a brief gesture to the vast digitization efforts by two premier print collecting institutions: the British Museum in London and the Rijksmuseum in Amsterdam.[4] He remarked that these new digital resources had the potential to revolutionize print research, if only researchers could devise inventive methods for using them. Though Luijten did not explicitly connect these two trends, this dissertation will demonstrate that the recent surge in digitization of prints (both photographic images as well as their contextual information, or "metadata") enables new, macro-scale perspectives on these structures of print production.

These advances may help address the persistent challenge that *scale* presents to authors of artistic print history. Like many museums, the vast majority of the British Museum's artistic holdings (counted object for object) are prints. (Figure 2) This illustrates the difficulty that scholars face when attempting to make overarching conclusions about the printmaking industry. How can one author hope to cogently synthesize this wealth of evidence? In the face of this wealth of objects, scholarship on artistic prints has generally followed one of two general tracks:

1. *Catalogue raisonné* projects such as the *Hollstein* and *New Hollstein* series, which index individual printmakers' oeuvres in relative isolation.

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3. Ger Luijten, "Où en sommes-nous? L'évolution des questions d'étude sur l'estampe néerlandaise," trans. Raoul Mendegarque, *Perspective: actualité en histoire de l'art*, no. 2 (December 31, 2011): 793–795, https://perspective.revues.org/785.

4. Ibid., 796–797.

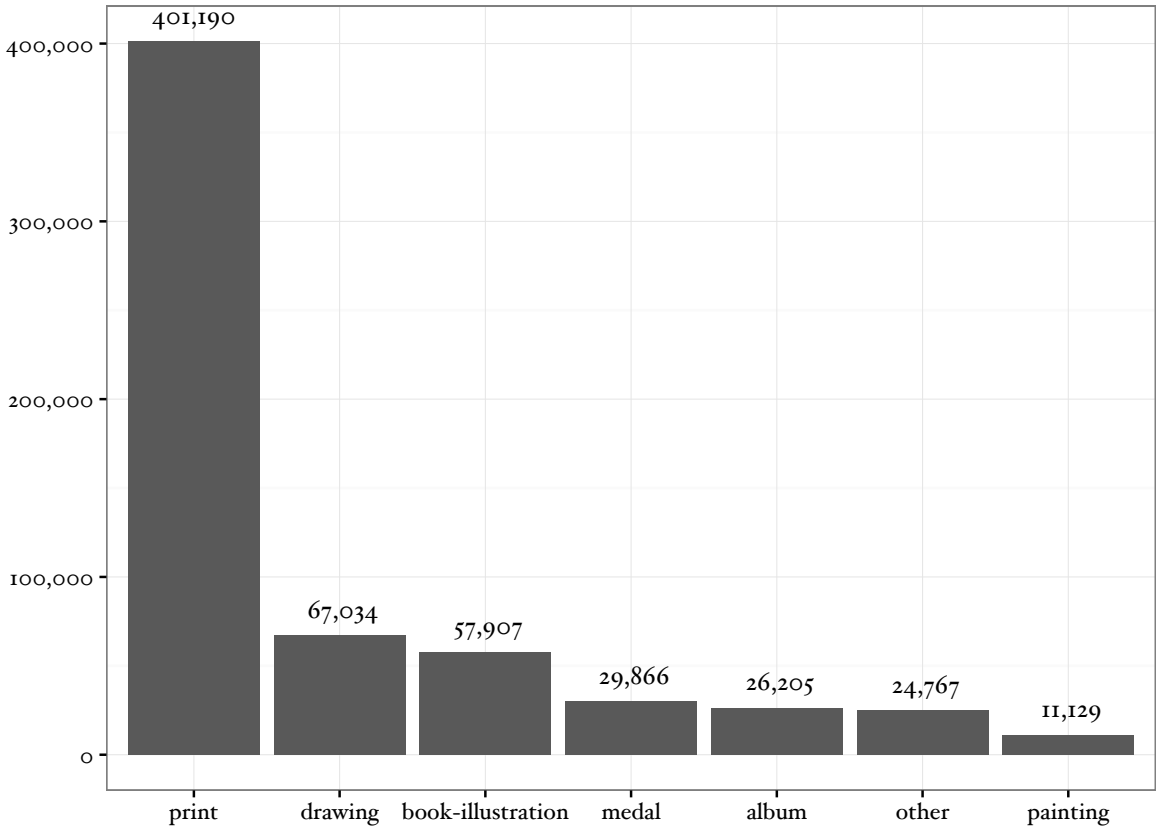

Figure 2: Counts of artworks in the British Museum, by type.

2. Synthetic narratives (frequently in the form of exhibitions; more rarely as full scholarly monographs) that use case studies to build larger claims about the history of prints.[5]

The enormous number of surviving prints inhibit traditional methods of art historical scholarship that would result in products of the second, synthetic type, instead encouraging print scholars to focus on cataloguing projects. Quantitative, computer-assisted approaches may offer new paths forward by harnessing these indices. These particular large-scale resources and computational methods are novel to the study of printmaking, and have only rarely been used in the study of art history in general.[6]

"More", of course, does not necessarily mean "better". That is why I would underline the fact that large-scale evidence can support research that is different in *kind*, not just in degree.[7] What types of research become feasible when we can incorporate evidence concerning thousands of artists, rather than the dozen or less that might be considered in a traditional scholarly monograph or exhibition? Is it possible to break out of the traditional tracks of print scholarship that choose between individual catalogues or case-study-driven argumentation? Can we create a *longue durée* history of printmaking in this period that enhances the usual search for single key artists and significant historical events?

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5. Examples of this literature are discussed in section 1.4.

6. There are some important exceptions to this claim. On early precursors to data-driven art history or digital art history *avant la lettre*, see section 1.3; also see my contribution in Johanna Drucker et al., "Digital Art History: The American Scene," *Perspective: actualité en histoire de l'art*, no. 2 (December 5, 2015), http://perspective.revues.org/6021.

7. These debates have recently been foregrounded in the context of computationally-aided literary study, such as in the conference *Scale and Value: New and Digital Approaches to Literary History* held at the University of Chicago, May 15–16, 2015 (http://scaleandvalue.tumblr.com).

These approaches touch on longstanding debates about the most appropriate scale for the writing of history.[8] Jan De Vries, an historian of the sixteenth- and seventeenth-century Netherlands, articulated these debates within an art historical context in a 1991 essay for the Getty volume *Art in History/History in Art*.[9] De Vries contrasts art historians' preference for micro-histories and a focus on the close analysis of individual objects, against the mid-century "New History" typified by Fernand Braudel's focus on the *longue durée*. Braudel and the *Annales* school of French historians famously advocated for a history focused on the slow-moving forces of geography and demographics that operate below or beneath the short-term history (or *histoire événementielle*) of single individuals and political events.[10] While this historical model might appear antithetical to a history of art, De Vries argued that such long-scale forces as demographics, or even physical terrain, *must* be considered when dealing with a subject that is so affected by the forces of economics and the market.[11]

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8. Jo Guldi and David Armitage, *The History Manifesto* (Cambridge, United Kingdom: Cambridge University Press, 2014) argue that recent historians have begun to focus too closely on micro-histories and short time spans, and ought to return to a focus on *longue durée* history in order to reclaim their declining influence on policy. Though their normative observations have been challenged (e.g. Deborah Cohen and Peter Mandler, "*The History Manifesto*: A Critique," *The American Historical Review* 120, no. 2 (April 2015): 530–542, doi:10.1093/ahr/120.2.530), more relevant to this dissertation is the argument by Guldi and Armitage that the availability of computationally-tractable sources and methods for analyzing them must be connected to the work of the *Annales* school.

9. Jan De Vries, "Art History," in *Art in History, History in Art: Studies in Seventeenth-Century Dutch Culture*, ed. David Freedberg and Jan De Vries (Santa Monica: Getty Center for the History of Art & The Humanities, 1991), 249–271.

10. Fernand Braudel, "Histoire et Sciences sociales: La longue durée," *Annales. Histoire, Sciences sociales* 13, no. 4 (Fall 1958): 725–753; translated to English in Fernand Braudel, "History and the Social Sciences: The *Longue Durée*," in *The* Longue Durée *and World Systems Analysis*, ed. Richard E. Lee, trans. Immanuel Wallerstein (Albany: State University of New York Press, 2012), 241–276; see Peter Burke, *The French Historical Revolution: The Annales School, 1929-89* (Stanford: Stanford University Press, 1990), especially chap. 3, for an overview of the *Annales* school, its precursors, and its successors.

11. More recent writers have also revisited how an *Annales*-like focus on geography may affect how we write the history of art, including Thomas DaCosta Kaufmann, *Toward a Geography of Art* (Chicago: University of Chicago Press, 2004); Elisabeth de Bièvre, *Dutch Art and Urban Cultures, 1200-1700* (New Haven: Yale University Press, 2015).

In the case of prints, it is the gradual spread of printmaking — not just mere knowledge of its existence, which may spread quickly, but the slow establishment of production capability at a regional or national scale — that ought to inform our histories of printmaking. Returning to the print by Stradanus shown at the start of this introduction will help make this point clear. (Figure 1) The print belongs to Stradanus' *Nova reperta*, or illustrations of "new inventions" that had been unknown to the ancients.[12] While lists of modern inventions had been a subject of discussion even for fifteenth-century humanists, Stradanus' series is the first known visual treatment of this topic, and is distinguished by including artistic inventions like engraving and oil painting.[13] Stradanus highlights the multiplicative aspect of engraving by including an array of drying prints hung in the rear of the studio. He also depicts young students learning from an older, bespectacled engraver how to handle the difficult burin.

This inclusion is significant. Just as prints could serve as vessels for spreading both artistic and scientific knowledge through easily-traded multiples, printmaking itself was itself a new technology that spread across Europe at the speed of an experienced master teaching his apprentices.[14] Like all technologies, printmaking was thus only

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12. Further bibliography on this series can be found in Susan Dackerman, ed., *Prints and the Pursuit of Knowledge in Early Modern Europe* (Cambridge: Harvard Art Museums, 2011), cat. 1.

13. Alex Keller, "A Renaissance Humanist Looks at 'New' Inventions: The Article 'Horologium' in Giovanni Tortelli's *De Orthographia*," *Technology and Culture* 11, no. 3 (July 1970): 345–365.

14. This approach to thinking about the transmission of innovations has been termed *diffusionism*. As articulated by Everett Rogers, diffusionism frames cultural change as the result of a process whereby a new tool, be it a mechanical technology or technique, or a cultural tool such as a visual style or literary construct, spreads into a community; Everett M. Rogers, *Diffusion of Innovations* (New York: Free Press, 1983). When overextended, diffusionism has come under critique for promulgating a Eurocentric view of the world that situated major technological innovations like agriculture solely in the European continent, with all other regions being passive receptors; see in particular James M. Blaut, *The Colonizer's Model of the World: Geographical Diffusionism and Eurocentric History* (New York: Guilford Press, 1993). While acknowledging the problematic applications of diffusionism in prior geographic and anthropological research, it can still provide a useful model for explaining artistic changes, and has been tacitly adopted by many art historians; for an overview, see Kaufmann, *Toward a Geography of Art*, 187–189.

adopted gradually, often with many years between its early appearance in a given region (e.g. Lucas van Leyden's late-fifteenth-century engravings in the northern Netherlands) and its fullest flourishing (e.g. mid-seventeenth-century Amsterdam as *le magasin de l'univers*).[15] How this dissemination affected the social structure of print production, and how this changing structure may have affected the experience of individual artists, guides the questions that this dissertation will take up.

Chapter Plan

Chapter one addresses the divide between art historian's colloquial understanding of the term "network", and that which is used in computational network analysis. Networks as a concept would seem to be familiar to art historians, whether in the study of artistic dynasties, the transmission of styles from one community to another, or in the history of patronage, collecting, and the art market. However, computational approaches to networks require strict and precise definitions of the borders of a network, the identities of its participants (called nodes), and the connections (called edges) that tie them together. This chapter will outline these differences, providing an historiography of computational network analysis in the humanistic disciplines, including art history, and explaining how a network approach is particularly fitting for the study of prints from this period.

In chapter two, I focus on the question of printmaking professionalization and its effect on the relative centralization of print production in the Low Countries in this period. David Landau and Peter Parshall in *The Renaissance Print*, and Timothy Riggs and Larry Silver in *Graven Images*, have both posited that the skills demanded by intaglio printmaking, and the benefits of production at scale, incentivized the dominance of a

15. On this term, see the eponymous edited volume: Christiane Berkvens-Stevelinck, ed., Le magasin de l'univers*: The Dutch Republic as the Centre of the European Book Trade* (Leiden: Brill, 1992).

handful of large sixteenth-century print publishers like Hieronymus Cock who could virtually monopolize all aspects of artistic print production in a region. However, neither of these studies examine if the continuing rise in popularity of printmaking in the *seventeenth* century would continue to be sustained by a few major houses. Would the technical and logistical demands of engraving in particular prevent smaller houses from gaining a foothold in a mature market? Or would a growing availability of engraving talent in a burgeoning economy allow a more decentralized network of printmakers and publishers? And how did individual artists react to these changing dynamics?

Dutch and Flemish printmaking did not occur in isolation from the rest of Europe. Chapter three takes up the analysis of print production that occurred between artists across regional and international boundaries. By dint of their light weight and small size, print designs, print plates, and print impressions could be easily shipped across Europe. At what points between 1550 and 1750 did Dutch and Flemish artists, printmakers, and publishers tend to work with collaborators within their own borders, versus internationally? Were these changes due to specific historical events, or were they the result of long-term changes in population and printmaking capacity? And how varied were *individuals'* strategies when it came to domestic and international collaboration? When did individual artists, printmakers, or publishers distinguish themselves by working predominantly with international or local collaborators?

Finally, chapter four will attend to the issue of genre specialization and diversity in printmaking. Growing numbers of Dutch and Flemish painters began to specialize in certain genres (e.g. still life, landscape, portraiture) around the turn of the seventeenth century. Painters did so, in part, due to an economic incentive to stand out in an increasingly crowded market. But did the same pattern hold true for printmakers, or for print publishers? Current case studies offer conflicting evidence. In this chapter, I

will apply a common measure of information diversity (applied to questions as diverse as measuring ecological diversity, industrial specialization, and racial segregation) to chart the change in artist oeuvre diversity over time. I will first demonstrate the effectiveness of the metric for capturing painters' increasing specialization, before using the method to gauge the same trend among printmakers. The results are significant for understanding certain economic incentives that distinguished the output of professional versus amateur printmakers. But the story goes beyond simple market forces. I will also suggest how period understandings of the function of prints, and the ideal model of what a printmaker should be able to do, ultimately shaped how printmakers defined themselves within in a competitive field.

Throughout this dissertation, I will argue that macro-scale analysis of these artistic production networks is necessary to understand printmaking in this period. But such analysis is not, on its own, sufficient. To paraphrase Braudel, networks explain much, but they do not explain all. Individual artists also had a say in the matter. For this reason, each analytical chapter will include selected case studies alongside each macro-scale analysis. These studies are not intended to be comprehensive, but rather to serve as tangible examples that connect macro-scale quantitative analyses to the experiences of individual artists. By doing so, I hope to illustrate how artists may have reacted to these larger trends, and to highlight exceptional individuals who did not adhere to the crowd.

While some of these case studies will spotlight well-known names in printmaking history, such as Aegidius Sadeler or Hendrick Goltzius, they will also feature lesser-known artists like Cornelis Bloemaert and Jonas Suyderhoef who have been overlooked by conventional histories and exhibitions that focus on creative aesthetic achievement. We will find that these unsung artists actually had central or exceptional roles in the world of print production, at least when viewed through the lens of these novel

quantitative analyses. As a consequence of this selectivity, some common landmarks of Dutch printmaking such as Hercules Segers or Rembrandt van Rijn will not feature prominently in the following chapters. This is not because they do not fit into this method of analysis, but because, at least from this particular perspective, they are often less prominent than unacclaimed figures like Suyderhoef and Bloemaert. Far from rejecting or replacing a "conventional" focus on aesthetics and artistry, I seek to raise up a concurrent history of long-term trends and long-running incentives that shaped the medium and the market though which printmakers channeled their creativity. This history may, at times, feature different players than we may be used to.

"Modeling" History

Before addressing any of these questions, however, it is crucial to underline exactly what the subjects of this study will be, and what they will not; why this dissertation claims to "model" print production networks, rather than, say, chart a "history" of them. To paraphrase Christopher Warren's description of the *Six Degrees of Francis Bacon* project, what this study claims to offer is not a portrait of *the singular* print production network as it existed historically, but rather an understanding of what kinds of networks and practices *could have* produced the artworks that we know today.[16] This is, of course, no different than the products of any art historical study, computationally-aided or not. We always use surviving artworks and archival evidence as proxies for historical events, and while we may express some claims with greater certainty than others, our histories are inevitably representations of the past. However, it is particularly important to keep this epistemic distance in mind when confronted with tables, charts, and other quantitative results.

16. Christopher Warren et al., "Six Degrees of Francis Bacon," September 13, 2015, http : / / sixdegreesoffrancisbacon.com/.

The material evidence that will be used to infer these production networks is affected by historical filters. This necessarily limits the scope of the claims I will be able to make. This dissertation will focus on the production of what seventeenth-century Dutch publishers termed *constprenten*: fine art prints, generally issued as single sheets or in series.[17] This is, in large part, due to the focus of the two museum databases from the Rijksmuseum and the British Museum that I will be using for these analyses.[18] Both these museums' print collections were built based on nineteenth- and twentieth-century acquisition practices that tended to prefer single sheets or series to the collection of books that happened to contain intaglio illustrations.[19] Unless cut from their original volumes and collected separately, illustrations bound within books were (and are) far more likely to have been left to libraries to collect.

From the viewpoint of sixteenth- and seventeenth-century production, this is an arbitrary distinction, as the same engravers frequently produced both standalone *constprenten* as well as book illustrations. Many engraved book illustrations are also present in these collections, so book illustrations can hardly be said to be missing from this account.[20] However, book illustrations are likely *undercounted* compared to art

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17. On the usage of the term *constprenten* in print publisher inventories, see section 4.1.

18. See section 2.2 for more detail on these two databases.

19. For a history of the British Museum's print collections in particular, see David M. Wilson, *The British Museum: A History* (London: British Museum Press, 2002), 62–63, 109–111.

20. Often engravers of book illustrations, such as the Wierixes and Sadelers, also created independent fine art prints. Likewise, engravers like Hendrick Goltzius who are primarily known for their standalone sheets also periodically pursued book illustration projects. In 1586 the Antwerp book publisher Christoph Plantin approached Goltzius with a commission for more than one hundred and fifty engravings for an edition of the *Natalis Bible* to be published in Rome by the Jesuit order, although the commission eventually went to others; see Huigen Leeflang, *Hendrick Goltzius 1558-1617: Drawings, Prints, and Paintings* (Amsterdam: Rijksmuseum, 2003), 38. Goltzius would later produce fifty-two illustrations to accompany Ovid's *Metamorphoses*, though he had planned a full suite of at least three hundred plates; see Eric Jan Sluijter, "'Herscheppingen' in prenten van Hendrick Goltzius en zijn kring (I)," *Delineavit et Sculpsit*, no. 4 (December 1990): 1–23; Eric Jan Sluijter, "'Herscheppingen' in prenten van Hendrick Goltzius en zijn kring (II)," *Delineavit et Sculpsit*, no. 5 (May 1991): 1–19.

prints, so the effects of book illustration on the networks discussed here will be muted. This dissertation will also, unfortunately, have little to say about the lowest end of the printmaking market. This is, again, due to historical collecting and preservation practices. Early evidence of print collecting in the sixteenth century suggests how artistic prints were more carefully preserved than workmanlike printed images such as playing cards, calendars, or cheap devotional images that were damaged or destroyed through use. What copies survived were then largely ignored by early print collectors.[21] These present limitations may be addressed by future work in building and uniting databases from other museums, libraries, and archives.[22]

I will also be examining just one group of professional relationships among the many that may have informed and constrained individual artists. A useful metaphor may be the X-ray image of a painting.[23] Like an X-ray image, network analysis flattens and simplifies our subject. Alone, it offers only a single, restricted channel of information. But when interpreted properly in the context of other sources of information, X-ray images can provide previously-inaccessible insights into an artist's process. The set of connections inferred from these prints exists in parallel with a wealth of other contemporary networks — familial, financial, political, religious — that lie outside the scope of this dissertation. Although these different domains could interact in complex ways, it can nevertheless be useful to isolate one restricted facet of this

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The logistical demands of book illustration were similar in kind, though often magnified in degree; for example, see the discussion of Plantin's struggles in section 2.1. The Luyken family of book illustrators will also be discussed in section 4.4.2.

21. Van der Stock, *Printing Images in Antwerp*, 179–180.

22. See the conclusion (page 200) for discussion of future directions for this research.

23. After arriving at this metaphor with the aid of Arthur Wheelock, I discovered that Franco Moretti also independently invoked it in Franco Moretti, "Network Theory, Plot Analysis," *Pamphlets of the Stanford Literary Lab*, no. 2 (May 1, 2011): 4. http://litlab.stanford.edu/?page_id=255.

general social network at a time for close examination, as each facet may have its own history of structural change.[24] For example, even if the print production network in the Netherlands was highly decentralized in 1650, it is entirely possible that correspondence networks, or religious affiliations, were becoming more centralized at this time. To unite all these domains into the same network model could potentially return meaningless results, with the mutations of one layer of relationships masking those of another layer. While it is limiting to concentrate on just one class of interactions, this self-limitation also provides focus. Understanding this restricted group of professional connections will provide a basis of comparison for future network models of other domains like artistic studios, or family networks.

It is because of this self-conscious simplification and abstraction that I speak of "modeling" print production networks. The term model is frequently used in the sciences to refer to a simplified description of an observable phenomenon. We have direct interactions with models every day, perhaps most obviously in the form of the weather forecast: meteorologists have developed complex mathematical formulae based on past observations; with new observations, the formulae return predictions for future events. Such formulae are aptly called models because they encode assertions about how the world works (e.g., that a drop in pressure of n units increases the chance of precipitation by X percent.)

Because these models often take a mathematical form, and are most visibly applied to making predictions, one may wonder why they could be relevant to historical work. However Willard McCarty argues that humanistic scholars dealing in qualitative interpretations engage in model building, too, writing that, "traditional [humanistic]

24. Christina Prell, *Social Network Analysis: History, Theory and Methodology* (Los Angeles: Sage, October 26, 2011), 66–67. Understanding how coexisting networks interact with each other is an active question in network theory; for a very recent overview problems in multilayer networks, see Ginestra Bianconi, "Interdisciplinary and Physics Challenges of Network Theory," September 1, 2015, http://arxiv.org/abs/1509.00345.

scholarship typically approaches the transcendence of artifacts by classification and categorization, then by studying how the individual work inflects or even violates the categories to which it has been assigned."[25] Joshua Epstein has likewise pointed out that modeling is a common tool used by anyone who ventures a guiding structure or phenomenon to explain observed facts — something that humanities scholars do all the time, albeit usually implicitly, rather than explicitly.[26]

Data-driven, computational analysis and modeling can improve our histories in two ways. Firstly, it can introduce new perspectives through a larger scale of evidence. These widened perspectives are crucial to better *describing* the existing evidence of what happened in the past. After all, it is difficult to proffer explanations for a phenomenon whose effects we have not adequately comprehended.

Secondly, computing allows us to more quickly evaluate our historical explanations for *why* such evidence exists today. Reconstructing such a story from fragmentary evidence is tempting for art historians. We are trained, perhaps all too well, to derive explanatory theories from the slightest of material clues. An yet, a theory explaining why the past unfolded in the way that it did is, by itself, merely a "just-so" story.[27] Comparing the attributes of the networks constructed from evidence in the British Museum and Rijksmuseum to those patterns found in other networks of the same size and shape can help us begin to sort out the differences between the effects of

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25. Willard McCarty, "Being Reborn: The Humanities, Computing and Styles of Scientific Reasoning," in *New Technologies and Renaissance Studies*, ed. William Roy Bowen and Raymond George Siemens (Tempe: Iter in collaboration with ACMRS (Arizona Center for Medieval & Renaissance Studies), 2007).

26. Joshua M. Epstein, "Why Model?," *Journal of Artificial Societies and Social Simulation* 11, no. 4 (2008): 1.2, http://jasss.soc.surrey.ac.uk/11/4/12.html; also see Patrick Grim, "Computational Modeling as a Philosophical Methodology," in *The Blackwell Guide to the Philosophy of Computing and Information*, ed. Luciano Floridi (Malden: Blackwell, 2004), 337–349.

27. This is all the more true when interpreting historical networks; see Shawn Graham and Scott B. Weingart, "The Equifinality of Archaeological Networks: An Agent-Based Exploratory Lab Approach," *Journal of Archaeological Method and Theory*, December 28, 2014, 1–27, doi:10.1007/s10816-014-9230-y.

exceptional historical events and individuals on print production (that is, the effects of an *histoire événementielle*) versus the effects of *longue durée* trends in the slow spread of printmaking capacity throughout Europe.

1 Networks in Art History and Beyond: A Methodological Background

Scholars of literature and history have begun to adopt computational approaches to analyzing networks over the last decade.[1] In part, this surge has been enabled by a proliferation of network analysis software suites with relatively easy-to-use graphical interfaces. Another driver is, admittedly, the prime position of both "networks" and "data" in the zeitgeist. Popular attention is now devoted not only to the use of internet-enabled social media, but also to the way in which analysts empowered with large-scale computing resources controlled by the likes of Facebook and Google, can claim the ability to discern large-scale social structures from the traces of all these digital interactions. In light of the rapidly growing list of libraries, archives, and museums that have made available digitized troves of documents and other historical information, it seems only natural to apply the same computational tools to sift these cultural data in the search for historical insights.

The rhetoric of networks holds a particular attraction for art historians. After all, we like to think that we are accustomed to studying the multilayered web of interactions between artists and patrons, collectors and dealers, exhibitions and institutions, and periods and styles. Network analysis would appear to offer a novel way to take advantage of accumulated troves of primary and secondary art historical sources and

1. These approaches are an outgrowth of renewed interest in the application of computational approaches to humanistic inquiry in the last decade; for example, see Susan Schreibman, Ray Siemens, and John Unsworth, eds., *Companion to Digital Humanities*, Blackwell Companions to Literature and Culture (Oxford: Blackwell Publishing Professional, 2004), http : / / www . digitalhumanities . org / companion/; Willard McCarty, *Humanities Computing* (Basingstoke: Palgrave Macmillan, 2005).

mine them for hidden structures that can advance our understanding of these histories. However, to do so demands that we adapt analytical frameworks developed in one group of disciplines and reapply them to our own.[2] In doing so, we must grapple with guidelines for expressing assumptions, formulating hypotheses, and gathering and testing evidence, that are expressed in a language of network theory and sociology that can seem alien, if not inimical, to our own. There are wide gaps to be bridged between the informal or colloquial understandings of networks as they have used in earlier art historical literature, and the requirements and outputs of computational network analysis.

Has network analysis proved useful in literary or historical studies? How do these quantitative methods fit into the larger historiography of art history, specifically? And how can art historians productively adopt a more formalized approach to thinking about networks? These are the core questions I will address in this chapter, in order to build a methodological foundation for the analytical chapters that follow. I will first briefly chart how this study draws from network analyses in related humanistic disciplines. I will then explore how these computational approaches diverge from earlier uses of "network" rhetoric in the art historical literature. My aim is to highlight the issues that arise as we attempt to map the results of formalized analysis to the types of art historical knowledge we are accustomed to producing, outlining both the affordances as well as the restrictions of this approach.

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2. These issues are explored further in Willard McCarty, "Becoming Interdisciplinary," in *Proceedings of Digital Humanities 2013* (Lincoln: University of Nebraska, July 17, 2013), http://dh2013.unl.edu/abstracts/ab-107.html.

1.1 Network Analysis in the Humanities

Network analysis is a systematic approach to studying the structures, or networks, that emerge from the interactions of individuals.[3] This approach is grounded in the proposition that analyzing the patterns of relations between actors, whether they are people, business firms, biological proteins, or computer circuits, can be just as important as analyzing the individual attributes of those actors.[4] By formalizing data about these relations in a mathematical, and thus computable, model, we can begin to describe and measure patterns of interaction in ways that are difficult or impossible to do manually. Originating in theoretical mathematics and computer science, network analysis was soon adapted by social scientists as a way to bring statistical rigor to models of social interaction.[5] Today, network science comprises a theoretical discipline in its own right that enjoys widespread application in sociology, political science, business management, engineering, computer and information science, neurology, and epidemiology.

When applied to historical subjects, network analysis can recast the way we describe the behaviors of individuals and groups, and alter the narratives we use to explain historical events.[6] Over the past few decades, historians have begun to evaluate earlier,

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3. In network analysis, the terms "network" and "graph" are often used interchangeably when referring to an instance of a formalized network. The term graph is often used in particular to refer to a visualization *of* a network. For the sake of consistency, this text will use the term network, however note that some citations use the term graph instead.

4. Robert A. Hanneman and Mark Riddle, *Introduction to Social Network Methods* (Riverside: Univeristy of California, Riverside, 2005), 15, http://faculty.ucr.edu/~hanneman/nettext/.

5. For a concise historiography of social network analysis, see Prell, *Social Network Analysis*, ch. 2.

6. Hanneman and Riddle, *Introduction to Social Network Methods*, 45–50.

loosely-defined conceptions of networks against mathematical network models constructed from historic records.[7] A landmark example is John Padgett and Christopher Ansell's analysis of the Cosimo de' Medici's social and economic network-formation strategy in Renaissance Florence.[8] The authors amassed a database of various types of ties formed and maintained by the Medici family, including marriages, friendships, political patronage, and creditor/debtor ties. Computationally-aided analysis of this dataset revealed a previously unrecognized pattern: instead of making all possible types of links to the competing family groups of Florence, the Medici carefully segregated their connections. Families linked to the Medici by marriage, for example, were not offered economic ties such as personal loans.[9] This strategy produced a group of marriage-related families that was distinct from a group of business-related families. As a result, any family in one relationship group, or "block", attempting to establish ties with a family in another block would find the Medici family to be a necessary broker of introductions. The Medici were thus able to establish themselves as gatekeepers mediating the interactions between Florentine families in these separate economic, political, or marriage clusters. By segregating their social links strategically, the Medici were able to stake out a central, and thus influential, position in the Florentine society. Padgett and Ansell conclude that Cosimo's careful connection strategy allowed his family to splinter the Florentine oligarchs, who could otherwise have united against

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7. For an historiography of historical social network analysis, see Charles Wetherell, "Historical Social Network Analysis," *International Review of Social History* 43, Supplement S6 (December 1998): 125–144, doi:10.1017/S0020859000115123; Claire Lemercier, "Formal Network Methods in History: Why and How?," in *Social Networks, Political Institutions, and Rural Societies*, ed. Georg Fertig (Turnhout: Brepols, 2011), https://halshs.archives-ouvertes.fr/halshs-00521527.

8. John F. Padgett and Christopher K. Ansell, "Robust Action and the Rise of the Medici, 1400-1434," *American Journal of Sociology* 98, no. 6 (May 1993):

9. Ibid., 1285.

the upstart Medici.[10] Their paper offers an ideal example of the possibilities of network analysis:

1. Formulating a hypothesis that can be evaluated with network metrics (that the Medici established relationships strategically to contain the political power of competing family groups)
2. Discrete selection of sources with systematically-described attributes (here: Florentine banking and marriage records)
3. Constructing a computable network from these sources, and then comparing the results of various network analysis techniques in order to evaluate the initial hypothesis.

The archival documents that Padgett and Ansell used to construct their historical network representation are a common source of evidence for building explicitly-derived networks, where links are built based on the direct evidence provided by a document. Correspondence networks are another type of explicit network, where links are made between individuals based on surviving letters between them.[11] Physical evidence is also a potential source for constructing historical networks. Archaeologists are increasingly using network analysis to infer community structures and patterns of evolution from the surviving material record.[12] In his 2011 book *An Archaeology of Interaction: Network Perspectives on Material Culture and Society*, Carl Knappett argued that network analysis could produce new archaeological knowledge at multiple scales:

10. Padgett and Ansell, "Robust Action," 1309.

11. See, for example: Ruth Ahnert and Sebastian E. Ahnert, "Protestant Letter Networks in the Reign of Mary I: A Quantitative Approach," *English Literary History* 82, no. 1 (2015): 1–33, doi:10.1353/elh.2015.0000.

12. One forerunner to this recent wave of complexity and network theory in an archaeological context can be found in R. Alexander Bentley and Herbert D. G. Maschner, eds., *Complex systems and archaeology*, Foundations of Archaeological Inquiry (Salt Lake City: University of Utah Press, 2003).

the micro-scale (reconstructing the links of pottery production within a single complex in Bronze Age Crete), the meso-scale (relationships between pottery production sites across the island), and the macro-scale (the growth of regional trade across the Aegean).[13] At the macro-scale in particular, Knappett rejects the assumption that geography was the sole determinant of trade patterns and centers in the Bronze Age Aegean. He instead suggests that phenomena found in many types of networks, such as path-dependency (the tendency for certain routes between nodes to become inscribed over time, even in the face of newer, more efficient paths) and "small-world" patterns of connection (the ability of just a handful of ties between distant nodes to sharply increase the overall connectivity of the network) may have guided trade history in this region even more than spatial relationships.[14] More recent archaeological scholarship has begun to build on Knappett's conceptual structure with computationally-aided network analysis based on empirical data.[15]

Network analysis has also been taken up in literary studies, particularly research in to the history of literary production and dissemination. Research has included looking at how authors were associated with each other by publishing houses, discerning the communities that emerge from the reviewing practices of literary journals, and the

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13. Carl Knappett, *An Archaeology of Interaction: Network Perspectives on Material Culture and Society* (Oxford: Oxford University Press, 2011).

14. Knappett, *An Archaeology of Interaction*, 134–135; on small-world networks, see Duncan J. Watts, *Small Worlds: The Dynamics of Networks Between Order and Randomness* (Princeton: Princeton University Press, 1999).

15. Other prominent examples include Fiona Coward, "Grounding the Net: Social Networks, Material Culture and Geography in the Epipalaeolithic and Early Neolithic of the Near East (21,00-6,00 cal BCE)," in *Network Analysis in Archaeology: New Approaches to Regional Interaction*, ed. Carl Knappett (Oxford: Oxford University Press, April 25, 2013), 247–280; Emma Blake, *Social Networks and Regional Identity in Bronze Age Italy* (New York: Cambridge University Press, 2014). A full accounting of the use of network analysis in archaeology is well outside the scope of this dissertation; for a recent overview of such work, see Anna Collar et al., "Networks in Archaeology: Phenomena, Abstraction, Representation," *Journal of Archaeological Method and Theory* 22, no. 1 (March 2015): 1–32, doi:10.1007/s10816-014-9235-6.

networks of text republication and copying in antebellum U.S. newspapers.[16] Literary network studies need not be rooted strictly in the facts of historical production; network analysis has also been applied to questions of literary narrative, character development, and descriptive imagery.

One compelling example is the work of Stiller et al., who proposed to test the Aristotelian understanding that effective drama mirrors real human behavior.[17] Do the social networks in Shakespeare's plays, they asked, have similar properties to those found in a wide range of social network observed in the real world? The authors constructed social networks for every play, connecting characters when they appeared in the same scene. They observed that most of Shakespeare's plays exhibit so-called "small-world" characteristics found in many social networks in reality: they contained multiple tight clusters, but also a few inter-cluster links that reduced the overall distance between any two characters in the network. They proposed that, by following the general boundaries of real-world social interactions, Shakespeare made his complex plots intelligible to his audiences. Outliers to these patterns appear to prove the rule: *Richard III* has a large number of minor characters that constitute a more fragmented social network than those usually observed in the real world. In

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16. On publishing networks, see Hoyt Long, "Fog and Steel: Mapping Communities of Literary Translation in an Information Age," *The Journal of Japanese Studies* 41, no. 2 (2015): 281–316, https://muse.jhu.edu/journals/journal_of_japanese_studies/v041/41.2.long.html; Gisèle Sapiro, "Translation and Symbolic Capital in the Era of Globalization: French Literature in the United States," *Cultural Sociology* 9, no. 3 (September 1, 2015): 320–346, doi:10.1177/1749975515584080; Andrew Goldstone, "Doing Without Texts: Sapiro on Translation," Andrew Goldstone, August 23, 2015, http://andrewgoldstone.com/blog/2015/08/23/sapiro/; on reviewers see Richard Jean So and Hoyt Long, "Network Analysis and the Sociology of Modernism," *boundary 2* 40, no. 2 (June 20, 2013): 147–182, doi:10.1215/01903659-2151839; on newspapers, see Ryan Cordell, "Reprinting, Circulation, and the Network Author in Antebellum Newspapers," *American Literary History*, June 11, 2015, doi:10.1093/alh/ajv028; David A. Smith, Ryan Cordell, and Abby Mullen, "Computational Methods for Uncovering Reprinted Texts in Antebellum Newspapers," *American Literary History*, June 12, 2015, ajv029, doi:10.1093/alh/ajv029.

17. James Stiller, Daniel Nettle, and Robin I. M. Dunbar, "The Small World of Shakespeare's Plays," *Human Nature* 14, no. 4 (December 2003): doi:10.1007/s12110-003-1013-1.

many stagings, however, *Richard III*'s minor characters are frequently collapsed into single roles, effectively reducing the network size and bringing it back in to line with those social networks observed in real life.[18]

Each of these studies deploys network analysis to investigate larger scale questions (e.g,. what was the nature of Cosimo de' Medici's social strategy?) by identifying a smaller, testable question (e.g., did the Medici fill a structural hole in the social network of elite Florentine families?) that can serve as an illuminating proxy. This is the process of *operationalizing*, or translating concepts into a series of discrete operations that return measurements.[19] This creative use of structured thinking allows a colloquial understanding of a network to turn into into a formal one.

1.2 Art Historical Networks

The colloquial concept of the network is not foreign to art history. Indeed, implicit discussions of networks span a wide spectrum of specialities and methodologies within the discipline. The flow of both technical know-how and academic theory from individual to individual is a central subject of discussions about artistic studios, academies, and kinship networks of artist families. Likewise, the connections between individual artists, patrons, and viewers, and the network concepts of prestige, influence, and of reciprocal versus one-way relationships are central to how art historians discuss

18. Other selected examples from literary network analysis include: character networks in comic books: R. Alberich, J. Miro-Julia, and F. Rossello, "Marvel Universe Looks Almost Like a Real Social Network," February 11, 2002, http : / / arxiv . org / abs / cond - mat / 0202174; concept associations: Peter S. Bearman and Katherine Stovel, "Becoming a Nazi: A Model for Narrative Networks," *Poetics* 27, no. 2–3 (March 2000): 69–90, doi:10.1016/S0304-422X(99)00022-4; plot networks: Moretti, "Network Theory, Plot Analysis"; and descriptive imagery: Scott B. Weingart and Jeana Jorgensen, "Computational Analysis of the Body in European Fairy Tales," *Literary and Linguistic Computing* 28, no. 3 (January 9, 2013): 404–416, doi:10.1093/llc/fqs015.

19. On operationalization in the humanities, see Franco Moretti, "'Operationalizing': Or, the Function of Measurement in Modern Literary Theory," *Pamphlets of the Stanford Literary Lab*, no. 6 (December 2013): 1–15, http://litlab.stanford.edu/?page_id=255.

patronage and gift-giving.[20] Trade in material goods in the art market, the strategies of artists, buyers, and dealers, and the history of collecting also touch on network concepts of brokerage and community formation. The concept of network has also been mustered in studies of art historiography to structure narratives about the evolution and spread of disciplinary methodologies, and of central versus peripheral scholars and movements.[21]

Perhaps no art historical project is more enmeshed in network concepts than the charting of stylistic influence from artist to artist, period to period, and culture to culture.[22] Rare, though, is the art historian who has described these networks in an explicit and formalized way. The exception that may (infamously) prove the rule is

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20. Network rhetoric is particularly frequent in scholarship on patronage in the Italian Renaissance: F. W. Kent, "Individuals and Families as Patrons of Culture in Quattrocento Florence," in *Language and Images of Renaissance Italy*, ed. Alison Brown (Oxford: Clarendon, 1995); Evelyn S. Welch, "Women as Patrons and Clients in the Courts of Quattrocento Italy," in *Women in Italian Renaissance Culture and Society*, ed. Letizia Panizza (Oxford: European Humanities Research Centre, 2000); on networks in gift-giving, see Michael Zell, "The Gift Among Friends: Rembrandt's Art in the Network of His Patronal and Social Relations," in *Rethinking Rembrandt*, ed. Alan Chong and Michael Zell (Boston: Isabella Gardner Stewart Museum, 2002); Michael Zell, "Rembrandt's Gifts: A Case Study of Actor-Network-Theory," *Journal of Historians of Netherlandish Art* 3, no. 2 (2011); Carrie Anderson, "Material Mediators: Johan Maurits, Textiles, and the Art of Diplomatic Exchange," *Journal of Early Modern History* 20, no. 1 (January 26, 2016): 63–85, doi:10.1163/15700658-12342489.

21. See in particular Elizabeth Mansfield, ed., *Art History and Its Institutions: The Nineteenth Century* (Routledge, 2002), part II; network rhetoric has been especially relevant to discussions of feminist art and art history: Mary D. Garrard, "Feminist Politics: Networks and Organizations," in *The Power of Feminist Art: The American Movement of the 1970s, History and Impact*, ed. Norma Broude and Mary D. Garrard (New York: H. N. Abrams, 1994); Michelle Moravec, "Toward a History of Feminism, Art, and Social Movements in the United States," *Frontiers: A Journal of Women Studies* 33, no. 2 (2012): 22–54, https://muse.jhu.edu/journals/frontiers/v033/33.2.moravec.html.

22. Even Heinrich Wölfflin referred to networks of artistic influence in reference to Albrecht Dürer, albeit in order to argue that Dürer transcended such influences:

> Even if the whole network were visible and we could see what influences he came under we still would not find an answer because genius cannot be explained by an addition of influences.

Heinrich Wölfflin, *The Art of Albrecht Dürer (1905)*, trans. Alastair Grieve and Heide Grieve (New York: Phaidon, 1971), 41–42.

Alfred Barr's *Diagram of Stylistic Evolution from 1830 until 1935*, a network-like genealogical visualization generated for the Museum of Modern Art's 1936 exhibition *Cubism and Abstract Art*.[23] (Figure 3) Likely the first image that comes to mind at hearing the term "art historical network", Barr's diagram has proven to be both a trenchant image as well as an enduring magnet for criticism.[24]

For all its compelling visual clarity, though, Barr's *Diagram* is hardly a network suitable for mathematical analysis.[25] It is unpredictably multimodal, its many "isms" commingling with named artists ("Cézanne"), media categories ("Japanese Prints"), and formal schools ("Bauhaus"). This is not to say that the Barr chart or other informal diagrammatic networks are useless in art historical argument. Indeed, they can be all too effective at presenting an author's argument in terms easy to comprehend — and difficult to refute. It is a network constructed with its final visualization firmly in mind, useful for illustration and persuasion, but not for exploratory analysis or hypothesis testing.

The use of formalized, computable networks for the study of art history has been suggested at least twice in literature predating the current "digital" turn in humanistic

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23. Alfred H. Barr Jr., *Cubism and Abstract Art [1936]*, Reprint (New York: Museum of Modern Art, 1966).

24. MoMA revisited the diagram in digital form (http://www.moma.org/interactives/exhibitions/2012/inventingabstraction) as an online companion for Leah Dickerman and Matthew Affron, *Inventing Abstraction, 1910-1925: How a Radical Idea Changed Modern Art* (New York: Museum of Modern Art, 2012). On period critique of the *Diagram*, Barr's contemporary Meyer Schapiro expressed his disappointment that Barr approached the genealogy of Cubism and abstraction solely as a question of style, with no interest in the effects of historical events or social change; Meyer Schapiro, "The Nature of Abstract Art (1937)," in *Modern Art: 19th & 20th Century: Selected Papers*, vol. 2 (1978: George Braziller, 1978), 189. More recently, Astrit Burkhardt has interrogated how the schematic clarity of the diagram acts as a screen concealing Barr's politics: Astrit Schmidt Burkhardt, "Shaping Modernism: Alfred Barr's Genealogy of Art," *Word & Image* 16, no. 4 (October 2000): 387–400, doi:10.1080/02666286.2000.10435694.

25. For one experimental attempt to use formal analysis on the Barr chart, see Yanan Sun, "From Diagram to Network: A Multi-mode Network Approach to Analyze Diagrams of Art History," in *Social Informatics*, ed. Akiyo Nadamoto et al., Lecture Notes in Computer Science 8359 (Springer Berlin Heidelberg, 2014), 100–109.

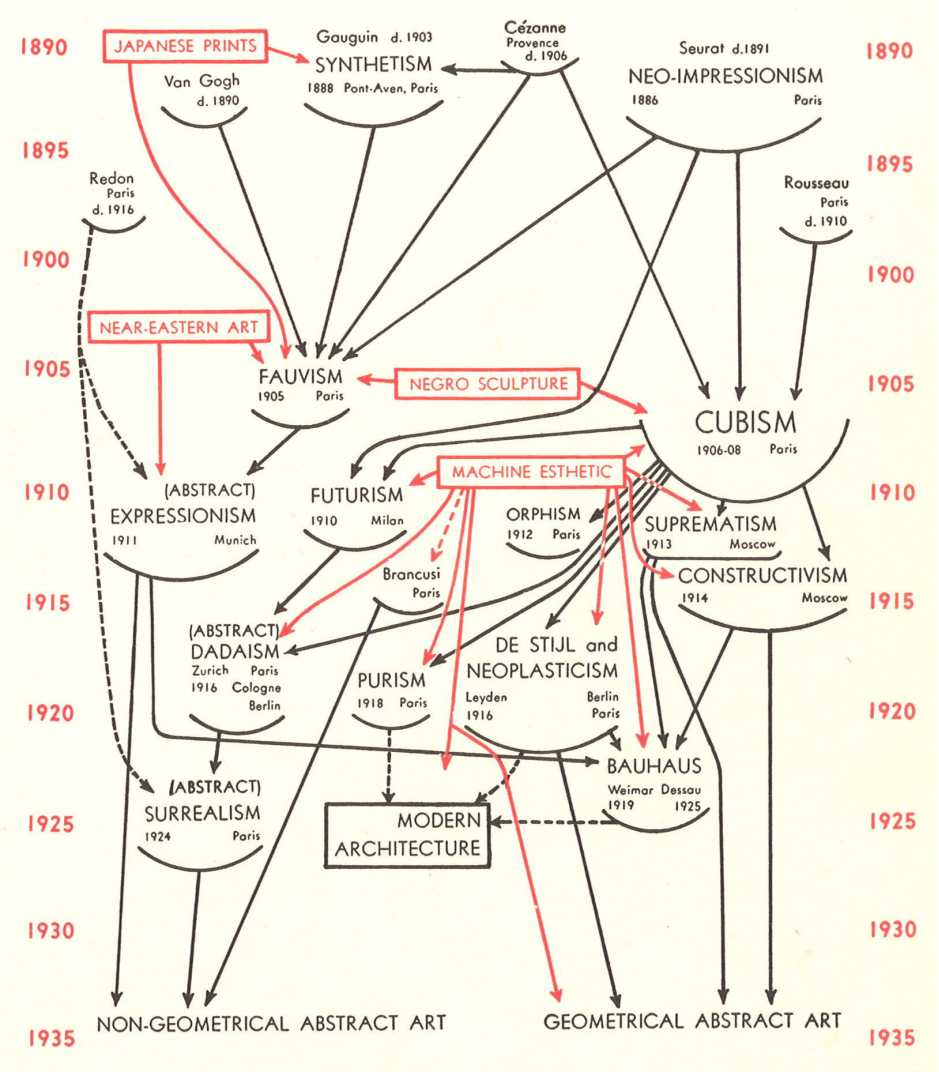

Figure 3: Alfred H. Barr, Jr., *Diagram of Stylistic Evolution from 1830 until 1935*, in *Cubism and Abstract Art [1936]*, reprint (New York: Museum of Modern Art, 1966).

study. George Kubler invoked both network rhetoric as well as a mathematical network model in his discussion of formal sequences in his 1962 book *The Shape of Time*. Kubler, concerned with describing a model for classifying art objects and organizing them in a narrative history, suggested thinking of objects (or, more precisely, their abstracted "form classes" like the late French gothic cathedral façade or the Greek *rhyton*) as nodes in a sequential, evolutionary networks. Any given form in this network may have multiple predecessors that informed its generation, and may itself be tied to any number of descendants. Alongside this discussion, Kubler included an illustrated commentary by his Yale colleague Oystein Ore, who suggested that such a sequence might be conceived of in mathematical terms as a formalized directed network.[26]

Kubler and Ore offered only a sketchy theoretical suggestion for how networks could be used to structure histories of art. It was not until 1981 that Julius Chrościcki and Vladimir Odinec unearthed Ore's suggestion and attempted to implement it.[27] Chrościcki and Odinec proposed a system for systematically measuring the manifold paths of influence that connect different artistic objects. They took as their example the designs for the entry of cardinal-infante Ferdinand into Antwerp of April 17, 1635. The triumphal arches and other temporary festival decorations, including a 31-meter-wide *Porticus Caesarea-Austriacae*, were designed by the workshop of Peter Paul Rubens. (Figure 4) The initial designs produced by the Rubens workshop went on to be modified, worked out, and realized by draftsmen, carpenters, sculptors and painters — their derivative works all sitting "downstream" of the Rubens workshop patterns. Upstream of Rubens, on the other hand, were the sources that the artist consulted

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26. It is little coincidence that Ore was also a major progenitor of graph theory, the mathematical basis for network analysis as it used today; George Kubler, *The Shape of Time: Remarks on the History of Things* (New Haven: Yale University Press, 1962), 33–34, note 3.

27. Juliusz A. Chrościcki and Vladimir P. Odinec, "On Directed Graph Models on Influences in Art Theory," *Artibus et Historiae* 2, no. 3 (January 1981): 113–130, doi:10.2307/1483105.

in the course of producing these designs, like the descriptive history *XII Caesarum Austriacorum vitae et elogiae* by Jan Gaspar Gevartius, and Octavius de Strada's 1615 *De vitis imperatorum et Caesarum Romanorum*. Chrościcki and Odinec systematically ranked the similarities between each artwork and their literary/visual sources, generating similarity scores based on a clearly-stated (if somewhat arbitrary) formula accounting for shared medium, shared geographical region, shared visual style, shared iconography, and so forth. Though Chrościcki and Odinec exhaustively detailed their method, they offered little in the way of interpretation, presenting only a synthetic overview of the wide array of sources tangent to many artistic projects. And while based on a systematic method, their visualizations, were, to put it mildly, convoluted. (Figure 5) They would draw few imitators.[28]

Only in the past few years have art historians have once again taken up network analysis methods in order to resolve clearly-stated questions. They are now backed by more user-friendly computational tools, and much larger datasets. A pioneering example is Anne Helmreich's research on the art market networks of the late nineteenth-century firms Goupil & Cie/Boussod and Valadon & Cie, whose records have been preserved and digitized in the Getty Provenance Index. It had commonly been understood that the London art market grew rapidly in size during this period, but the nature of its importance to the global art market, Helmreich argues, is not fully evident without considering the art trade as a dynamic network of artists, dealers, and buyers. Using network visualization techniques to parse the Getty databases, Helmreich discovered that, by the 1870s, the London branches of each of these firms were acting as intermediaries between a surprisingly international range of artists and buyers. The London market had not only grown in size, but had become highly central

28. A variation on Chrościcki's and Odinec's work can be found in Günther Korbel, "Eine Typologie von Portweinflaschen mit Hilfe eines Dreieckdiagramms: der methodologische Aspekt," *Zeitschrift für Archäologie des Mittelalters*, no. 11 (1983): 109–114.

Figure 4: Theodoor van Thulden, after Peter Paul Rubens, *Porticus Caesaro Austriaca* in *Pompa introitus honori Ferdinandi...* by Jean Gaspard Gevaerts, published by Joannes Meursius, Antwerp, 1641. London, British Library.

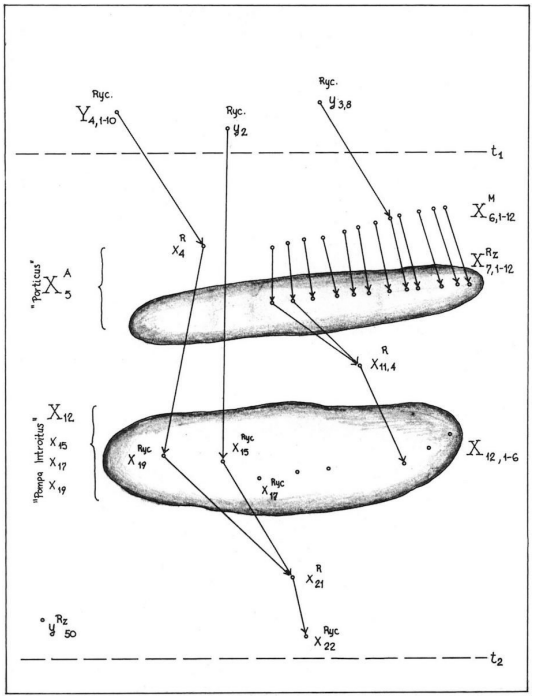

Figure 5: Stanisław Karłowski, "A graph of influences on Peter Paul Rubens", in Juliusz A. Chrościcki and Vladimir P. Odinec, "On Directed Graph Models on Influences in Art Theory," *Artibus et Historiae* 2, no. 3 (January, 1981), fig. 19.

to an international network connecting Britain, continental Europe, and the United States, uniting these regional markets in a way that no city had done before.[29] In addition to providing much of the foundational data for Helmreich's study, the Getty Research Institute's Provenance Index, headed by Christian Huemer, continues to explore the dynamics of other art market networks derived from auction and gallery records maintained by the Getty.[30]

Textual records have also been productive sources for scholars interested in how communities of artists have been formed and defined by co-exhibition. One compelling example is Martin Papenbrock's and Joachim Scharloth's work examining the shift from regionalized to more centralized exhibition patterns in Germany as the Nazis began to enforce their cultural policies after 1937.[31] Maxmilian Schich has demonstrated how inferencing networks from *secondary* sources, that is, mining our own troves of past scholarship, can also produce new insights. At the meso-scale, Schich has analyzed the 1947 *Census of Antique Works of Art and Architecture Known in the Renaissance* as a way of determining which antique sites and monuments tended to be mentioned together.[32]

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29. See Anne Helmreich, "The Global: Goupil & Cie/Boussod, Valadon & Cie and International Networks", in Pamela M. Fletcher and Anne Helmreich, "Local/Global: Mapping Nineteenth-Century London's Art Market," in collab. with David Israel and Seth Erickson, *Nineteenth-Century Art Worldwide* 11, no. 3 (Autumn 2012), http://www.19thc-artworldwide.org/index.php/autumn12/fletcher-helmreich-mapping-the-london-art-market.

30. Christian Huemer, "Provenance on Steroids: Or, the Promise of Big Data" ('New Projects in Digital Art History' symposium, Washington, D.C., November 21, 2014); art market networks have also been suggested to be useful by Sophie Raux, "Visualizing Spaces, Flows, Agents, and Networks of the Art Markets in the 18th Century: Some Methodological Challenges," *Artl@s Bulletin* 2, no. 2 (December 12, 2013), http://docs.lib.purdue.edu/artlas/vol2/iss2/4; Béatrice Joyeux-Prunel, "Provincializing Paris. The Center-Periphery Narrative of Modern Art in Light of Quantitative and Transnational Approaches," *Artl@s Bulletin* 4, no. 1 (June 11, 2015), http://docs.lib.purdue.edu/artlas/vol4/iss1/4.

31. Martin Papenbrock and Joachim Scharloth, "Datengeleitete Analyse kunsthistorischer Daten am Beispiel von Ausstellungskatalogen aus der NS-Zeit: Musteridentifizierung und Visualisierung," *Kunstgeschichte*, May 10, 2011, esp. 17–18. http://www.kunstgeschichte-ejournal.net/248/.

32. Maximilian Schich, "Netzwerke von komplexen Netzwerken in der (Kunst) Wissenschaft," in *Die Dynamik sozialer und sprachlicher Netzwerke Konzepte, Methoden und empirische Untersuchungen an Beispielen des*

At the large-scale, he has looked at large biographical databases such as the *Allgemeines Künstlerlexikon* and the Getty Union List of Artist Names as proxies for understanding general properties of human cultural networks. Schich et al. found differences between "winner-takes-all" countries such as France, where Paris was far and away the greatest attractor of notable cultural figures, and more distributed countries like Germany, where cultural competition is multi-centric.[33] Similar work based on secondary sources is currently being developed as part of the aptly-named *Six Degrees of Francis Bacon* project.[34]

It is also worth noting several early-stage projects in the study of Dutch and Flemish art are presently compiling network data with an eye towards eventual network analysis. Koenraad Brosens has begun to construct a network model of the seventeenth-century Brussels tapestry industry. He believes his colloquial understanding of the "network" of tapestry producers in Brussels is, at present, too fragmentary and ill-defined to support his contention that the tapestry industry was largely driven and shaped by patterns of trust and distrust in personal relationships.[35] To augment episodic case studies, Brosens proposes mining the rich archives documenting the layers of kinship,

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WWW, ed. Barbara Frank-Job, Alexander Mehler, and Tilmann Sutter (Wiesbaden: Springer, August 4, 2013), 161–178.

33. Maximilian Schich et al., "A Network Framework of Cultural History," *Science* 345, no. 6196 (January 8, 2014): 558–562, doi:10.1126/science.1240064; this paper rightly has come under criticism for making claims about human culture writ large based on biographical databases restricted largely to figures from Western history; Mark Byrnes, "What We Can and Can't Learn From 2,000 Years of Migration Data for 'Western Intellectuals'," The Atlantic: CityLab, August 4, 2014, http://www.citylab.com/tech/2014/08/what-we-can-and-cant-learn-from-2000-years-of-migration-data-for-western-intellectuals/375485/.

34. Warren et al., "Six Degrees of Francis Bacon."

35. Koenraad Brosens, "Can Tapesty Research Benefit from Economic Sociology and Socal Network Analysis?," in *Family Ties: Art Production and Kinship Patterns in the Early Modern Low Countries*, ed. Koenraad Brosens, Leen Kelchtermans, and Katlijne van der Stighelen (Turnhout: Brepols, 2012), 43–51.

artistic, and financial ties that connected tapestry makers in this period. Marten Jan Bok and Harm Nijboer are also currently developing a database of kinship, professional, and geographic relationships between Dutch painters in the sixteenth and seventeenth centuries.[36] Their database is part of a larger umbrella research group dedicated to compiling a wide array of network-like data on early modern northern Europe.[37]

1.3 Formalizing Networks

Despite these early precedents for the use of network analysis in art history, virtually no studies analyze relationship data derived directly from artworks themselves, preferring instead the evidence of textual documents like sales records or exhibition catalogs.[38] Moreover, none have yet drawn on the large datasets that have been published by a growing number of museums, which represent a rich and relatively untapped vein for historical research.[39] This reluctance may be, in part, because analyzing collections will generally tell you more about the history of that particular collecting institution than about the broader historical framework form which its objects came.[40] (Though

36. Marten Jan Bok and Harm Nijboer, "ECARTICO: Linking Cultural Industries in the Early Modern Low Countries, ca. 1475-ca. 1725," 2014, http://www.vondel.humanities.uva.nl/ecartico/.

37. Charles van den Heuvel and Leonor Álvarez Francés, *Report Knaw Project: Mapping Notes and Nodes in Networks* (November 1, 2014), https://www.huygens.knaw.nl/wp-content/uploads/2015/05/EndReportMNN.pdf.

38. Portions of this section have been adapted from my contribution to Drucker et al., "Digital Art History: The American Scene."

39. Dominic Oldman et al., "Realizing Lessons of the Last 20 Years: A Manifesto for Data Provisioning and Aggregation Services for the Digital Humanities (A Position Paper)," *D-Lib Magazine* 20, nos. 7/8 (July 2014), doi:10.1045/july2014-oldman; Melissa Terras, "Opening Access to Collections: The Making and Using of Open Digitised Cultural Content," *Online Information Review* 39, no. 5 (September 14, 2015): 733–752, doi:10.1108/OIR-06-2015-0193.

40. Jefferson Bailey and Lily Pregill, "Speak to the Eyes: The History and Practice of Information Visualization," *Art Documentation: Journal of the Art Libraries Society of North America* 33, no. 2 (September 1, 2014): 185–190, doi:10.1086/678525.

I argue in chapter 2 that a justifiable, albeit provisional exception may be made for the study of prints.) Part of this discomfort may stem from the explicit distancing from the individual object that network analysis, or any other kind of quantitative analysis, enforces. Kubler voiced this concern in *The Shape of Time*:

> It is disturbing to those who value the individuality of a thing to have that individuality diminished by classifications and generalizations. We are caught between difficulties: single things are extremely complicated entities, so complicated that we can pretend to understand them only by generalizing about them. One way out is frankly to accept the complexity of single things. Once their difficulty is conceded, it is possible to find aspects that can be used in comparisons. No such trait now known is unitary or fundamental: every trait of a thing is both a cluster of subordinate traits as well as a subordinate part of another cluster.[41]

Kubler's sentiments are hardly revolutionary. Yet it is still necessary to acknowledge this inevitable distancing in the context of computationally-aided studies, which are often challenged (sometimes fairly; often not) as un-nuanced.[42] It is true that objects, artistic ones particularly so, resist both the structured description and the abstraction that computational methods rely upon. Compared to structured data for libraries' generally homogeneous collections of books, for example, museums do not yet have interoperable standards for describing their heterogeneous collections of unique objects. While library data is generally produced through broad consensus about the facts of a book's publication and classification, knowledge about historical objects tends to be advanced through iterative and conflicting scholarly argumentation — a difficult (though not impossible) process to represent in a database.[43] Moreover, the

41. Kubler, *The Shape of Time*, 36.

42. For a provocative take on this critique, see Kieran Healy, "Fuck Nuance" (Chicago, August 2015), http://kieranhealy.org/files/papers/fuck-nuance.pdf.

43. Diane M. Zorich, "Library and Museum Information: Beauty and the Beast," *Spectra* 18, no. 4 (Fall 1991): 3.

relative abstractability of text has eased scholars' adoption of computational linguistics methods for literary research. The contingency of image and physical object in art historical interpretation, however, complicates efforts to integrate analogous methods into our discipline. Certainly, not all art historical questions ought to be expressed as structured data. The precision and specificity that would be required for certain types of description — for example, how the artist manipulated a particular pigment in a certain section of a painting, and the interplay between that technique and its visual effect — recalls the specter of Jorge Luis Borges' impossibly-mimetic 1:1 map.[44]

That said, explicitly quantitative approaches to art history have a long pedigree, dating back as early as 1708, when Roger de Piles produced tables quantifying stylistic qualities of old masters for his treatise *Cours de peinture par principes*.[45] (Figure 6) In the modern era, Jules Prown's 1966 computer-aided work on patterns of patronage in the portraits of John Singleton Copley is frequently cited as one of earliest computer-aided art history projects, alongside Anthony Garvan's 1968 statistical study of American church silver.[46] Quint Gregory's unorthodox approach to looking at Haarlem still

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44. Jorge Luis Borges, *A Universal History of Iniquity*, trans. Andrew Hurley (New York: Penguin, 2004).

45. Roger de Piles, *Cours de peinture par principes* (Jacques Estienne: Paris, 1708), http://hdl.handle.net/2027/gri.ark:/13960/t5w67fg51; these data have been explored by both statisticians as well as economists: M. Davenport and G. Studdert-Kennedy, "The Statistical Analysis of Aesthetic Judgment: An Exploration," *Journal of the Royal Statistical Society. Series C (Applied Statistics)* 21, no. 3 (January 1, 1972): 324–333, doi:10.2307/2346281; Kathryn Graddy, "Taste Endures! The Rankings of Roger de Piles (†1709) and Three Centuries of Art Prices," *The Journal of Economic History* 73, no. 3 (September 2013): 766–791, doi:10.1017/S0022050713000600.

46. Jules David Prown, *John Singleton Copley*, 2 vols. (Cambridge: Harvard University Press, 1966), I:97–137; Anthony N. B. Garvan et al., "American Church Silver: A Statistical Study," in *Winterthur Conference Report: Spanish, French, and English Tradition in the Colonial Silver of North America* (Winterthur, 1968), 73–104; A full historiography of what might be termed "digital art history" has yet to be authored, but guiding references would include Kathleen Cohen et al., "Digital Culture and the Practices of Art and Art History," *The Art Bulletin* 79, no. 2 (June 1, 1997): 187–216, doi:10.2307/3046243; William Vaughan, "History of Art in the Digital Age: Problems and Possiblilites," in *Digital Art History: A Subject in Transition*, ed. Anna Bentkowska-Kafel, Trish Cashen, and Hazel Gardiner (Portland: Intellect, 2005), 3–13; Johanna Drucker, "Is There a 'Digital' Art History?," *Visual Resources* 29, nos. 1-2 (2013): 5–13, doi:10.1080/01973762.2013.761106.

lifes from 1600–1660 offers one example where computer-aided analysis made it possible to identify not only major trends in both iconography and compositional solutions, but also to identify cases where artists seem to have diverged from certain norms.[47] Researchers of the Dutch and Flemish art markets in this period have also demonstrated how thoughtful quantitative research can support richer understandings about the motivations behind artists' decisions. John Michael Montias devoted his career to exploring the economic aspects of artistic styles, the historic values of painting genres, the development of seventeenth-century auction practices, and the patterns of painting display in Dutch households.[48] Neil De Marchi, Hans van Miegroet, and Jan De Vries have also studied the relationship of art and the market in this period.[49]

Even more common, however, are *implicitly* quantitative methods. The *catalogue raisonné* can be understood as an object of digital scholarship *avant la lettre*: a volume that structures knowledge by enumerating and categorizing artworks such that the scholar may efficiently locate single objects, or gain a synthetic overview of an artist's

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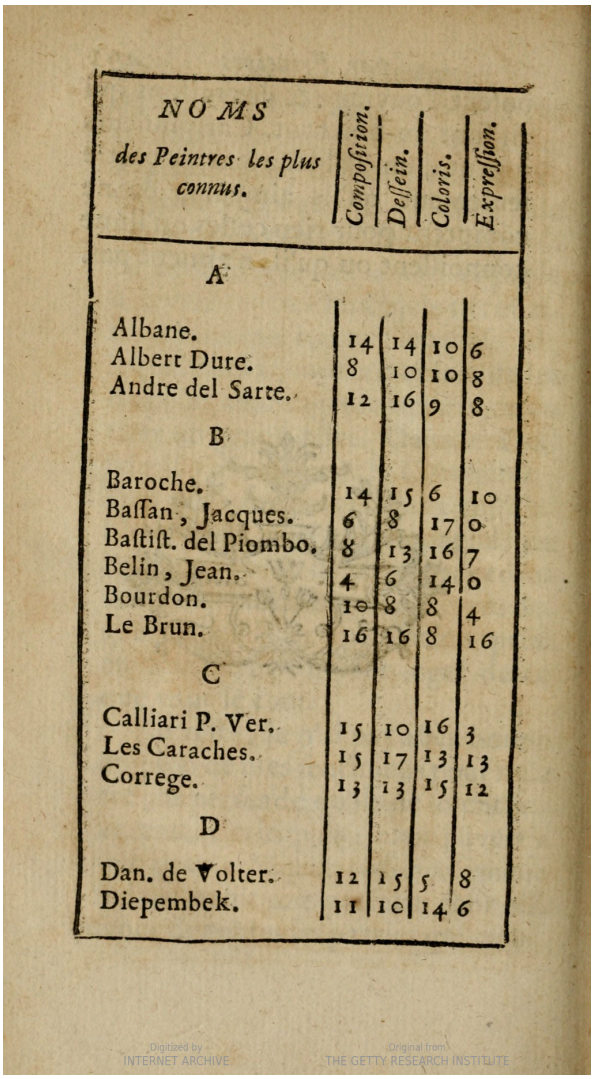
47. Henry Duval Gregory, "Tabletop Still Lifes in Haarlem, c. 1610-1660: A Study of the Relationships Between Form and Meaning" (PhD diss., University of Maryland, 2003), 16.

48. Key works by Montias include: John Michael Montias, "The Guild of St. Luke in 17th-Century Delft and the Economic Status of Artists and Artisans," *Simiolus: Netherlands Quarterly for the History of Art* 9, no. 2 (January 1977): 93–105, doi:10.2307/3780327; John Michael Montias, *Artists and Artisans in Delft: A Socio-Economic Study of the Seventeenth Century* (Princeton: Princeton University Press, 1982); John Michael Montias, "Cost And Value In Seventeenth-Century Dutch Art," *Art History* 10, no. 4 (December 1987): 455; John Michael Montias, *Vermeer and His Milieu: A Web of Social History* (Princeton: Princeton University Press, 1989); John Michael Montias, "Socio-Economic Aspects of Netherlandish Art from the Fifteenth to the Seventeenth Century: A Survey," *The Art Bulletin* 72, no. 3 (September 1990): 358–373, doi:10.2307/3045746; John Michael Montias, "Works of Art in Seventeenth-Century Amsterdam: An Analysis of Subjects and Attributions," in *Art in History, History in Art: Studies in Seventeenth-Century Dutch Culture*, ed. David Freedberg and Jan De Vries (Santa Monica: Getty Center for the History of Art & The Humanities, 1991), 331–376; John Loughman and John Michael Montias, *Public and Private Spaces: Works of Art in Seventeenth-Century Dutch Houses* (Zwolle: Waanders, 2000).

49. Neil De Marchi and Hans J. van Miegroet, "Art, Value, and Market Practices in the Netherlands in the Seventeenth Century," *The Art Bulletin* 76, no. 3 (September 1, 1994): 451–464, doi:10.2307/3046038; Neil De Marchi and Hans J. van Miegroet, *Mapping Markets for Paintings in Europe 1450-1750* (Turnhout: Brepols, 2006); De Vries, "Art History."



NOMS des Peintres les plus connus.	Compoſition.	Deſſein.	Coloris.	Expreſſion.
A				
Albane.	14	14	10	6
Albert Dure.	8	10	10	8
Andre del Sarte.	12	16	9	8
B				
Baroche.	14	15	6	10
Baſſan, Jacques.	6	8	17	0
Baſtiſt. del Piombo.	8	13	16	7
Belin, Jean.	4	6	14	0
Bourdon.	10	8	8	4
Le Brun.	16	16	8	16
C				
Calliari P. Ver.	15	10	16	3
Les Caraches.	15	17	13	13
Correge.	13	13	15	12
D				
Dan. de Volter.	12	15	5	8
Diepembek.	11	10	14	6

Figure 6: Roger de Piles, *Cours de peinture par principes* (1708, Paris: Jacques Estienne)

oeuvre. Arguments for or against an attribution, or for the location of an artwork within a chronology, rely on the author's mental model of the artist's overarching career — a model based on a sense, however tacit, of the numeric distribution of certain features across that oeuvre.[50] This goes to show that we have always been counting pictures. Now we have a chance to engage with that practice more explicitly, and more creatively.

1.4 A Case for Network Models in Printmaking History

If network analysis offers useful approaches for art history writ large, what about the histories of printmaking in the Low Countries? Over the last two decades, researchers have paid increasing attention to how the business practices of publishers and reproductive printmakers affected the style, subjects, and cultural status of prints. David Landau and Peter Parshall charted the emergent division of labor between designers, printmakers, and publishers in the fifteenth and sixteenth centuries, while Timothy Riggs and Larry Silver have argued that this professionalization continued into the seventeenth century.[51]

A series of publications in the wake of these books has used in-depth case studies to detail how the behaviors of print publishers may have shifted in the early seventeenth century. In a short, but rich, article from 1995, Nadine Orenstein contrasted the business approaches of three Dutch publishers from 1600–1625, Hendrick Hondius, Jacques Razet, and Jan Pietersz Berendrecht, to their sixteenth-century predecessors in

50. On this tendency in literary studies, see Matthew Wilkens, "Digital Humanities and Its Application in the Study of Literature and Culture," *Comparative Literature* 67, no. 1 (January 3, 2015): 11–12. doi:10.1215/00104124-2861911.

51. David Landau and Peter Parshall, *The Renaissance Print, 1470-1550* (New Haven: Yale University Press, 1994); Timothy Riggs and Larry Silver, *Graven Images: The Rise of Professional Printmakers in Antwerp and Haarlem, 1540-1640* (Chicago: Mary and Leigh Block Gallery, Northwestern University, 1993).

Antwerp, Hieronymus Cock, Hans Liefrinck, and Gerarde de Jode.[52] Orenstein delved deeper into Hondius' engraving and publishing practices in her 1996 book *Hendrick Hondius and the Business of Prints in Seventeenth-Century* Holland, where she argued that Hondius deliberately diversified both the genres, as well as the styles of prints that he published, as a response to the growing number of printmakers and publishers in the Netherlands over the course of his career.[53] She revisited the question of variety in print publishing in another article in 1998, in which she contrasted the varying specialization or diversification of genre in the oeuvres of Hendrick Hondius, Claes Jansz Visscher, Jacob Matham, and Jacques Razet.[54] Elizabeth Wyckoff has also argued that a wider distribution of genres was necessary to succeed in the seventeenth-century print market.[55] On the other hand, Lorena Baines presents a counterexample in her study of Nicolaes de Bruyn, a prolific printmaker working between 1592 and 1650 in Antwerp and Rotterdam.[56] Unlike the engravers cited by Orenstein and Wyckoff, De Bruyn apparently found exceptional professional success by specializing in ornate, narrative landscape scenes, rather than relying on diversification of subject matter as insurance against changing market tastes.

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52. Nadine M. Orenstein, "The Shift from Antwerp: The Diversification of Print Publishers in the United Provinces around 1600," *Block Points: The Annual Journal and Report of the Mary and Leigh Block Gallery* 5 (1995): 43–63.

53. Nadine M. Orenstein, *Hendrick Hondius and the Business of Prints in Seventeenth-Century Holland* (Rotterdam: Sound & Vision Interactive, 1996).

54. Nadine M. Orenstein, "Marketing Prints to the Dutch Republic: Novelty and the Print Publisher," *Journal of Medieval & Early Modern Studies* 28, no. 1 (1998): 141.

55. Elizabeth Ann Wyckoff, "Innovation and Popularization: Printmaking and Print Publishing in Haarlem During the 1620s" (PhD diss., Columbia University, 1998), 194.

56. Lorena A. Baines, "Nicolaes de Bruyn (1571–1656) and the Art of the Professional Engraver" (PhD diss., University of Delaware, 2011); Lorena A. Baines, *Nicolaes de Bruyn*, ed. Nadine Orenstein, 2 vols. (Ouderkerk aan den IJssel: Sound & Vision Publishers, 2014).

I share with these earlier projects the overarching goal of illuminating how the changing mechanics of print production shaped the style, subjects, and status of prints in this period. However, generalizations about what made for successful and unsuccessful printmaking and publishing practices, such as the arguments about diversification made by Orenstein and Wyckoff, cannot be supported through case studies alone. Print scholarship in particular, as Lorena Baines has suggested, relies heavily on a quantitative sense of artists' production, as oeuvres or inventories of hundreds and sometimes thousands of prints defy synthetic textual description.[57] Thus, many books on printmakers and their oeuvres look more like intricately cross-referenced databases than they do synthetic histories that fluently assess all these artistic data.[58]

This is not to denigrate the indexing impulse in the history of printmaking, but simply to acknowledge how central these catalogs are to even the best attempts, such as Landau and Parshall's *Renaissance Print*, to create overarching histories. Indeed, these indices will form the foundation of the data-driven analyses in the following chapters. Network analysis has much to offer in sifting these stockpiles of art historical knowledge. Art history tends to privilege an individualist perspective that, in its best instances, results in compelling and detailed accounts of artists' personal

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57. Lorena A. Baines, "Revisiting the Life and Work of the Flemish Engraver Nicolaes de Bruyn (1571-1656)" (Works in Progress, National Gallery of Art, Washington, D.C., April 28, 2015).

58. There is perhaps no better example of this than Marie Mauquoy-Hendrickx, *Les estampes des Wierix: conservées au Cabinet des estampes de la Bibliothèque royale Albert Ier: catalogue raisonné, enrichi de notes prises dans diverses autres collections* (Brussels: Bibliothèque royale Albert Ier, 1978), reviewed by Martin Royalton-Kisch, "Review: The Brothers Wierix," *Print Quarterly* 3, no. 2 (June 1986): 141–143. Royalton-Kisch dedicates a significant portion of his review to describing the scholarly machinery that Mauquoy-Hendrickx provides her readers, including its use of subject matter as an overarching organizational principle ("the only practicable solution to the problem of organizing so many engravings"); no less than three indices cross-referenced by chronology, signatures, and iconography (not to mention an index of the indices themselves); and a system of categorization codes and symbols for impression locations and states that is so complex it had to be listed on its own removable reference card.

circumstances and influences. In its worst instances, however, this individualist perspective constructs the artist as a genius who transcends all material and social circumstances.[59] At times when we do wish to characterize larger movements (one is again reminded of Barr's *Diagram*), we sometimes struggle to reconcile the wealth of material evidence into comprehensible, synthetic theories that still account for the place of the individual artist.

Network analysis offers a bridge between these micro-scales and macro-scales because its network representations are explicitly constructed from information about individual actions. The print production network in this study, for example, will still be constructed from the associations inferred from a multitude of individual prints. We will retain the ability to drill into a particular connection and identify the physical objects that are being used to justify it. Frequent reference back to this micro-scale view will be necessary to avoid losing the trees for the forest, as it were.[60] This multi-scalar approach often reveals how varied both networks, and the positions and choices of individuals that constitute them, can appear based on one's frame of reference.

While art historians have long thought about networks in a colloquial sense, I hope to have made clear that formalized, computational network analysis presents an excellent opportunity for new research, even as it challenges our current usage of the term. The affordances and drawbacks of network analysis presented in this overview should provide a useful lens for the following chapters. Quantitative techniques do demand a certain level of abstraction of reality. At the same time, they also require practitioners to be particularly precise in their assumptions, hypotheses, and

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59. The classic critique of the (male) genius artist construct is found in Griselda Pollock, *Vision and Difference: Femininity, Feminism, and Histories of Art* (New York: Routledge, 1988).

60. On this critique of network analysis, see Mustafa Emirbayer and Jeff Goodwin, "Network Analysis, Culture, and the Problem of Agency," *American Journal of Sociology* 99, no. 6 (May 1, 1994): 1415.

description of evidence. However, the examples of network analysis both in art history as well as in other humanistic fields presented here demonstrate that these considerations are not all that far removed from the same concerns in "traditional" art history. Even though they necessarily simplify reality, computational methods like network analysis make more explicit the process of humanistic modeling that we are already doing. And, for prints in particular, network analysis may allow us to gain a synthetic overview that has often eluded scholars.

2 Print Production Centralization in the Low Countries

How centralized was print production in the Low Countries in the sixteenth and seventeenth centuries?

This is not an arbitrary question. The development of a professionalized printmaking industry in northern Europe during the mid-sixteenth century has been singled out as a turning point in the history of early modern reproductive prints. In their landmark overview of European printmaking, *The Renaissance Print*, David Landau and Peter Parshall trace two parallel trends in artistic print production in sixteenth-century Europe: individual, highly innovative printmakers who acted as their own printers and distributors; and, on the other hand, an emerging class of professionalized publishers who coordinated the print production pipeline.[1] Landau and Parshall argued that, as artists and publishers grappled with the possibilities and challenges presented by printing technology over the course of the late fifteenth and early sixteenth centuries, they inevitably came to embrace a more professionalized, and thus centralized, reproductive print market. By the mid-sixteenth century, "industrialized" houses such as that of Hieronymus Cock in Antwerp and Antonio Lafréri in Rome began to dominate the artistic print landscape landscape. By 1530, according to Landau and Parshall, the golden age of the independent Renaissance *peinture-graveur* was finished. In their place, highly-centralized engravers and publishers would instead dominate the late sixteenth and early seventeenth centuries.

Theirs is a compelling argument. To make one's business out of selling relatively cheap images, one had to operate at scale. Publishers needed a wide-ranging network

1. Landau and Parshall, *The Renaissance Print*, 260–283.

of buyers, yes, but also of talented platecutters, suppliers of paper, plates, and presses, as well as artistic collaborators for creating designs for single prints, series, or large book illustration projects. Modern firms separated the roles of *inventor* and *sculptor* as a way to increase the efficiency and scale of production. Large, highly-centralized firms could take full advantage of these affordances of scale. A print publisher who was able to position himself in the core of the larger web of the print market by accumulating enough artistic, material, and social capital would have rosy prospects, indeed.

But what, in fact, happened in the wake of this turn towards centralized printmaking? Current overviews of seventeenth-century print production in the Low Countries offer conflicting assessments. Timothy Riggs and Larry Silver have argued that the continuing division of labor between designers, printmakers, and publishers affected the style and status of Netherlandish printmaking through the mid-seventeenth century.[2] They generally support the premise that the continuing professionalization of artistic printmaking perpetuated the shift from prints' role as artistic objects to utilitarian media useful for their reproductive potential.[3] While the roles of print design and production may have become increasingly separated during the seventeenth century, other evidence from the Low Countries suggests that publishing did not remain centralized in the hands of a few large houses. Nadine Orenstein's research into the prominent seventeenth-century Dutch printmaker/publishers Hendrick Hondius, Jacques Razet, and Jan Pietersz Berendrecht, suggests that an increasing number of

2. Riggs and Silver, *Graven Images*.

3. Along this same line of argument, see Ilja M. Veldman, "The Consequence of Professionalism: Prints as Visual Communication," *Block Points: The Annual Journal and Report of the Mary and Leigh Block Gallery* 5 (1995): 10–27.

smaller publishing houses began to flourish in the northern Netherlands around mid-century.[4]

A preliminary glance at the dataset of extant prints in the British Museum collections would seem to confirm that the number of artists active in printmaking began to rise steadily from 1575 onwards, peaking in 1650 before gradually descending. (Figure 7) The numbers of Dutch and Flemish printmakers were subject to long-term demographic and economic cycles that also affected their painting colleagues. The numbers of active Dutch painters from this period, as measured both in modern-day paintings collections and by listings in probate inventories, similarly began a gradual increase around 1575, peaking between 1640 and 1650, before declining.[5] This peak and decline the population of active artists tracks, in turn, the larger population the share of Europe's urban population that were living in Dutch and Flemish cities in this period.[6] (Figure 8)

As we will see, these gradual changes in the population of printmakers could have a significant, and sometimes surprising impact on the shape of this network. But it can be hard to gauge this impact through this one chart. Size is but one dimension of a network. Networks with the same number of members may have radically different internal structures that could result in very different experiences and incentives for their constituents. Any comprehensive investigation into the way that printmakers connected to each other must also take account of these structures.

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4. Orenstein, "Marketing Prints to the Dutch Republic."

5. De Vries, "Art History," 260–261, tables 1–2.

6. These population data have been derived from Jan De Vries, *European Urbanization: 1500-1800* (Cambridge: Harvard University Press, 1984), appendix 1. I have published a digitized version of this dataset in Matthew D. Lincoln, "europop: Historical Populations of European Cities, 1500-1800" (R Package [version 0.2], December 14, 2015), doi:10.5281/zenodo.35425.

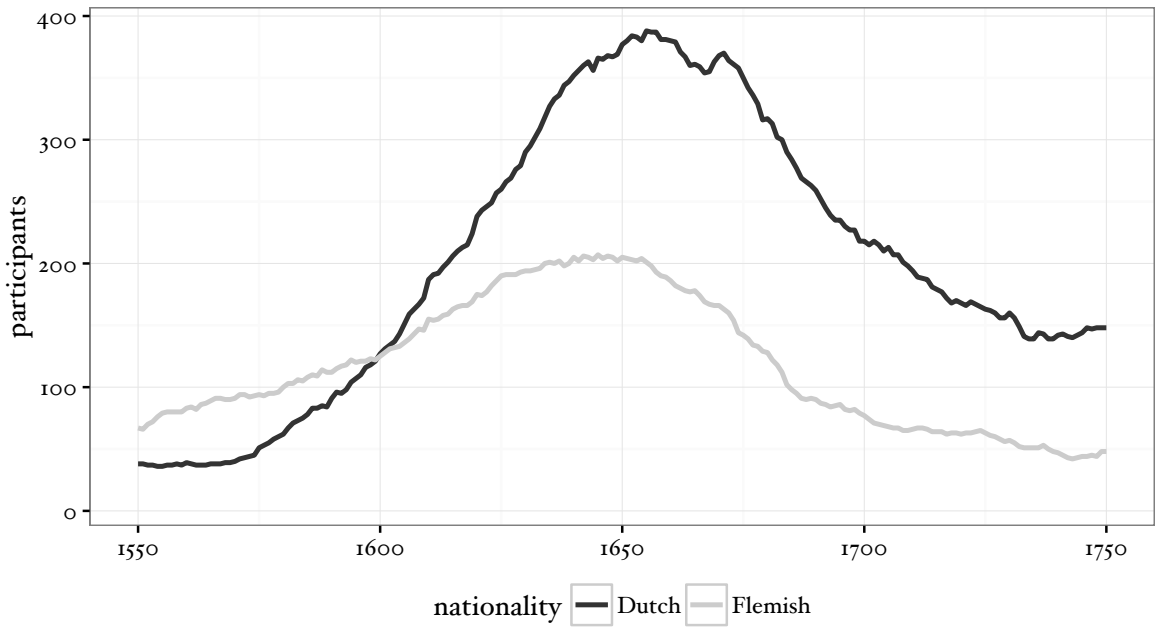

Figure 7: The number of participants (artists, printmakers, and publishers) in the Dutch and Flemish print production networks between 1550–1750, as measured from the British Museum dataset.

In this chapter, I take a quantitative approach to the question of centralization by applying network analysis methods to gauge just how centralized or distributed print production in the Low Countries was at different points between 1550–1750. I will then compare these results to those found in random graphs in order to understand which changes in centralization, if any, may have been due to fundamental changes in the way that printmakers connected, and which were simply the result of the regular growth and shrinkage of the Dutch and Flemish networks over time. Finally, I will reconsider the careers of several individual printmakers and publishers in light of these results, suggesting how a changing network structure may have affected their own professional decisions. The results will allow us to revaluate Landau and Parshall's claims, but also to explore how the simple incentives that they have posited could, in combination with gradual changes in the size of these networks, result in unexpectedly complex realities.

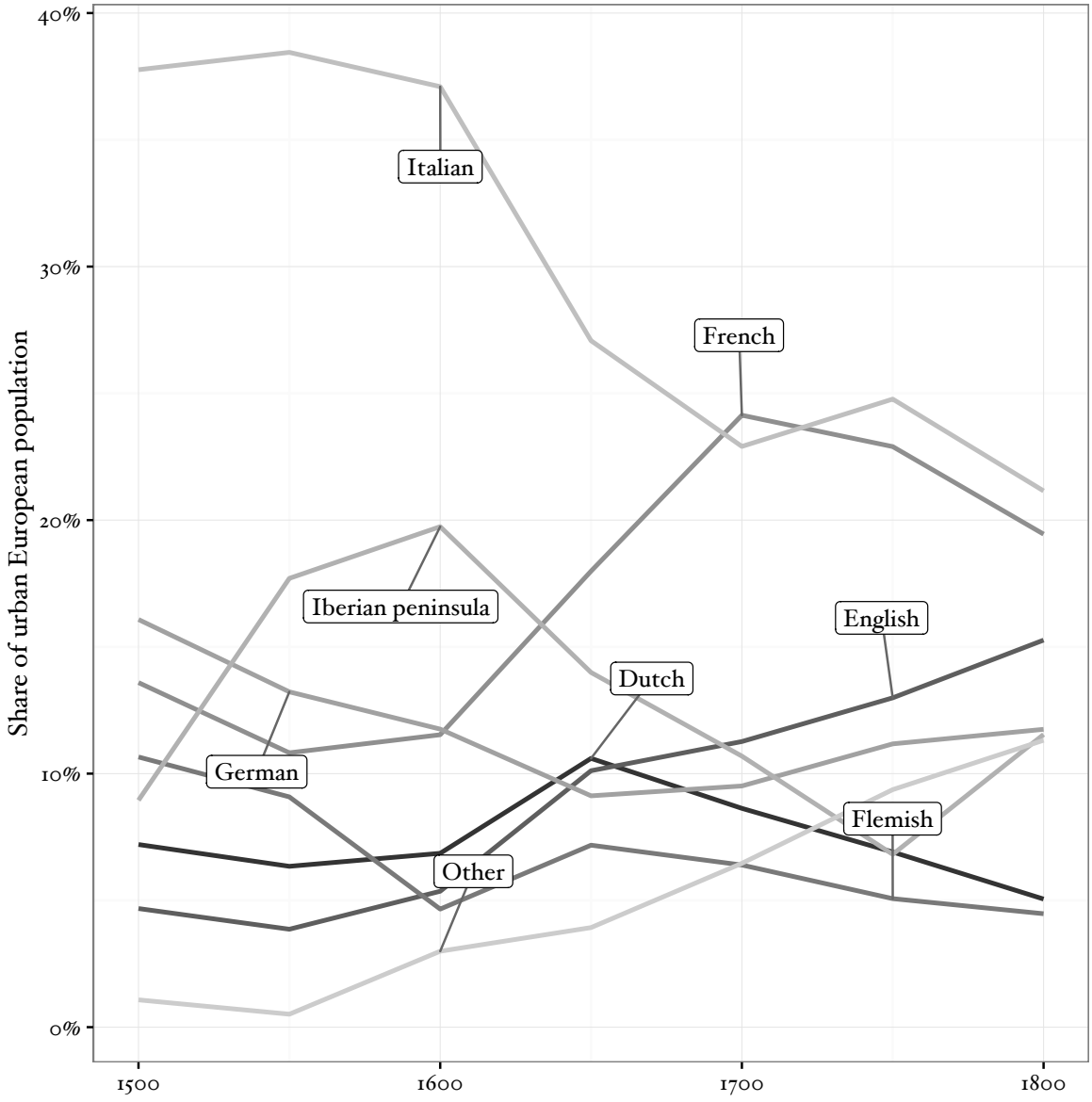

Figure 8: Proportional populations of different European regions. Over this period, France and England increased their share of the European urban population, while the population share of Italian and German cities decreased. The Dutch share of the European urban population peaked in 1650. ("Other" regions include Scandinavia, Scotland and Ireland, and eastern Europe)

2.1 Background: Why Centralization Mattered

A key structural property of any network is its network centralization, a quantitative measure of how evenly or unevenly ties are distributed between its members. In a centralized network, a few key individuals occupy powerful and flexible broker positions. Actors in these positions are able to initiate contact with a wide range of individuals they already know, and are granted easy access *through* those immediate contacts to the rest of the network. (Figure 9(a) and 9(b)) Centralized networks are not equal networks, however. The average individual in that same network is unlikely to know multiple well-connected actors, meaning that their access to the rest of the network is mediated and easily cut off by those few highly-central individuals. Conversely, in a more decentralized network (Figure 9(c)), where connections are spread more evenly, a given individual has a better chance of knowing more than one well-connected actor, reducing his or her distance to the rest of the network and making it easier to forge new and diverse connections.

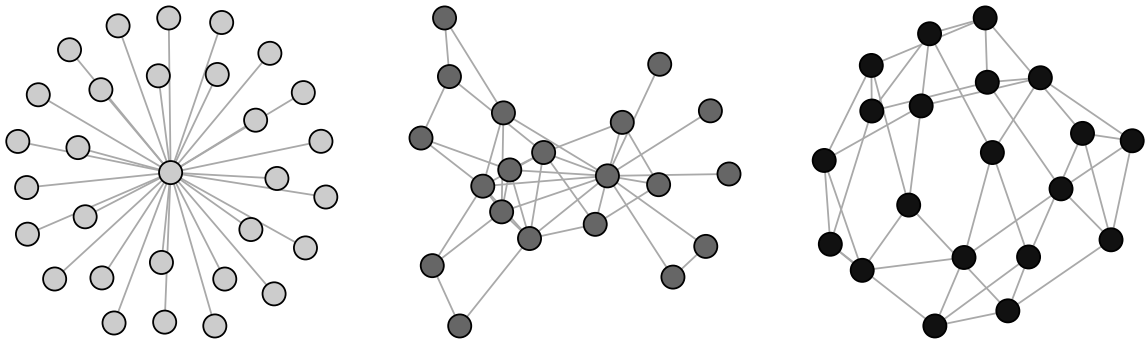

Figure 9: Network centralization examples. (a) is a highly-centralized "star" graph, where one actor receives all the connections. (b) is a relatively centralized graph, where a few nodes receive most of the connections. (c) is a relatively decentralized graph, where most nodes have the same number of connections.

This characteristic of networks is directly relevant to the making of artistic prints. On the one hand, the medium of printing demanded a set of artistic and technical skills,

not to mention a set of social connections and financial capital, that presented a barrier to new entrants into the printmaking world. Print production required several types of knowledge that could only be gained through sustained experience. Differences between printmaking techniques like woodcut, engraving, and etching could present challenges even to highly skilled artists. Albrecht Dürer, for example, seems to have only experimented briefly with etchings compared to his prolific output of woodcut and metal engravings, which suggests that he found the technique to be a poor match to his established skills.[7] Painters like Peter Paul Rubens or Abraham Bloemaert, who instead entrusted the cutting of an engraving plate to dedicated printmakers, had to carefully select an engraver who could successfully render the painter's distinctive hand into the printed medium. This requirement led to the rise of some star engravers who had a reputation for their ability to faithfully reproduce a painter's style, such as Boetius Bolswert, engraver of prints after designs by Bloemaert, Rubens, David Vinckboons, and Michel Mierevelt.[8] Print distribution presented yet another hurdle to new entrants to the market. Publishers gained a competitive advantage by having a large pool of contacts, both with artists as well as with distributors and buyers in domestic markets and at the international book fairs. All these requirements may have made it more likely that a few centrally-connected individuals would continually increase their number of contacts in a rich-get-richer pattern of increasing centralization.

Evidence suggests that printmakers and publishers in the sixteenth and seventeenth centuries were quite conscious of these kinds of network effects, and developed different strategies to respond to them. Publishers of books with intaglio illustrations

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7. Susan Dackerman, "Dürer's Etchings: Printed Drawings?," in *The Early Modern Painter-Etcher*, ed. Michael Wayne Cole (University Park: Pennsylvania State University Press, 2006).

8. On Bolswert, see Nico van Hout and Paul Huvenne, *Copyright Rubens: Rubens en de grafiek* (Ghent: Ludion, 2004).

may have felt these demands most dearly, and serve a useful illustration of the logistical challenges print publishers faced. Like publishers of single prints or standalone series, they needed to coordinate the production of a large series of images, sourcing copper plates, commissioning designs and engravers, and ensuring they were correctly printed (often by a third party printer). The complexity of these efforts were compounded when carried out in parallel with the printing of text, which required an entirely separate infrastructure of platen presses with text blocks, in addition to the roller presses used for making impressions from copper plates.

Christopher Plantin was one of the first publishers to excel at *profitably* producing books with intaglio illustrations in the mid-sixteenth century in Antwerp. The technical knowledge of how to correctly register intaglio print impressions within already-printed text pages was not novel in this period. What set Plantin apart was his ability to coordinate all the necessary third-party labor consistently. This logistical acumen minimized financial costs as well as delays, which were one of the most ruinous roadblocks in publishing. As Plantin once lamented, production delays and labor shortages presented, "innumerable problems to find and keep engravers who are often depraved, pernickety, difficult, and do not keep their promises."[9] Plantin's wide array of connections to draughtsmen, platecutters, and specialized intaglio printers made it possible for him to keep several engravers on retainer, which mean that he could apportion them to projects as necessary.[10] Plantin understood that maintaining a large

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9. Plantin was almost certainly referring to his troublesome experience with the brothers Jan and Hieronymus Wierix; Karen L. Bowen, *Christopher Plantin and Engraved Book Illustrations in Sixteenth-Century Europe*, in collab. with Dirk Imhof (Cambridge: Cambridge University Press, 2008), 363.

10. ibid., 22–25, 54–55. Plantin also employed three different intaglio printers during his career: Pieter Huys (who also produced plates for him), Mynken Liefrinck, and Jacques van der Hoeven. Another case study on the negotiation between ambitious authors and the logistical constraints faced by publishers is described in Dirk Imhof, "An Author's Wishes Versus a Publisher's Possibilities: The Illustration of Thomas Sailly's Prayer Books Printed by the Plantin Press in Antwerp c. 1600," in *Illustrated Religious Texts in the North of Europe, 1500-1800*, ed. Feike Dietz et al. (Burlington: Ashgate, 2014), 205–220.

number of contacts, thus placing himself in a central position within a larger network, gave him a commercial advantage.

On the other hand, several factors at both the individual as well as the societal level may have instead encouraged a less centralized printmaking network. A nascent printmaking community with a relatively small population of printmakers and publishers might well have had just a few relatively skilled, experienced, and professionally-established individuals occupying very central positions. But such a structure could be transient. As the number of constituents increased, those experienced, highly-central players would necessarily take on apprentices and commission less-experienced collaborators. Knowledge is not a fixed quantity; as printmaking opportunities expanded, more and more of those less experienced artists could have learned the technical skills necessary to succeed in the medium. Likewise, a greater number of knowledgeable publishers would be able to create their own local connections without relying on the established knowledge and social connections of a printmaking "elite". As a result, what began as a highly-centralized network could, over time, evolve into a much more distributed one.

Once again, we have anecdotal evidence for this type of behavior. Talented and ambitious printmakers often strove to expand their own range of connections, moving from a peripheral position associated with just one powerful publisher, to becoming influential brokers themselves, able to publish their own designs and those of others. The sixteenth-century Antwerp brothers Hieronymus and Johannes Weirix certainly pursued this role. They worked almost exclusively for Plantin early in their careers. However, as their own professional stars rose, they began to reject Plantin's commissions, as they found they were able to secure higher fees by shopping their talents around to a number of different publishers.[11] The Wierixes in the sixteenth

11. Bowen, *Christopher Plantin*, 50–51.

century and the Bolswerts in the seventeenth century were essentially following the same pattern of behavior. Many engravers were already angling for independent positions where they could publish their own work or set their own prices. This might explain why Plantin tended to hire young engravers who were not yet able to stake out on their own. They needed this experience in order to leverage even better professional positions for themselves. Plantin, for his part, needed easy access to accommodating labor.

There is anecdotal evidence for more decentralized print production, too. While prominent publishers like Christopher Plantin or Hendrick Hondius exercised careful control over all aspects of printmaking, from design to plate cutting to distribution, there were alternative channels for print production that did not include the coordinating hand of a professional publisher. In 1616, a witness at an Amsterdam court described a German man seen visiting print shop of Nicolaes van Geilkercken, where he ordered a print to be made from a chalk drawing. Notably, the German only wanted Van Geilkercken to cut the image; he may have intended to commission a calligraphic inscription for the print elsewhere.[12] This anecdote reminds us that print production did not have to be centralized within one studio, or even limited to a tightly established cooperative between painter, designer, and publisher. There was apparently enough room in the printmaking market for low-end specialists to participate, and for individual consumers of certain means to direct the production of their own prints. A burgeoning Dutch economy in the first half of the seventeenth century may have contributed to this decentralization by supporting print markets in smaller Dutch towns, thus enabling a more decentralized network of print producers

12. Nadine M. Orenstein et al., "Print Publishers in the Netherlands: 1580-1620," in *Dawn of the Golden Age: Northern Netherlandish Art 1580-1620*, ed. Ger Luijten and Ariane van Suchtelen (Amsterdam: Rijksmuseum, 1993), 167; the original document is published in J. G. van Dillen, *Bronnen tot de geschiedenis van het bedrijfsleven en het gildewezen van Amsterdam*, 3 vols. (The Hauge: M. Nijhoff, 74 1927), vol. 2, no. 264.

with a wider geographic spread. Michael Montias has shown how economic prosperity in the early decades of the seventeenth century may have promoted a burst in painting activity between 1630 and 1650 in Delft, a market that was relatively decentralized, with little institutional patronage compared to other contemporary artistic centers.[13] Might the same effect have changed the production pattern of prints as well?

On paper, these contradictory incentives are both plausible; indeed, they both may have been operating in parallel between 1550 and 1750. Can we determine, though, which incentive (if either) won out? Using the empirical evidence offered by the British Museum and Rijksmuseum print databases, I will show how the balance of these centralizing and decentralizing incentives may have played out over the seventeenth century.

2.2 Data on Artistic Prints

The rich collections of Dutch and Flemish prints in the British Museum (hereafter BM) and the Rijksmuseum (hereafter RKM) present an excellent opportunity to bring quantitative methods to bear on data concerning prints. It must be noted that while these institutions have especially rich holdings, particularly in Dutch prints, no one print collection can be said to be perfectly "representative" of the full range of actual connections between printmakers in the sixteenth and seventeenth century. There are two major, though not insurmountable, biases in these datasets. First, the relationship between historical print production and the collections of prints found in the modern-day BM and RKM is distorted by the independent histories of collecting unique to each institution. This distortion can be mitigated, however, by comparing two distinct

13. Montias, *Artists and Artisans in Delft*, ch. 7.

sources of data about the same phenomenon.[14] By running the same analysis on both datasets, it will be possible to easily compare the results offered by both sources. Many of the results presented below are shown twice: once for measurements derived from the BM dataset, and once for those derived from the RKM dataset. Where similar results are returned by both the BM and RKM datasets, we can at least reject the claim that the results are *solely* artifacts of collecting preferences specific to each museum.

Second to the source-specific biases of each dataset is the larger question of historical distortion inevitably shared by *both* institutions. This study will have to contend with the same unknown unknowns that plague any historical investigation. Because of paper impressions' fragility, prints likely have a very uneven survival rate, and it would be unwise to take modern day collections as a proxy for the absolute sizes of editions and print runs in the sixteenth and seventeenth centuries.[15] That said, the reproducibility of prints does grant one advantage. Peter Parshall has endorsed the idea that, if the exact sizes of *print runs* are not accurately represented in modern day print collections, we can nevertheless understand a great deal about overall *patterns* of production because the survival rate of a given print that has been reproduced several times is much greater than that of other non-reproducible artifacts. In 1998, Parshall suggested that the voluminous evidence of today's museum print rooms, could be invaluable for research if only it could be aggregated and analyzed fluently.[16] We now have that capability.

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14. For an effective demonstration of this technique, see De Vries, "Art History," 259–260.

15. Future work may involve applying statistical models of survivability to thinking about the loss of prints, possibly based on surviving archival evidence about the sizes of original print runs; see, for example, Karen L. Bowen and Dirk Imhof, "18,257 Impressions from a Plate," *Print Quarterly* 22, no. 3 (September 2005): 265–279.

16. Peter Parshall, "Prints as Objects of Consumption in Early Modern Europe," *Journal of Medieval & Early Modern Studies* 28, no. 1 (Winter 1998): 21.

Both the BM and the RKM have published the cataloged information for their collections as structured digital data.[17] These data include object-level descriptions such as creators and their various roles, title, date, medium, dimensions, and subject matter. For printed artworks, each database details (when known) the artists who produced the original design for the print, the printmaker who cut the woodblock or plate, and, when applicable, the publisher who printed and distributed the artwork. The BM database describes 49,205 print impressions dated between 1550 and 1750. The RKM database describes 45,120 print impressions from the same period. These numbers represent records that have been assigned dates, and which also have at least two identified creators.[18] Each database also contains biographical information on the creators associated with these prints, including classifications by nationality. (Table 1)

Table 1: Count, by nationality, of artists born between 1500 and 1750 as represented in the BM and RKM databases.

Nationality	BM artists	RKM artists
Dutch	874	606
Flemish	494	281
English	1,149	153
French	1,162	410
Italian	1,061	480
German	944	390

17. On the BM Linked Open Data initiative, see Oldman et al., "Realizing Lessons of the Last 20 Years." What documentation is available for the RKM data may be found at http://rijksmuseum.github.io/.

18. For the handling of unknown creators, see appendix A.1.

2.3 Methodology: Inferring Print Production Networks

In the previous chapter, I recounted several examples of historical network analyses. In each of the studies, researchers inferred a network for analysis by establishing a source of evidence, and following a set method for identifying what elements of that evidence would serve as the *nodes*, or agents within that network, and what evidence would be used to establish *edges*, or connections between those nodes. I will return to two examples now in order to illustrate this process, before explaining the particular process for constructing this print production network.

In the case of Padgett and Ansell's research on Florentine familial networks, the authors worked from archival records dating between 1400 and 1434 to establish a network whose nodes were separate families (e.g. The Medici, the Albizzi, the Peruzzi). The edges between them were marriages, employment in family-owned businesses, real estate transactions, or loans.[19] In the case of Stiller et al.'s analysis of character networks in the plays of Shakespeare, each play was taken as the basis for a separate network. Nodes were individual characters within a play, and an edge was established between characters when they appeared on stage together.[20]

The same can now be done using these print collections. From these individual artwork records, it is possible to construct a digital model of a network that represents the inferred social connections between these artists.[21] In this network, artists (the *nodes* of the graph) are connected (by *edges*) when they are associated with the production of a print in one of three general roles: *designer* (either as an active

19. See section 1.1, page 20.

20. See section 1.1, page 23.

21. Only a high-level discussion of how I have inferred this network will be presented in this chapter text. More detailed specifics can be found in appendix A.

participant, or simply "made after"), *printmaker*, and/or *publisher*. These three roles encompass 97% of the artistic ties as described by the BM for the set of prints under consideration, and 77% of all ties described by the RKM.[22] A single print may thus provide a basis for connecting designer, engraver, and publisher nodes at a particular point in time. Dozens or hundreds of prints support the construction of a larger network. The basic process for this construction entails the following steps:

1. Create small sections, or time-slices, of the production network as it may have existed at different points in time.
2. From these time-slices, calculate various metrics on the network as a whole.
3. For each individual within each of these time-slices, calculate various metrics for that given individual at that point in time.

Rather than construct a large network looking at every print in the BM and RKM databases at the same time, I will use a rolling window approach to construct many "slices" of the network as it existed at different points in time and compare changes in certain network characteristics over time. (Figure 10) For example, a slice of the network between 1645 and 1655 would include all artists who were alive at some point during that ten year interval.[23] These artists will only be connected by edges derived

22. Details on various types of production roles can be found in appendix A.2.

23. The interval of ten years is somewhat arbitrary. I have selected it because it strikes a good balance between granularity and generality, and also falls within the rough art historical convention of using "circa" to mean ± five years.

from what prints were being produced during that same 1645–1655 interval.[24] (Figure 11) The resulting network will be unweighted and undirected.[25]

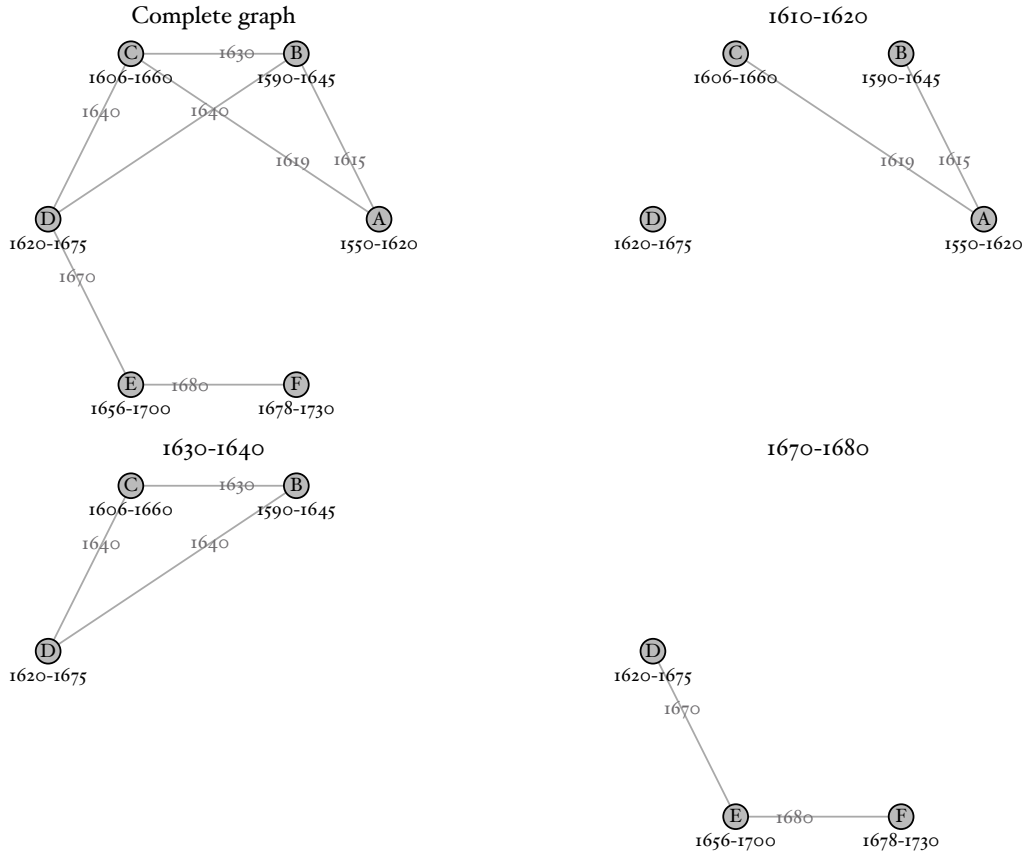

Figure 10: Visualizing the method for creating time slices of the historical print production network. Each node in the graph is an artist, engraver, or publisher, and links are formed when two artists both worked on the same print.

Constructing each time slice of the network in this way does simplify one important aspect of print production: that printmakers could reproduce designs of artists who were no longer alive, and, furthermore, that publishers could purchase and republish plates by printmakers who were no longer alive. In anticipation of this problem, I ran

24. Both the BM and RKM databases specify a "start date" and "end date" for artworks. Most artworks have only one date of production associated with them; in these cases, "start date" and "end date" are equal.

25. On directed versus undirected networks, see appendix A.3; on network weighting, see appendix A.4.

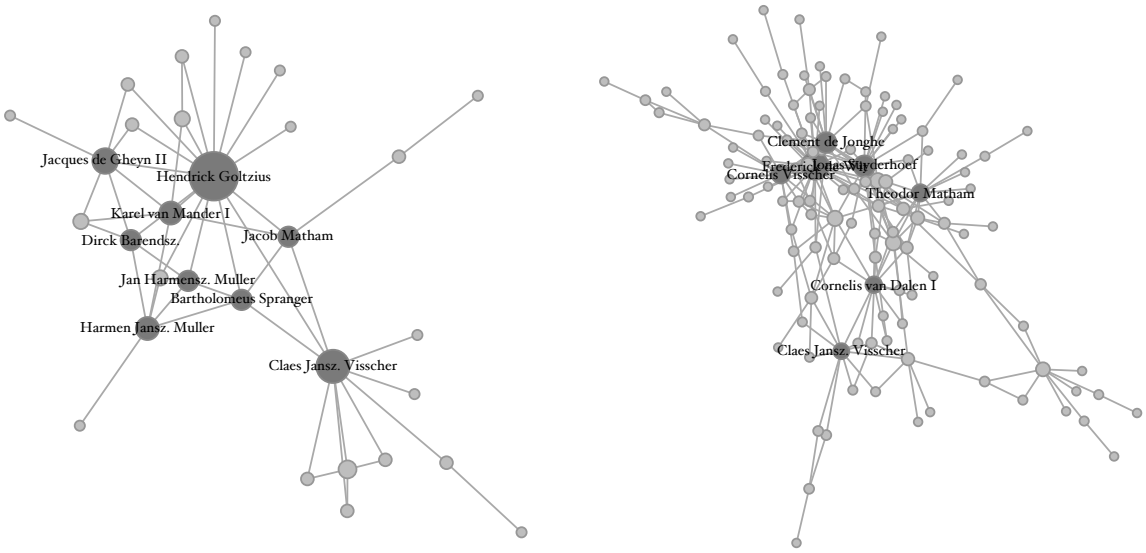

Figure 11: Visualizations of the core components of two Dutch network time slices, with some of the most central figures labeled.

all analyses in this chapter and the following ones twice: once using this "alive only" method of time slice construction, and once constructing each slice by including all artists who had been born up to that date, including ones who had already died. For all the metrics considered in this and those that follow, the choice to exclude dead artists from the network analysis had only a marginal effect on the observed statistics such as centralization. For the sake of visual legibility, all the figures shown here, unless otherwise noted, are based on networks constructed using the "alive only" method.

I also want to focus on the particular subsection of the broader European print production network comprising Dutch and/or Flemish artists. Therefore this chapter

will only consider professional connections inferred from objects that had at least one Dutch or Flemish creator.[26]

Having created national sub-networks from each time slice, we can compute their graph centralization scores.[27] The higher score, the more centralized a graph is; the lower the score, the more distributed it is. It is also possible to characterize centralization at the scale of the individual. An individual node's degree centrality characterizes how many different connections it has to other members of the network.[28]

2.4 Results: A Mixed Message

Figure 12 displays the changing network centralization score for the Dutch and Flemish communities of print producers between 1550–1750, contrasting that metric with number of participants in the network (nodes) and the changing number of connections between them (edges). Results from both the BM and RKM datasets are overlaid. While there are several local differences between the BM and RKM results, they are generally consistent with each other, providing some measure of confidence that the

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26. The dynamics of international connections will be discussed at greater length in chapter 3. For more on the challenges of describing nationality in the early modern period, see section 3.2.

27. Freeman defines graph centrality by summing the difference of each individual nodes' degree centrality $C(p_i)$ to that of the most-central node $C(p^*)$, normalized based on the size N of the network:

$$C(g) = \frac{\sum_{i=1}^{N} C(p_i) - C(p^*)}{N^2 - 3N + 2}$$

Linton C. Freeman, "Centrality in Social Networks: Conceptual Clarification," *Social Networks* 1, no. 3 (1978): 226–237, doi:10.1016/0378-8733(78)90021-7.

28. There are several other more subtle methods for measuring centralization, such as betweenness, closeness, or eigenvector centrality. The basic measure of degree centrality is useful for this particular question because we are interested in looking at the basic numbers of collaborators that these network participants had, rather than more complex 2nd-degree or nth-degree relationships whose meaning in this co-production network is more ambiguous.

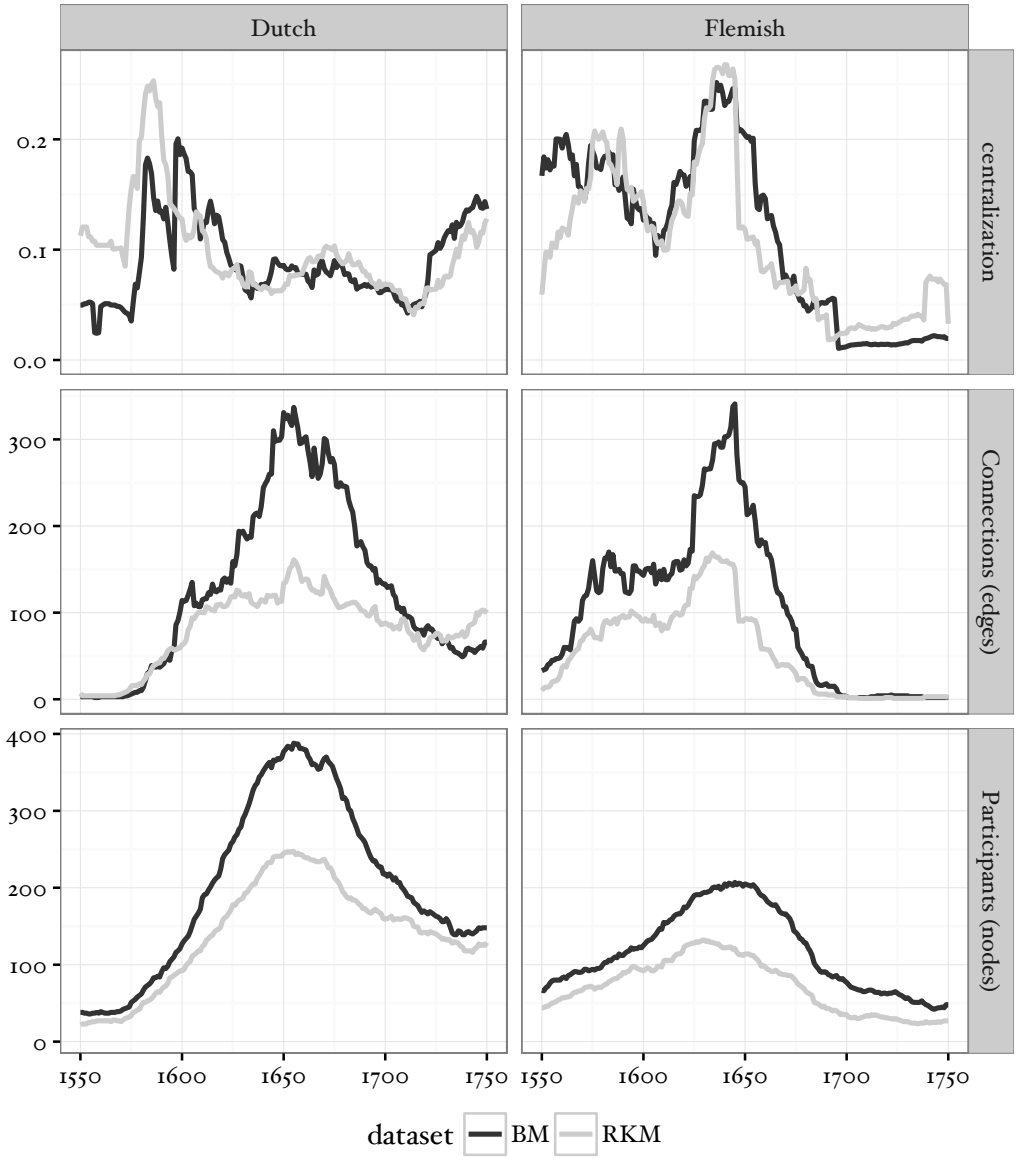

Figure 12: Comparison of the changing centralization of the Dutch and Flemish print production network between 1550–1750 with the changing number of participants in the network (nodes) and the changing number of connections between them (edges) over the same period.

result we are seeing is partially representative of actual historical trends, and not solely an artifact of the individual collecting practices of either the BM and RKM.

We see a gradual rise and fall in the number of active printmakers over the sixteenth and seventeenth centuries. However, the networks of both Dutch and Flemish printmakers fluctuated sharply between relative centralization and decentralization during the same period. In the northern Netherlands, centralization was generally low through most of the sixteenth-century, spiking rapidly around 1575, with another spike at 1600, before falling quickly down to earlier levels by about 1650. With small variations, the Dutch network centralization remained at relatively consistent levels from then until about 1720, when it once again quickly increased.

The southern Netherlands, by comparison, exhibited a much higher level of centralization in the mid-sixteenth century than did the Dutch. In 1550, the Flemish network also had more participants than did the Dutch. However, the population of Flemish printmakers increased only gradually through 1650, the number of active Dutch printmakers surpassing them in 1600. By 1650, the number of Flemish printmakers began to decline. Despite the smaller number of active printmakers, the print production of the southern Netherlands easily rivaled that of the north, experiencing an especially sharp increase between 1625 and 1645. Flemish centralization gradually declined until shortly after 1600, when that network experienced its own sharp spike in centralization at the same time as it saw a dramatic increase in the number of prints being made by Flemish artists. This spike was short-lived, however, and by 1650 the Flemish print production underwent relatively quick decentralization as soon as this brief printmaking boom wore off, dropping to very low levels by 1675 as it diminished greatly in size and activity.

Both the Dutch and Flemish results suggest that both the centralizing and decentralizing incentives posited above *did* have their effect in the sixteenth and seventeenth

centuries, but that the incentives towards *decentralization* won out — at least in the long run. This would seem to confirm Landau and Parshall's claim that the highly-centralized model that Hieronymus Cock constructed in Antwerp was an immense success in its own time. But these initial results also undermine the notion that printmaking would inevitably necessitate highly centralized production in the following centuries. If printmaking, as a medium, encouraged high centralization at the local level, with printmaker-publishers amassing a wide range of contacts, why did this not result in persistently high centralization at the regional level? What is more, these results also suggest the surprising speed with which these structural shifts could occur. The gradual changes seen in the network population would indeed appear to mask more dynamic upheavals in actual network concentration.The change in centralization, on the other hand, was far more abrupt.

Unaccustomed to thinking of our subject matter in terms of unpredictable systems, art historians may be surprised to find such rapid structural changes in networks involving hundreds of artists, printmakers, and publishers. Why would the Dutch printmaking network have centralized so abruptly, only for this intense focus to rapidly dissipate within a generation, even as the volume of Dutch print production continued to increase? This type of "phase change" behavior, where marginal changes in one set of characteristics catalyze a much more dramatic change in another measurement, are common characteristics of complex systems like social networks.[29] This raises the question: which of these changes might signify the influence of some outside event or other fundamental change in the ways in which these designers, printmakers, and publishers connected to each other? (e.g. were certain publishers or printmakers able to attract far more students or collaborators than we might expect given the size of that

29. Watts, *Small Worlds*, 53.

network?) And which changes are just the kinds of shifts we might find in any other networks of the same size that follow a similar, rich-get-richer pattern of connection?

2.4.1 Random Networks: Distinguishing the Exceptional from the Expected

Stiller et al. faced a similar problem in their research on Shakespeare's character networks. They aimed to find which plays had unusually densely—or sparsely—connected character networks, and how these compared to other kinds of non-play networks. To do this, they compared metrics calculated from each play network to the metrics found in randomly-generated networks of similar sizes.[30] This made it possible to isolate those truly exceptional plays, like *Richard III*, that exhibited quite different characteristics from networks of the same size that had been generated at random. In other words, Shakespeare had connected characters in *Richard III* in a manner very different from the way he had done so in other plays, and in a way that could not be accounted for simply by looking at the number of characters and interactions in the play's character network.

While Stiller et al. were comparing differences between different plays, we want to compare the state of the print production network at different points in time. In which years were these networks about as centralized as we would expect for a network of similar size, and when were they much more (or less?) We can do this by running the same centrality measurement on a random network of the same size as each network time slice (that is, with the same number of nodes and the same number of edges) derived from the BM or RKM data. Links between any two nodes in this graph are generated based on a *power law probability distribution*.[31] It produces a graph such that

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30. Stiller, Nettle, and Dunbar, "The Small World of Shakespeare's Plays," 401–404.

31. A probability distribution assigned the probability that a variable will have a particular value within a particular range. Different types of probability distributions weight probabilities differently. For

a handful of nodes have a very large number of connections, and the majority of nodes make very few connections. This distribution of edges creates a network similar to the kind that we have observed in the print production networks: a rich-get-richer scenario, where a few actors make and receive the majority of connections. Because random graph generation is stochastic, the same simulation run twice with the same inputs will produce slightly different outputs. (Figure 13 (b-f)) Run many times, a randomized simulation will tend to produce values that fall within a certain range, with many iterations producing values close to some average, and a few iterations producing outliers.

Figure 14 compares the centralization values returned by these random graph models to those found for the Dutch and Flemish communities in both the BM and RKM datasets. The shaded bands indicate the range occupied by 90% of the most central values produced by random graph sampling (thus excluding the most extreme outliers). The black trend line represents the actual centralization value measured from the data at each year. These bands indicate how centralized random networks of the same size tend to be.

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example, in a *uniform probability distribution*, all possibilities have an equal probability. In the context of making connections within a network, a uniform distribution of ties means that all nodes in the network will have an equal chance of making or receiving a connection. On the other hand, a *power-law probability distribution* describes the distribution of some set of ranked occurrences in which small occurrences (e.g. people with only a few social links) are extremely common, whereas large instances (e.g. people with a huge number of social links) are extremely rare.

The model implemented here sets the connection chance, or fitness f, of node n_i such that:

$$f_{n_i} = i^{-\frac{1}{\gamma-1}}$$

The exponent γ determines the skew of the probability distribution. In this context, the skew governs precisely how attractive well-connected individuals are to new entrants to the network, with a larger skew denoting a stronger attraction. A γ of 2.25 provides a close fit for almost every network shown here. On this model for generating random networks, see Albert-László Barabási and Réka Albert, "Emergence of Scaling in Random Networks," *Science* 286, no. 5439 (October 15, 1999): 511, doi:10.1126/science.286.5439.509, and the R implementation in G. Csardi and T. Nepusz, "The igraph Software Package for Complex Network Research," *InterJournal* Complex Systems (2006): 1695, http://igraph.org.

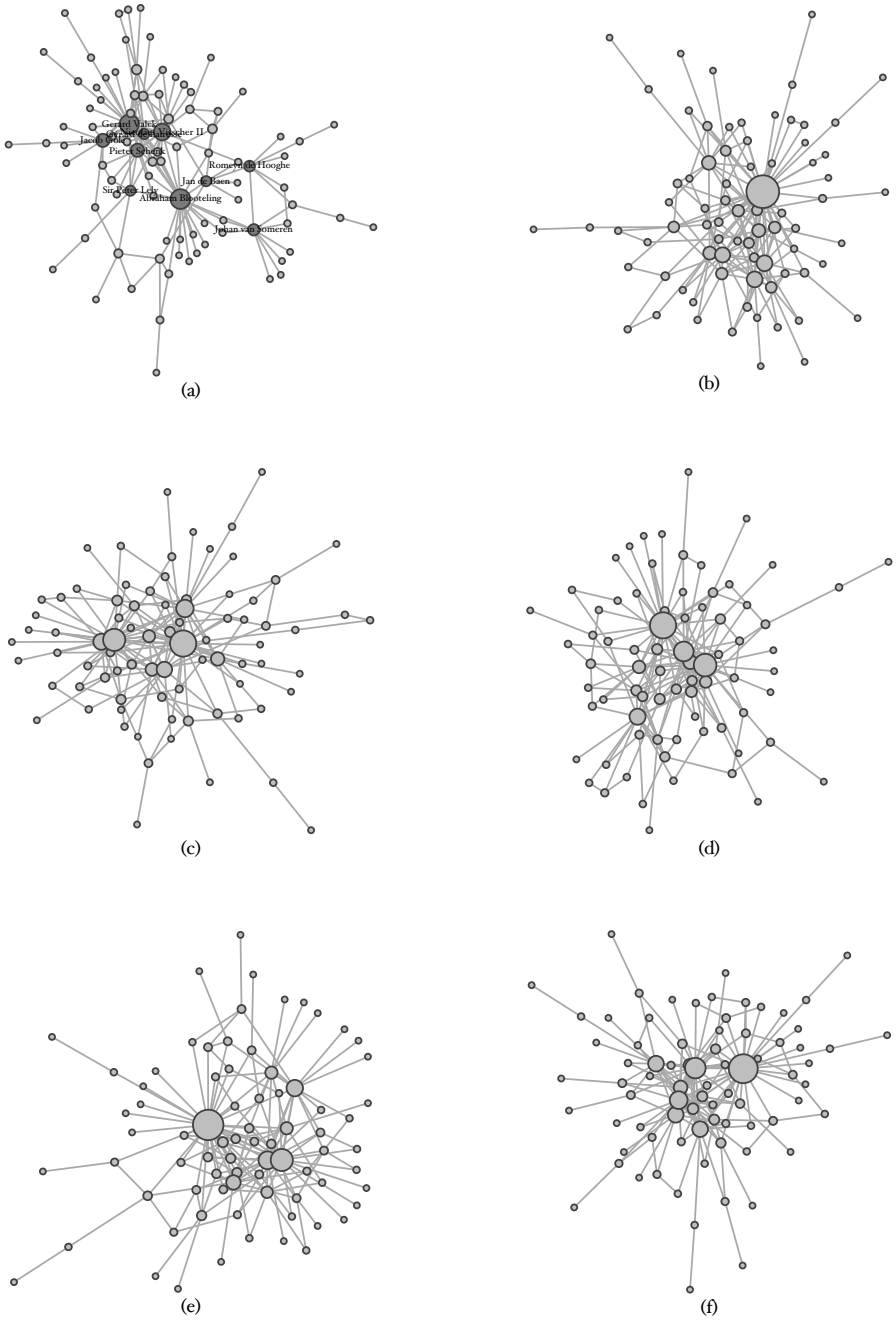

Figure 13: A visualization of random graph generation. (a) is the network generated from the BM data between 1640–1650. (b-f) are five randomly generated networks with the same number of nodes and edges as (a).

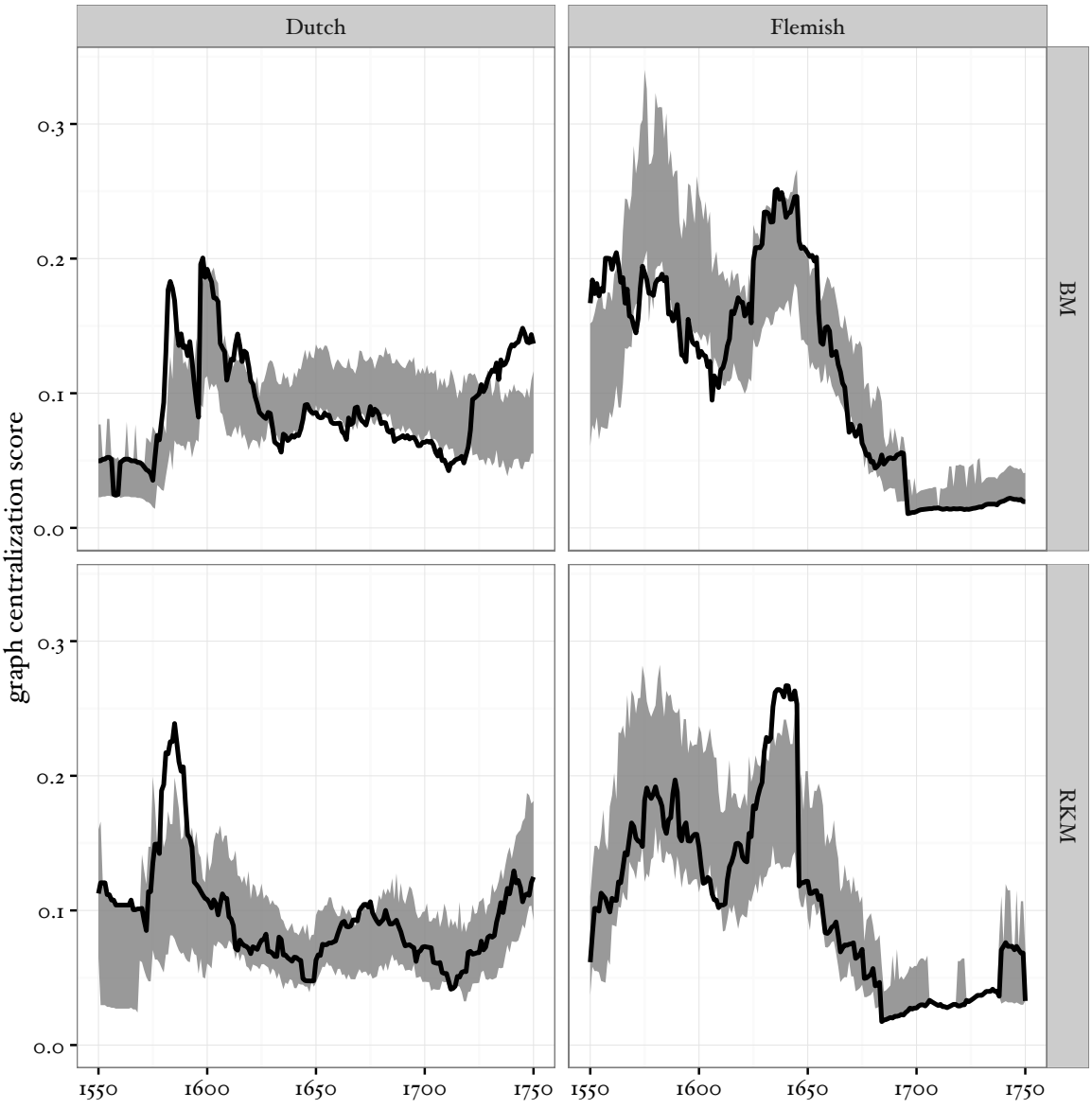

Figure 14: Comparing observed results with random graph results.

Both the BM and RKM datasets are largely congruent. Moreover, we find that many of the sudden changes in Dutch and Flemish centralization through the sixteenth and seventeenth centuries are surprisingly consistent with the results returned by random graph sampling. Even as observed levels of centralization shifted dramatically over this period, the basic attractiveness of well-connected individuals (the exponent λ of the power law probability distribution) remained essentially constant between 1550–1700. In other words, for all the apparent fluctuations in the printmaking networks in the northern and southern Netherlands, the simple incentive for printmakers to seek out well-connected collaborators appears to have been nearly constant through the end of the seventeenth century. This constant, coupled with the gradual changes in the sizes of these networks, could result in surprisingly sudden shifts in network structure. So, while the thesis that highly centralized printmaking of the sixteenth century would continue through the seventeenth century was not correct, its underlying assumption about the connective incentive of print production *did* persist.

Not every year of empirical data lines up with the random graph results, however. Not all these changes, in other words, were due to the shifting size of these communities alone. The first deviation, which appears in both the BM and RKM results, occurs in the Dutch network around 1580, with a spike in centralization that does not occur in the random graphs with the same number of nodes and edges. Another major aberration occurs in the BM results (though not the RKM model), where, around 1720, the model under-predicts the jump in centralization experienced by the Dutch network.[32] In the Flemish network, a large spike is observed around 1640 that exceeds the centralization shown by random graph sampling.

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32. This particular anomaly may be explained by the arrival of Bernard Picart, who established a highly-centralized school in Amsterdam, the *Amsterdamse tekenschool*, for training engravers. See section 3.4.4.

What (or who) may have caused these deviations? And what effect might these larger structural changes, whether predictable or not, have had on individual artists? That is the question we now turn to.

2.5 Case Studies in Centrality

Having calculated the overall level of centralization in the Dutch and Flemish print production networks above, it is useful to disaggregate these larger networks and look at the changing positions of the individual artists within them, both in the north and in the south.

Figure 15 shows the most central members of the Dutch print production network at different points in time.[33] Many of the most central artists in each of these years are well-known names, such as Hendrick Goltzius, Claes Jansz Visscher, Hendrick Hondius, and Frederick de Wit. However, other highly central artists are relatively unknown, such as Abraham Blooteling and Jonas Suyderhoef. Though each held relatively central positions in their own time, their respective networks were radically different from each other. We must ask how the experience of being "central" in the printmaking network had changed between the end of the sixteenth century and the start of the eighteenth. Three case studies of Hendrick Goltzius, Hendrick Hondius, and Jonas Suyderhoef, will explore the impact that these individual artists may have had on the larger network, while also reevaluating how the broader shape of the network may have affected these artists' individual decisions.

33. This sampling of years is somewhat arbitrary, but does provide a relatively even overview of the time period under consideration.

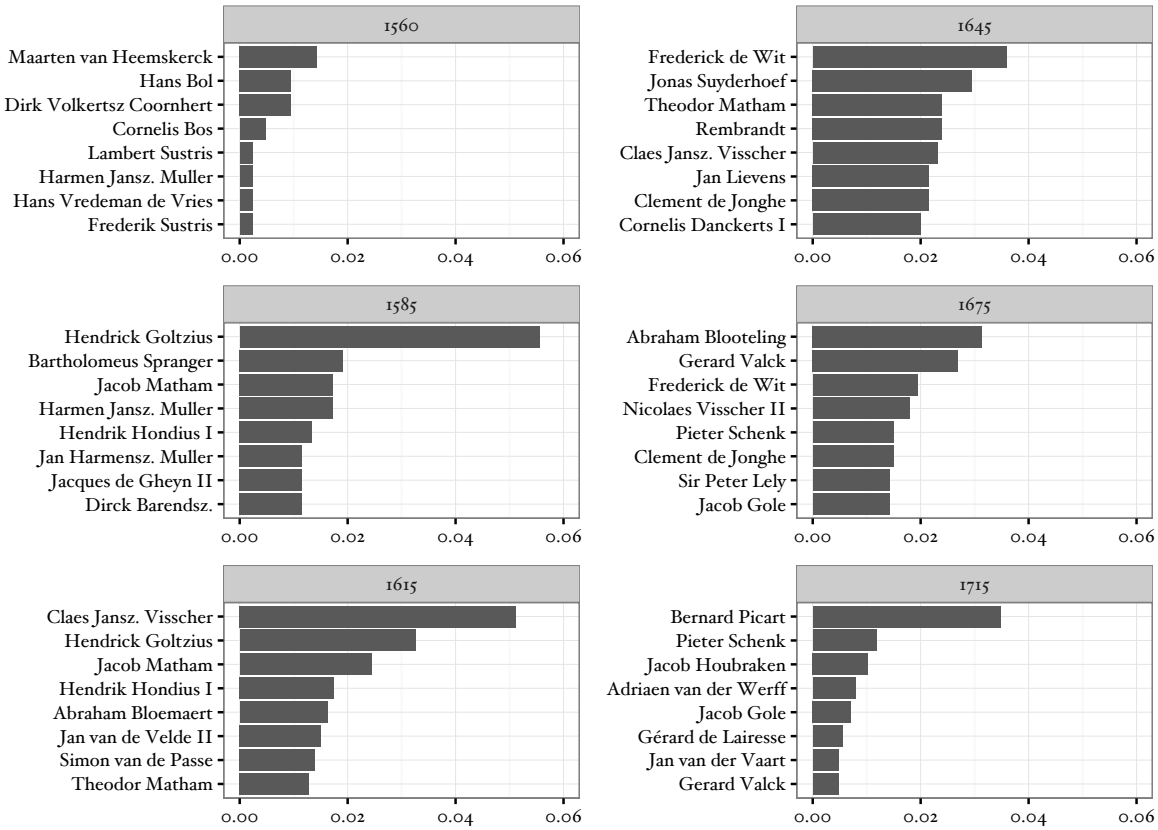

Figure 15: The top most central members of the Dutch printmaking network in the years 1560, 1585, 1615, 1645, 1675, and 1715, ranked by their degree centrality (BM Dataset)

2.5.1 Hendrick Goltzius and His Studio

In 1582, Goltzius left the employ of Philips Galle to begin his own independent studio in Haarlem.[34] Goltzius assembled a large group of engravers who learned to emulate his distinctive style in order to produce prints from Goltzius' own designs. The Goltzius studio quickly became one of the foremost print producers in the northern Netherlands at that time. Perhaps the most talented of Goltzius' pupils was Jan Saenredam, an engraver who came to work in Goltzius' shop in 1589, relatively late in his life. Saenredam had an exceptional grasp of the technicals of engraving. More so than his fellow students, Saenredam seems to have inherited his teacher's ability to bend the rigid and difficult technique to his will, rendering highly coloristic prints with deft handling of light, shadow, and volume. Saenredam put these talents to use executing a number of late Goltzius designs that featured single or paired allegorical figures. (Figure 16) After Goltzius turned to painting in 1600, his stepson Jacob Matham took over the Haarlem shop. Saenredam had returned to his hometown of Assendelft in 1595, where he began to produce prints after his own designs, while continuing to engrave plates for others, including the prolific painter and draughtsman Abraham Bloemaert.[35] Like the other printmakers who had worked with Goltzius, Saenredam was able to establish his own career as an independent printmaker. However, he never built a firm as large and renowned as Goltzius had, nor did he attract a large school of students. He also did not publish his own prints independently, but instead worked with third parties to have

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34. On the Goltzius studio, see Jan Piet Filedt Kok, "Hendrick Goltzius: Engraver, Designer, and Publisher 1582-1600," *Nederlands Kunsthistorisch Jaarboek* 42-43 (1991): 159–218; Leeflang, *Goltzius*, ch. 4.

35. Walter L. Strauss, ed., *Netherlandish Artists: Matham, Saenredam, Muller*, 2 vols., The Illustrated Bartsch 4 (New York: Abaris Books, 1980); Ilja M. Veldman, "Maurice as the Nimrod of his Age: Political Propaganda Prints by Jan Saenredam," *The Rijksmuseum Bulletin* 58, no. 2 (January 2010): 128–137.

his plates printed.[36] In the following decade, other Goltzius students also moved away from Haarlem and established their own engraving practices or full publishing houses. Jacob de Gheyn moved to Amsterdam, as did Jan Harmensz Muller, who inherited his father's publishing firm. Willem Jacobsz Delff returned to his hometown of Delft, and Pieter de Jode returned to Antwerp.

Goltzius made an enduring contribution to engraving styles and techniques, as well as to the overall artistic standing of prints in the Netherlands and beyond. But his firm also had a dramatic impact on the future structure of the Dutch printmaking network — an impact due in large part to the timing of his career. Goltzius' well-deserved reputation as a masterful printmaker attracted apprentice engravers from many different cities in the northern and southern Netherlands. This attractive power was truly exceptional. The rise of Goltzius and his studio likely explain that remarkable surge in centralization seen around 1580, one that exceeded what we might have expected in randomized networks of the same size. When Goltzius opened his firm in the mid-1580s, no Dutch competitors were as centrally-placed as he was, with connections not only to his own group of Dutch printmakers, but also to foreign publishers and commissions. Any aspiring printmaker or publisher looking for a partner in the northern Netherlands would have had few choices as attractive as Goltzius' Haarlem studio.

The highly centralized "star power" that attracted so many aspiring engravers to apprentice with Goltzius in the last decades of the 1600s likely primed the network for its speedy decentralization in the following decades. The following generation of printmakers had built up enough artistic and technical knowledge to allow the print network to spread out, increasing the number of relatively competitive printmakers

36. Several of his later prints bear the Amsterdam address of Hermann Allartz, of whom little is known; Ernst Wilhelm Moes and Combertus Pieter Burger, *De Amsterdamsche boekdrukkers en uitgevers in de zestiende eeuw* (Amsterdam: M. Nijhoff, 1915), 4:324–49.

Figure 16: Jan Saenredam, after Hendrick Goltzius, *Evening*, c. 1595. Engraving, 21.1 x 15.1 cm. National Gallery of Art, Washington. (Image courtesy National Gallery of Art, Washington.)

and thus decentralizing the overall network. To be sure, there would still be well-connected members of the network in the wake of Goltzius. However, after the surprising spike in centralization during Goltzius' most active period running his own print shop, the Dutch print production network returned to a level of centralization to be expected for a network of its size. Claesz Jansz Visscher would inherit Goltzius' position as the most central print producer (both as engraver and publisher) in the network of 1615, but he would not dominate the network to quite the same extent as Goltzius had. Printmaking dynasties like the Visschers and, to a lesser extent, the Mathams, were able to maintain relatively central positions throughout the century. For example, in 1640, Jacob Matham's son, Theodor (1605/6–1656) had risen to become the most well-connected member of the Dutch network, working in Amsterdam and specializing in engraving large figural scenes.[37] Claes Jansz Visscher and his progeny also feature prominently in the list of highly central Dutch print producers well into the 1600s, with Claesz holding prominent positions in 1600 and 1640, and his son Nicolaes continuing to rank amongst prominent publishers in 1670 like Frederick de Wit and Clement de Jonge.[38] However, even as the Visschers, particularly Claes, would assume powerful positions brokering ties between a large array of other artists, printmakers, and publishers, they would have more well-placed competition than Goltzius ever did. For the remainder of the century, no single individual would occupy as privileged a position in the Dutch network of printmakers as Goltzius did in the 1580s.

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37. Léna Widerkehr, "*Jacob Matham Goltzij Privignus*: Jacob Matham graveur et ses rapports avec Hendrick Goltzius," *Nederlands Kunsthistorisch Jaarboek* 42-43 (1991–1992): 219–60.

38. On the Visscher family, see Huigen Leeflang, "The Sign of Claes Jansz Visscher and his Progeny: The History and Significance of a Brand Name," *The Rijksmuseum Bulletin*, no. 62 (2014): 240–269.

2.5.2 Hendrick Hondius

Hendrick Hondius is also a well-known name in the history of Dutch printmaking who ranks as one of the more central network players in 1615. Nadine Orenstein has argued that Hondius, a successful publisher in Amsterdam, Leiden, and The Hague between 1600–1630, diversified the output of his shop, and thus his connections to the rest of the Dutch market, as a way to distinguish himself in an environment with more and more competing artists.[39] In the first decade that he opened his publishing business in The Hague, he engraved and issued landscapes, and mythological subjects from both northern and southern. He also produced portrait series, as well as several religious and allegorical images. Moving to Leiden in 1604, Hondius took on his first large-scale book illustration project, producing images for Hans Vredeman de Vries' *Perspectiva*. He also continued to produce original designs for landscapes and political allegories and portraits, while also publishing maps and other individual reproductive prints. Orenstein has also noted that Hondius diversified stylistically. He did not enforce the kind of "house style" that so distinguished Goltzius' print studio in the 1580s–90s, but rather commissioned engravers to work in different styles based on the designs they were reproducing, often juxtaposing varying hands by publishing prints by different engravers as part of the same series.[40] Hondius also published many genres of printed materials, from fine art prints (using designs by contemporaries, but also those of old masters whose works he carefully copied or whose old printing plates he had managed to acquire) to book illustrations.[41] Importantly, Hondius also appears to have courted a more domestic market than did Goltzius. He issued more engravings after Dutch

39. Orenstein, *Hendrick Hondius*, 139.

40. Ibid., 18–19, 75.

41. Ibid., 48.

designs than after foreign sources, and he applied to the States General for a printing privilege rather than to a foreign sovereign like Rudolf II, as Goltzius had done.[42]

Figure 17: Andries Stock after David Vinckboons, *Autumn*, published by Hendrick Hondius, 1618. Engraving, 38.5.x 50 cm. Rijksmuseum, Amsterdam.

To what extent did Hondius make these decisions a response not just to the growing size of the print market, as Orenstein argues, but also to the shifting *structure* of that network? As noted above, the size of the print market had been steadily increasing since 1580, and would not peak until 1650. By the 1610, however, the printmaking network in the Netherlands had already passed its most highly-centralized moment

42. Orenstein, *Hendrick Hondius*, 47. This may also have been due to a rise in the number of privileges that the States General dispensed after the Treaty of Münster; see section 3.3.1.

Figure 18: Simon Frisius after David Vinckboons, *Winter*, published by Hendrick Hondius, 1618. Engraving, 38.3.x 50 cm. Rijksmuseum, Amsterdam.

around 1600, and it would continue to decentralize over the rest of Hondius' career. In other words, the growing size of the print network was not a new problem for Hondius; its rapid decentralization, however, was. Hondius faced a print production landscape that was gradually becoming less structurally dependent on central publishers like Claes Jansz Visscher, or even himself.

This topological shift may have made certain professional strategies more attractive to Hondius than others. A more evenly-distributed network of designers, engravers, and publishers would have made it easier for Hondius to diversify his design sources. In a highly centralized network, a given individual has a smaller chance of knowing one of the few, highly-connected actors. As a result, his or her potential connections to other parts of the network are fewer, rendering them more isolated. On the other hand, in a more decentralized network where connections are spread more evenly, the same individual has a better chance of knowing other relatively well-connected actors, in effect reducing his or her distance to the rest of the network and making it easier to forge new connections with a diverse group of actors.

Like Visscher, Hondius began his career in a rather advantageous position, having made many prominent contacts both in Antwerp (though he worked in Holland most of his life, he was born in Brabant) as well as in Cologne and Paris before moving the Hague by 1597.[43] As the Dutch printmaking network rapidly decentralized between 1600–1650, Hondius would have found it more and more difficult to maintain this highly central position; indeed, his own centrality in the Dutch print network decreased over the course of his career. At the same time, however, a more distributed network meant that Hondius' immediate contacts were more likely to *themselves* be relatively well-connected, thus increasing Hondius' chances of making more diverse connections with new entrants to the print market. He would have found it progressively easier and

43. Orenstein, *Hendrick Hondius*, 25–26.

easier to connect to a diverse range of artists and engravers who specialized in a variety of genres, from maps to book illustrations to portraiture, landscape, and genre prints.

Rather than viewing Hondius' diversification as a fight against the competitive forces of a larger print market, it may be more useful to understand his publishing decisions as consonant with the evolving structure within which he operated. This structure was not only larger, but also increasingly diversified between many actors rather than centralized around a key few. As the next case study shall demonstrate, Hondius was not the only printmaker to modify his practice to suit a decentralizing production network.

2.5.3 Jonas Suyderhoef

It is unsurprising to find names like Goltzius, Visscher, or Hondius at the top of the Dutch centralization charts. Far less known is the printmaker Jonas Suyderhoef, who ranks as one of the central hubs of the Dutch print production network in 1640, even outranking Rembrandt. Like, Hondius, Suyderhoef also adapted to work in a more decentralized production network. What made him so central in his time, and why has he been overlooked in later studies of Dutch printmaking history?[44]

Jonas Suyderhoef was born in Haarlem to Andreas Pietersz Suyderhoef, secretary to the Dutch Ambassador to Constantinople.[45] He was an active member of the Guild of St. Luke, and would become dean in 1678. Suyderhoef used a combination of engraving and etching to produce prints after a remarkably wide range of artists. Formal portraits comprise a large proportion of his oeuvre. His most prominent project was

44. To their credit, Eddy de Jongh and Ger Luijten acknowledged this lacunae in Eddy de Jongh and Ger Luijten, *Mirror of Everyday Life: Genreprints in the Netherlands, 1550-1700* (Amsterdam; Ghent: Rijksmuseum; Snoeck-Ducaju & Zoon, 1997), cat. 64.

45. Johann Wussin, *Jonas Suyderhoef, son œuvre gravé, classé et décrit*, trans. Henri Hymans (Brussels: Labroue et Mertens, 1862), 11–12; F. W. H. Hollstein, *Dutch and Flemish Etchings, Engravings, and Woodcuts, ca. 1450-1700* (Amsterdam: M. Hertzberger, 1949), 28:201–260.

for Pieter Soutman's 1644 *Effigies imperatorum domus Austriacae*, a series of royal portraits done after paintings by Rubens, Gerrit van Honthorst, Anthony van Dyck, and Pieter Soutman himself. Soutman, who lived in Haarlem at the time, would likely have known Suyderhoef's reproductions after portraits of prominent Dutch intellectuals by Frans Hals, Rembrandt van Rijn, and Pieter Dubordieu.

Suyderhoef also reproduced a range of works after Gerard ter Borch II, from the official portrait of the signing of the treaty of Münster, to a portrait of Godart van Reede.[46] Nor did he limit himself to formal portraits. Suyderhoef also produced many plates after genre scenes by Adriaen van Ostade, at least one of Ter Borch's early guardroom scenes, and even an Italianate landscape by Nicolaes Berchem. Suyderhoef also rendered a handful of history paintings, including a free reproduction of Rubens' *Fall of the Damned* on two sheets, which was published by Soutman and dedicated to Constantijn Huyghens. (Figure 19) Produced just two years after Rubens' death in 1640, the print may have held special significance for the secretary to the Stadholder, as he and Rubens had maintained a correspondence between 1635 and 1640 debating the principles of architectural design, and their expression in each other's houses.[47] This print testifies to the continuing artistic exchange between Haarlem and Antwerp that continued long after Rubens visited the Dutch city in 1612.[48] It was during this visit that Soutman likely met Rubens. Soutman would join Rubens' Antwerp studio in 1616 as a

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46. François Gerard Waller, *Biographisch woordenboek van noord Nederlandsche graveurs*, in collab. with Willem Rudolf Juynboll (Amsterdam: B.M. Israël, 1974), 491.

47. Koen A. Ottenheym, "De correspondentie tussen Rubens en Huygens over architectuur," *Bulletin KNOB* 96, no. 1 (1997): 1–11, doi:10.7480/knob.96.1997.1.390.

48. J. G. van Gelder, "Rubens in Holland in de zeventeinde eeuw," *Nederlands Kunsthistorisch Jaarboek* 3, no. 1 (1950–1951): 103–150; Filip Vermeylen and Karolien De Clippel, "Rubens and Goltzius in Dialogue: Artistic Exchanges Between Antwerp and Haarlem During the Revolt," *De zeventiende eeuw* 28, no. 2 (December 19, 2012): 138–160, doi:10.18352/dze.8236.

printmaker and painter, returning to Haarlem in 1633 to open his own print publishing house. It is likely through Soutman that Suyderhoef was introduced to Rubens' works.

This remarkable scope of Suyderhoef's oeuvre is matched by (and likely a product of) the large number of publishers with whom he worked. In addition to publishing in Haarlem with Soutman, he also worked for the Leiden publisher Cornelis Banheinning, who published most of his reproductions after Dubordieu, a Leiden painter.[49] Suyderhoef's network also extended to Amsterdam, where the publisher Pieter Goos issued several of Suyderhoef's works after Rembrandt.[50] Goos also published his prints after Van Ostade, as did the Amsterdam publishers Frederick de Wit, Clement de Jonghe, Dancker Danckerts, and Nicolaes Visscher.[51] Often the same print would be issued under several different addresses, as happened with one of his print after Ostade (Figure 20) and another after a Soutman portrait of Goltzius (Figure 21).[52] These plates may

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49. Waller, *Biographisch woordenboek van noord Nederlandsche graveurs*, 425.

50. On Goos, see A. D. de Vries, "Biografische aanteekeningen betreffende voornamelijk Amsterdamsche schilders, plaatsnijders, enz. en hunne verwanten," *Oud Holland* 3 (January 1885): 145–146.

51. On Danckerts, see Jaap van der Veen, "Danckerts en Zonen: Prentuitgevers, plaatsnijders en kunstverkopers te Amsterdam, ca. 1625-1700," in *Gedrukt tot Amsterdam: Amsterdamse prentmakers en -uitgevers in de Gouden Eeuw*, ed. Elmer Kolfin and Jaap van der Veen (Amsterdam: Museum het Rembrandthuis, 2011), 58–119.

52. Suyderhoef's role in these reproductions is inconsistently referenced in publisher inventories. For example, in the c. 1680 inventory of Nicolaes Visscher, Suyderhoef is frequently noted as a creator of the print:

1. "Leuwejacht, door P.P. Rubens en Jonas Suyderhoef. :10:" (p. 7)
2. "Satyrs en Tygers, door de Laer en Suyderhouf. :10:" (p. 7)
3. "Boerekroeg. door Adr. van Ostade en Jonas Suyderhoef. :6:" (p. 15)
4. "Brandewijn drinckende Wijven. door Adr. van Ostado en Joh. Suyderhoef [no price]" (p. 15)

However Suyderhoef gets no credit for carving the plate of Soutman's portrait of Hendrick Goltzius (which, incidentally, is a reversed copy of Jacob Matham's original engraved portrait of his stepfather), which Visscher described only as "Henricus Goltius, door P. Soutman. :6:" (p. 16). *Catalogus van groote en kleene Land-Kaerten, Steden, Print-Kunst En Boecken van Nicolaes Visscher van Amsteldam. 't Amsteldam, Op den Dam, in de Visscher*, (c. 1680), Herzog August Bibliothek Wolfenbüttel Cb 105, transcribed in Jan van der Waals, *Prenten in de gouden eeuw: van kunst tot kastpapier* (Rotterdam: Museum Boijmans Van Beuningen, 2006), 219–229.

have been traded between the publishers themselves, though it is also possible that Suyderhoef may have lent the plate to each publisher under an agreement that each may have leased the plate for a set series of impressions.[53]

Suyderhoef fulfilled a demand for freelance engravers who were able to produce reasonably good engravings after almost any artist or genre, and who were willing to work with a wide array of publishers. Unlike Goltzius or Hondius, Suyderhoef does not appear to have ever tried to establish his own publishing business. Perhaps this was because there was already too much established competition among publishers in Haarlem by the 1630s when Suyderhoef would have began producing prints for the market. Conversely, the rising number of active publishers both in Haarlem and in other Dutch cities may have made it possible for Suyderhoef to make a comfortable living as a freelance engraver alone, rising to a high rank in the Haarlem guild. In the decentralized network that existed in the mid-seventeenth century northern Netherlands, it may have made professional sense not to work exclusively with a single publisher, given the wide array of reasonably well-connected publishers that were available as clients.

At first glance, it is easy to understand why Suyderhoef has been overlooked in histories of Dutch printmaking. Because his only known works are reproductions, he has never received the kind of close attention given to engravers from the same period who made original works as well as reproductions, such as Hendrick Hondius. Moreover, Suyderhoef's prints are often workmanlike in character. Despite occasional bright spots in his renderings, such as in his prints after Frans Hals, Suyderhoef tended to inscribe lines with a regularity that prevent his prints from replicating the vivacity

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53. On this practice, see Karen L. Bowen and Dirk Imhof, "Reputation and Wage: The Case of Engravers Who Worked for the Plantin-Moretus Press," *Simiolus: Netherlands Quarterly for the History of Art* 30, nos. 3/4 (2003): 161–195, doi:10.2307/3780915.

Figure 19: Jonas Suyderhoef, after Peter Paul Rubens, *Fall of the Damned*, published by Pieter Soutman, 1642. Engraving, 74.5 x 56.6 cm. National Gallery of Art, Washington. (Image courtesy National Gallery of Art, Washington.)

Figure 20: Jonas Suyderhoef after Adriaen van Ostade, *Three Crones or "Dutch Fates"*, (left) published by Dancker Danckerts; (right) published by Nicolaes Visscher. 29.8 x 22 cm. British Museum, London. (Images © Trustees of the British Museum.)

Figure 21: Jonas Suyderhoef after Pieter Soutman, *Hendrick Goltzius*, (left) published by Pieter Soutman; (right) published by Cornelis Visscher. Engraving and etching, 40.9 x 27.5 cm. National Gallery of Art, Washington. (Images courtesy National Gallery of Art, Washington.)

of their models. His figural handling is competent, but plagued by occasional awkward passages.

That said, there was clearly a broad market in the seventeenth century for prints of this quality, and it is for that reason that Suyderhoef's career deserves attention. While his aesthetic impact does not come close to that of Rembrandt's prints, it is remarkable that, *from the viewpoint of centrality to print production*, Suyderhoef actually outranks Rembrandt. Between his work with printmakers such as Jan Joris van Vliet and publishers like Clement de Jonghe, Rembrandt was also relatively well-connected; he does make the list of top ten most central Dutch print producers in 1645.[54] (Figure 15) Yet if Suyderhof didn't produce the stunning novelty that Rembrandt did, he did play a more crucial role in disseminating a wide range of images across many different cities in the northern Netherlands through his reproductions. In this way, Suyderhoef could be seen as a type of connective "dark matter" — unacknowledged in the canon, but critical to the functioning of the artistic world at the time.[55]

2.5.4 Flemish Printmaking Dynasties

Like the Dutch, the Flemish print production network underwent sudden structural fluctuations during the seventeenth century. As can be seen in Figure 12, these fluctuations did not occur in tandem. Disaggregating these network-wide statistics in order to examine individuals within this network sheds light on this difference. (Figure 22)

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54. On Rembrandt's work with Van Vliet in particular, see Christiaan Schuckman, Martin Royalton-Kisch, and Erik Hinterding, *Rembrandt & Van Vliet: A Collaboration on Copper* (Amsterdam: Museum het Rembrandthuis, 1996), 8-14.

55. I borrow this sense of the term "dark matter" from Gregory Sholette's study of the unseen inhabitants of the the contemporary art word (e.g. low/mid-level arts managers, "failed" artists and amateurs who support art classes and supply stores), whose crucial role in supporting the market is erased by the "interpretive" class of curators, critics, and academics who instead focus on the few elite visible artists; Gregory Sholette, *Dark Matter: Art and Politics in the Age of Enterprise Culture* (London: Pluto Press, 2011), 1–2. I thank Paul Jaskot for bringing this citation to my attention.

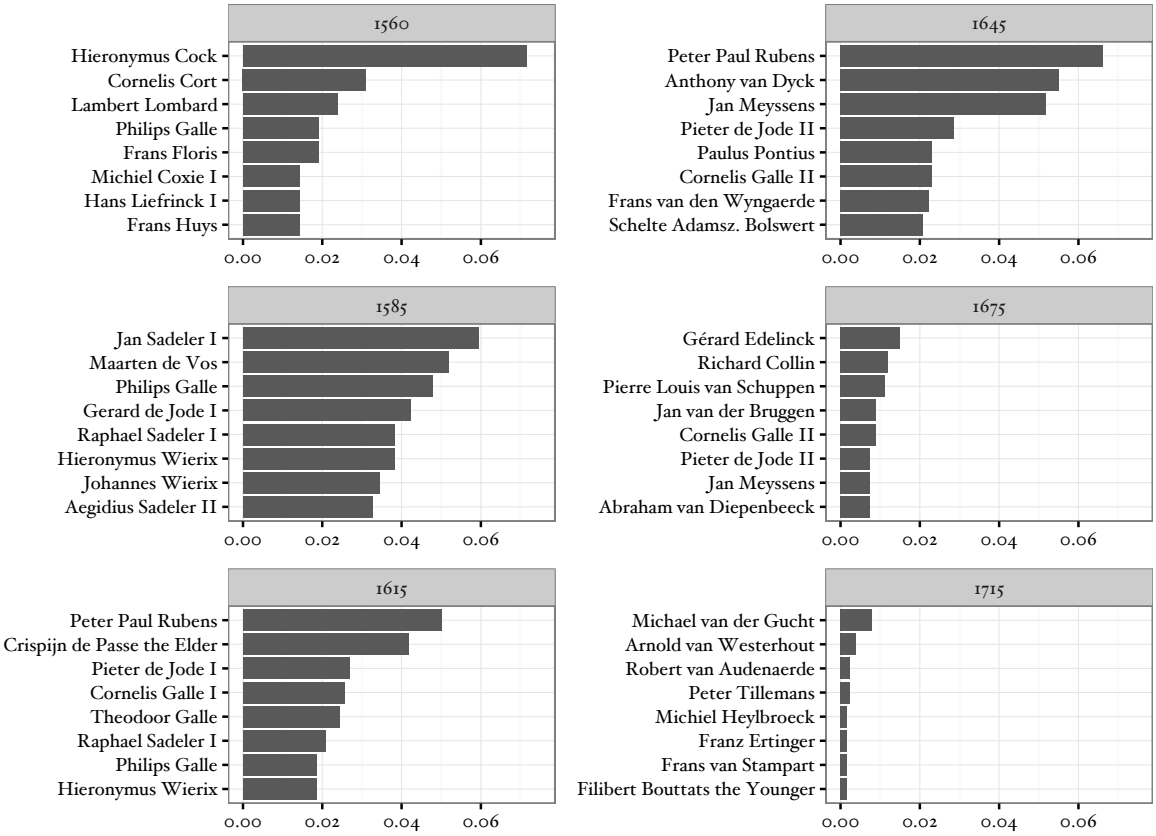

Figure 22: The top ten most central members of the Flemish printmaking network in the years 1560, 1585, 1615, 1645, 1675, and 1715, raked by their degree centrality (BM dataset)

Much as Goltzius did in the Dutch network of 1585, Hieronymus Cock unsurprisingly dominated the Flemish network of 1550. The other top-ranking participants in that year were either Cock's artistic sources (Lambert Lombard, Frans Floris, Pieter Bruegel the Elder, Michiel Coxie) or engravers with whom he contracted (Cornelis Cort, Philips Galle).[56] By 1585, the Flemish network had transitioned from a unipolar one with Cock at the center, to a multi-centric network with a large array of engraver/publishers who had worked for either Cock or Plantin early in their careers, but then transitioned into publishing works by themselves and after others. These included Jan and Rapahel Sadeler, Philips Galle (a former student of Cock's), Hieronymus and Johannes Wierix, and Gerard de Jode. Like the transition underwent by the Dutch network around 1610, the Flemish network trended towards a more decentralized structure as the overall skill level of its inhabitants increased. While one or two well-connected hub individuals might have maintained their dominance for a few decades, the small number of new printmakers that they enabled soon were influential enough to become hubs in their own right — albeit smaller in scale, and with more competition.

This smaller scale may explain the predominance of printmaking *families* among the list of central Flemish print producers like the Wierixes, the De Jodes the Galles, or the Sadelers.[57] They all established businesses that were able to produce massive, multi-generational stocks of plates.[58] With few newcomers in the seventeenth century tempted to try their luck at starting an engraving or publishing practice in Antwerp, already established firms were easily sustained over multiple generations.

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56. Joris van Grieken, Ger Luijten, and Jan van der Stock, *Hieronymus Cock: The Renaissance in Print* (New Haven: Yale University Press, 2013), 30–36.

57. The Sadeler family will be discussed at greater length in sections 3.4.1 and 4.4.3.

58. For example, Orenstein counts around 1,000 distinct plates offered by Cock, 1,700 by the Wierixes, and almost 3,700 by the Galle family; Orenstein, "The Shift from Antwerp," 48.

The Galle family is an excellent example. Philips Galle, who was born in Haarlem but worked for Hieronymus Cock in Antwerp, acquired citizenship in the Flemish city in 1571 and established his own printmaking workshop and publishing house there. He filled a gap left after Cock's death in 1571, specializing in learned humanist allegories and depictions of mythologies.[59] Galle thrived in Antwerp, and produced prints at a far greater rate than he ever had in Haarlem. This is likely because he stopped cutting plates by himself, and began to outsource both the cutting of plates as well as the drafting of print designs to specialized artists.[60] Like so many others, Galle professionalized his print production process by creating a locally-centralized network of artistic labor.

In addition to his own engravings, Philips published works by his own sons Theodoor and Cornelis, the Wierix brothers, the Collaerts, as well as the young Hendrick Goltzius, who commemorated his mentor with an engraved portrait when he left to establish his Haarlem studio in 1582.[61] (Figure 23) Theodoor took control of the workshop around 1600, and continued to produce from both his father's stock, reissuing many engravings originally produced in the late sixteenth century.[62] Under Theodoor's leadership, the Galle press also began to work more closely with Plantin, accepting more commissions from the book publisher than Philips had. Theodoor's own son Johannes would continue selling old Galle family prints well into the latter half of the seventeenth century. Philips' second son, Cornelis, was also well-placed to

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59. Orenstein, "The Shift from Antwerp," 49.

60. Manfred Sellink, "Philips Galle (1537-1612): Engraver and Print Publisher in Haarlem and Antwerp" (PhD diss., Vrije Universiteit, 1997), 18–22.

61. See section 2.5.1.

62. Sellink, "Philips Galle," 38–39.

take advantage of printmaking demand by the Rubens workshop, making a name for himself through his reproductions after the master painter.[63] (Figure 24)

The descendants of Gerard de Jode appreciated the same dynastic benefits. Like Galle, De Jode was born in the northern Netherlands, but established himself in Antwerp by 1547 as a master in the Guild of St. Luke. There, De Jode specialized in publishing original map engravings as well as maps cut by Jan and Lucas van Doetecum, as well as reprints of earlier maps, most notably Abraham Ortelius' *Theatrum orbis terrarum* of 1564. Gerard's son Pieter (I) studied with Goltzius in Haarlem, but would return to Antwerp by 1599, where he produced a wealth of book illustrations for Plantin and for Jacob Cats, and reproductive works after Rubens, Van Dyck, and other Antwerp painters. Pieter's son (also named Pieter) would continue in his father's and grandfather's footsteps, continuing to make his own new engravings (particularly reproductions of Van Dyck portraits) while publishing old plates from the family stock.[64]

More so than any of their counterparts in the northern Netherlands, these Flemish printmaking families were able to establish long-lived dynasties that dominated Antwerp print publishing for more than a century. Without the persistent influx of new talent and competition into Antwerp, these established Flemish families could easily maintain their businesses by passing down artistic knowledge, social connections, and (perhaps most importantly), large inventories of plates that provided a stable foundation for young heirs to the business.

This concentrated size of the Flemish print network may also explain why it suddenly *re*-centralized after the turn of the century. Starting around 1625, the

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63. Cornelis would also later travel in Rome and Florence; Sellink, "Philips Galle," 39.

64. On the De Jode dynasty, see Hollstein, *Dutch and Flemish*, 9:200–220; Carl Depauw and Ger Luijten, *Anthony Van Dyck as a Printmaker* (Antwerp: Antwerpen Open, 1999), 376–379.

Figure 23: Hendrick Goltzius, *Portrait of Philips Galle*, 1582. Engraving, 22.3 x 14.5 cm. Rijksmuseum, Amsterdam.

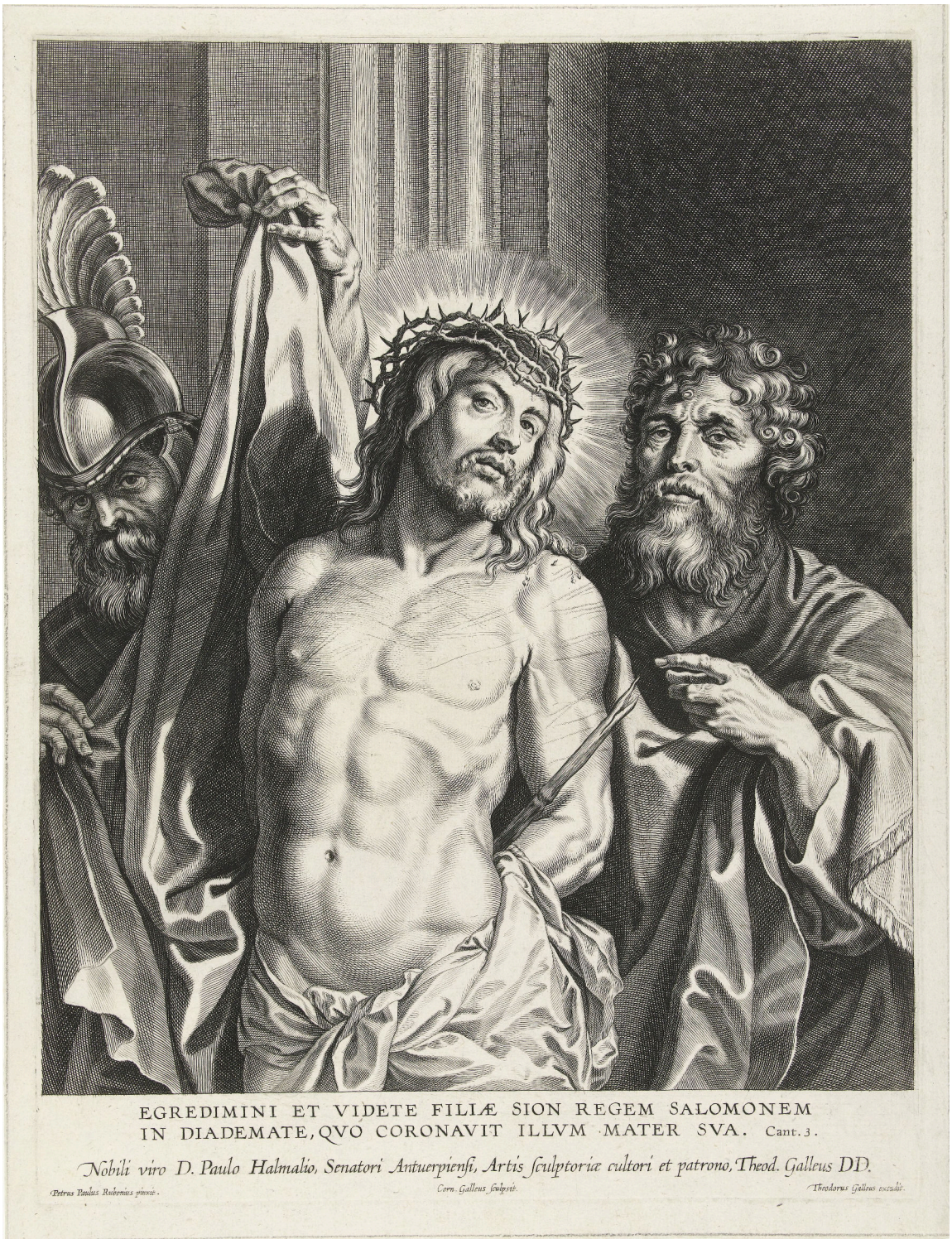

Figure 24: Cornelis Galle, after Peter Paul Rubens, *Ecce Homo*, published by Theodoor Galle, after 1612. Engraving, 37 x 28 cm. Rijksmuseum, Amsterdam.

gradual decline in Flemish centralization reversed sharply, if briefly, to become more centralized than ever before for about two decades — a surge that was far greater than expected for a similar network of that size. (Figure 14) As we saw during a similar centralization spike in the Dutch network, exceptional individuals could have a powerful impact on their regional printmaking networks. Sitting at the heart of this re-centered Flemish network were Rubens and Van Dyck, both of whom had a long, sustained engagement with printmakers.[65] Sweeping print series projects like Van Dyck's *Iconographie* or Jan Meyssens' *Theatrum principum virorumque* engaged the services of multiple engravers.[66] Rubens, of course, is famed for his sometimes-rocky relationships with a long line of engravers, including Lucas Vosterman, Paulus Pontius, and Christoffel Jegher.

During this period of greatest network concentration, the number of prints being made surged with no accompanying increase in the number of actual participants in the network. While Flemish printmakers and publishers were producing more prints than their northern counterparts at this time, note they did so with little more than half the number of participants in the network. At the same time that the United Provinces were experiencing an economic boom that attracted many artists, the southern Netherlands' economy was still suffering from the effects of Spanish invasion at the end of the sixteenth century. The closure of the Scheldt river and the exodus of prosperous Protestant merchants had led to economic stagnation in Antwerp. Though shining stars like Rubens and Van Dyck, not to mention engravers like Aegidus Sadeler, could still win international commissions, Antwerp itself was not an attractor for

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65. Hout and Huvenne, *Copyright Rubens*; Ann Diels, *The Shadow of Rubens: Print Publishing in 17th-Century Antwerp: Prints by the History Painters Abraham Van Diepenbeeck, Cornelis Schut and Erasmus Quellinus II*, trans. Michael Hoyle and Irene Schaudies (Turnhout: Royal Library of Belgium, 2009).

66. Joaneath A. Spicer, "Anthony van Dyck's *Iconography*: An Overview of Its Preparation," *Studies in the History of Art* 46 (January 1994): 325–364.

young artistic talent, be they printmakers or painters. In a small network with few new entrants, a handful of influential individuals could still maintain the kinds of highly centralized positions that were no longer available in the more distributed northern provinces. This focused and demanding environment would have favored highly professionalized printmakers who were able to produce prints consistently and prolifically.

2.6 Conclusion: Simple Rules for a Complex System

This chapter has examined multiple dimensions of this network: from its basic size in terms of nodes and connections, to the structural characteristic of centralization, to the attractiveness of well-connected nodes. Each one of these dimensions presents a distinct view of the environment that printmakers like Goltzius, Hondius, Suyderhoef, the Galles, or the De Jodes inhabited. Some of the most central members of these networks were familiar names to historians of art and printmaking, however even those well-known careers are better understood when set within a larger context. Both the lasting influence of Hendrick Goltzius' Haarlem studio, and the creative decisions of the engraver/publisher Hendrick Hondius, are enriched when we ask how they may have impacted the structure of the rest of the printmaking network, and how that network in turn may have affected their own actions. Moreover, printmakers like Jonas Suyderhoef exemplify how certain structurally-important individuals may have gone unacknowledged by the art historical canon.

In one sense, this analysis has confirmed Parshall and Landau's core argument: that the highly centralized form of print production originated by Hieronymus Cock, Hans Liefrinck, and other sixteenth-century publishers would govern printmaking well into the future. This system of professionalized publication would tend to favor well-connected individuals able to marshall commissions, clients, and labor from a wide

spectrum of the market. However, network analysis has also revealed that the ramifications of this simple rule could be unexpectedly complex. With a handful of exceptions where combinations of economic circumstances and extraordinary individuals like Hendrick Goltzius or Peter Paul Rubens caused unique spikes in centralization, many of the apparently major changes in Dutch and Flemish printmaking centralization were simply manifestations of the gradual rise and fall in the number of active printmakers over this period. This approach offers a crucial context for future studies of individual printmakers, while also demonstrating how network analysis can illuminate dimensions and scales of historical events that are otherwise difficult for art historians to conceptualize. How this system played out on the continental scale will be the subject of the next chapter.

3 The European Context: The Netherlands and International Printmaking Collaboration

The previous chapter explored a key aspect of the regional structures of Dutch and Flemish print production networks, only considering the relationships of different print producers within those two subsections of the larger European community. But prints from the Low Countries, much like paintings from that region, were produced within an international network of artists, dealers, and patrons. What light can network analysis shed on the international dynamics of early modern print production?

In this chapter, I will consider the place of these Dutch and Flemish printmaking communities within the larger European world of artistic prints, once again focusing on the potential historical professional networks that we can infer from surviving print impressions. Did Dutch and Flemish printmaking communities, as a whole, trend towards more internal, or more external collaboration between 1550 and 1750? One may locate a strong international strain of printmaking in Dutch printmaking in the sixteenth and seventeenth centuries, as printmakers like Hendrick Goltzius looked to foreign artists for design inspiration, or found favorable publishers and marketplaces in foreign cities. However, this internationalized print production existed alongside a domestic turn in Dutch printmaking in the same period. How do these communities' shifts compare to those in other prominent printmaking centers in Italy, Germany, or France? Moreover, how varied were *individuals'* strategies when it came to domestic and international collaboration? Did individual artists, printmakers, or publishers distinguish themselves by working predominantly with international or

local collaborators? Case studies will crucially illuminate how diverse practices of international print production were in this period in the context of these overall trends.

This chapter will also return to questions of the *longue durée* history of printmaking. Were these changes in the balance of international versus domestic production determined by specific historical events? Or were these patterns largely subject to larger, longer-duration structural incentives, like the gradually changing balance of printmakers working in Amsterdam versus Rome? Although dramatic shifts in the amount of foreign printmaking collaborations by both Dutch and Flemish artists between 1550–1750 can be found, this chapter will show that similar patterns in other countries suggest that many of these changes can be explained by longer-term demographic changes and the relative maturity of different regional print production communities. That said, it will also be shown that there are occasions where the mere size of these communities cannot predict how inwardly- or outwardly-facing their print production was. It is in these discrepancies that we may locate the influence of outside events on artists' ability to travel or work across long distances.

3.1 Background: Dutch and Flemish Print Production Across Europe

> There is no better means whereby the painter himself can make his renowned name known: Namely, that he sometimes, using time and diligence for this purpose, engraves one of his celebrated compositions of drawing in print: Because it can go through the whole world, coming into every art lovers' hands, while paintings almost always remain in one place...[1]

1. "Daer is oock noch een ander middel, waer door den Schilder hem selven een Vermaerden Naem kan maecken: Namentlijck dat hy somtijts, tijt ende vlijt daer toe aenwent, om eenige van sijn feste ordinantien en teyckeningen in print uyt te geven: Want vermits die de geheele Werelt door-wandelen, en in alle Liefhebbers handen komen, en dat de Schidleryen meest altijt maer in eene plaets blijven..."; Willem Goeree, *Inleydingh tot de practijck der al-gemeene schilder-konst* (Middelburg, 1670), 125, http://archive.org/details/inleydinghtotdep00goer

> ...release your works freely into print, so that your name will sooner fly over the world. Albrecht Dürer and Lucas van Leyden, though wondrous painters, obtained their greatest fame from engraving.[2]

> Regarding [prints'] effect: what fame is to the ear, theirs is to the eye. Painting has but one result, but engraving hundreds. Fame can tell the many wonders of painting in its absence; but engraving makes itself present everywhere; it flies the world over, as it sounds the echoing trumpet of renown.[3]

Late seventeenth- and early eighteenth-century Dutch art commentators Willem Goeree, Samuel van Hoogstraten, and Gérard de Lairesse uniformly agreed on the power of prints to transmit an artist's images far and wide. Thanks to the relative ease of moving finished impressions, prints had been a mainstay of the international art market in Europe for more than a century and a half. At the renowned Frankfurt book fair, prominent book publishers even included special sections in their inventory lists devoted to artistic prints and engraved maps.[4] The *consumption* of prints was clearly internationalized by the early 1500s. To what extent, however, was their *production* internationalized? When were engravers in the Low Countries inclined to make reproductions after foreign artists, or to work with foreign publishers?

Current histories of Dutch printmaking frequently contrast the relatively international character of Dutch printmaking in the late sixteenth-century with the meteoric

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2. "...laet dan vry uwe werken in print uitkomen, zoo zal uwen naem te spoediger al de werelt over vliegen. *Albert Durer* en *Lukas van Leyden*, wondere Schilders, hebben nochtans hun grootste gerucht door het graefyzer verkreegen."; Samuel van Hoogstraten, *Inleyding tot de hooge schoole der schilderkonst* (Rotterdam, 1678), 195, http://hdl.handle.net/2027/gri.ark:/13960/t51g2037s

3. "Wat haare uitwerking aangaat, zy is voor het gezicht het geen de Faam voor het gehoor is. De Schilderkonst heeft maar een Origineel, maar de Graveerkunde honderden. De Faam kan van de Schilderkonst veele wonderen vertellen in haar afweezen: maar de Graveerkunde maakt zich overal tegenwoordig. Zy vliegt zo wel de geheele waereld over, als de klank der galmende trompet des Geruchts."; Gérard de Lairesse, *Groot schilderboek: waar in de schilderkonst in al haar deelen...*, 2nd ed. (Amsterdam, 1712), 2:372–373, http://hdl.handle.net/2027/gri.ark:/13960/t5j97bv64

4. David Paisey, "Prints at the Frankfurt Book Fairs, 1568-1600," *Print Quarterly* 23, no. 1 (2006): 54–55.

rise of "domestic" imagery between 1580 and 1620. Indeed, the early history of Dutch printmaking is tightly interwoven with international influences. Lucas van Leyden attracted international attention for his masterful handling of the burin. In Italy, Marcantonio Raimondi frequently adopted Lucas' silvery landscape backgrounds for use in his own prints, such as the *Climbers* of 1510 that melds a quotation from Lucas with figures derived from Michelangelo's renowned drawing of the *Battle of Cascina*.[5] (Figure 25)

Figure 25: (left) Lucas van Leyden designed and engraved, *Mohammed and the Monk Sergius*, 1508. Engraving. British Museum, London. (Image © Trustees of the British Museum.) (right) Marcantonio Raimondi after Michelangelo Buonarotti, *The Climbers*, 1510–1520. Engraving, British Museum, London. (Image © Trustees of the British Museum.)

5. On Marcantonio's quotation of Lucas, see Bernadine Ann Barnes, *Michelangelo in Print: Reproductions as Response in the Sixteenth-Century* (Burlington: Ashgate, 2010), 16.

Lucas also gained the attention of the Nuremberg master Albrecht Dürer, who made a point to visit the Leiden artist during a journey to the Netherlands in 1520. Prints played a variety of roles on this trip. Dürer had brought not only his acute eye to the Netherlands (he produced many sketches while there), but also a sizable inventory of woodcut and engraving impressions. He carried no less than thirty four copies of his *Small Passion* series, and, according to his diary, gifted a complete set of his printed oeuvre on several occasions.[6] Dürer sold many of these prints to pay expenses for his trip. Others, however, served as objects of mutual gift exchange with distinguished hosts. Like many gifts, these were often strategic. For example, Dürer gave a complete set of impressions to the regent the of Netherlands, Marguerite of Austria, in the hopes of strengthening his own contacts with the new Hapsburg emperor, Charles V.

Dürer engaged in mutual artistic gift giving with several Netherlandish artists, using print impressions as well as the occasional drawn portrait as a conduit to exchange visual sources and to signal mutual esteem.[7] Tommaso Vincidor, a former pupil of Raphael who had moved to Antwerp in 1520, received a complete edition of Dürer's prints.[8] Dürer also made contact with the world landscape painter Joachim Patinir, gifting the Netherlandish artist several of his own prints, as well as some impressions of works by his German pupil Hans Baldung Grien.[9] Significantly, Dürer would exchange 8 florins' worth of his own prints for a complete set of Lucas' own oeuvre when the two met in

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6. Georges Marlier and Marnix Gijsen, eds., *Albrecht Dürer: Diary of His Journey to the Netherlands, 1520-1521* (Greenwich: New York Graphic Society, 1971).

7. On Dürer and artistic gift giving, see Arnold Nesselrath, "Raphael's Gift to Dürer," *Master Drawings* 31, no. 4 (December 1993): 376.

8. Dürer would also paint his portrait; Marlier and Gijsen, *Albrecht Dürer: Diary*, 19.

9. Dagmar Eichberger, "Dürer and the Netherlands: Patterns of Exchange and Mutual Admiration," in *The Essential Dürer*, ed. Larry Silver and Jeffrey Chipps Smith (Philadelphia: University of Pennsylvania Press, 2010), 153.

Leiden on June 10th, 1520.[10] The value of these gifts to Lucas is perhaps best measured by the subtle correspondences to be found between his own *Passion* series, engraved one year later, and Dürer's works.[11]

With the rise of large print production houses and the professionalization of engraving in the mid-sixteenth century, collaborative print production began to take on international dimensions. Some Dutch printmakers had built thriving careers creating engravings for Italian painters in Venice and Rome, enjoying the fruits of northern Europeans' reputation for printmaking skill that had been promulgated by Giorgio Vasari.[12] Cornelis Cort, in Rome from 1565–1578, found great success as a printmaker for major Italian painters such as Titian (Figure 26), Giulio Clovio, Girolamo Muziano, and Federico Zuccaro.[13] In addition to German and Italian centers, the mid-sixteenth-century publishing house of Hieronymus Cock, *Aux Quatre Vents*, proved especially influential to multiple generations of Dutch printmakers. As noted in the previous chapter, during his early career in Haarlem between 1557–1570, Philips Galle engraved several prints to be published in Antwerp by Cock.[14]

Galle's experience would be mirrored in the following generation of Dutch printmakers. Early in his career, Hendrick Goltzius produced many reproductive prints for Galle after a wide range of artists. Goltzius lived in Haarlem while Galle remained

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10. Marlier and Gijsen, *Albrecht Dürer: Diary*, 29.

11. Karin Orchard, *Albrecht Dürer und Lucas van Leyden: ein Vergleich; 14 September - 28 Oktober 1990* (Hamburg: Hamburger Kunsthalle, 1990), 14–15.

12. David Landau, "Vasari, Prints and Prejudice," *Oxford Art Journal* 6, no. 1 (January 1983): 3–10; Sharon Gregory, *Vasari and the Renaissance print* (Burlington: Ashgate, 2012), 2–4.

13. Manfred Sellink, *Cornelis Cort: Accomplished Plate-Cutter from Hoorn in Holland* (Rotterdam: Museum Boymans-Van Beuningen, 1994); Gert Jan van der Sman, "Dutch and Flemish Printmakers in Rome 1565-1600," *Print Quarterly* 22, no. 3 (September 1, 2005): 251–252.

14. See section 2.5.4.

Figure 26: Cornelis Cort, after Titian's altarpiece in S. Salvatore, Venice, published by Antonio Lafréri, *Annunciation*, c. 1566. Engraving, 41.5 x 47.6 cm. British Museum, London. (Image © Trustees of the British Museum.)

based in Antwerp, working via correspondence much as Galle had done for Cock in his early years. Goltzius would continue this model of remote collaboration even after setting up his own independent studio in 1582. The collaboration between Hendrick Goltzius and Bartholomeus Spranger, court painter to Rudolf II, illustrates well how the design, cutting, and marketing of a print could easily take on an international scope. In 1585 or 1586, Spranger sent a large, fully-finished drawing (Figure 27) from the Prague court to Haarlem, where Goltzius had recently established his own independent studio. By 1587, Goltzius had transformed Spranger's drawing into a masterful large-scale print dedicated to Wolfgang Rump, an official at the Prague court. (Figure 28) Early proofs of the print suggest that multiple versions were sent back and forth between Prague and Haarlem before the print was finalized.[15] This print would be marketed at the international Frankfurt book fair in September of that same year.[16]

Hieronymus Cock also exerted a lasting influence on printmaking in the Northern Netherlands with a series of Flemish country scenes (Figure 29) after the so-called "Master of the Small Landscapes" (engraved by Johannes and Lucas van Doetecum).[17] These unassuming prints inspired multiple generations of Flemish and Dutch printmakers to produce both direct copies and inspired renditions, and played a key role in the development of both the printed and painted Dutch landscape tradition. In the first

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15. Surviving proofs by Jan Muller bear hand-drawn corrections by Spranger, suggesting the painter maintained close involvement in the print production process; Jan Piet Filedt Kok, "Jan Harmensz. Muller as Printmaker — I," *Print Quarterly* 11, no. 3 (September 1994): 233; also see Annette Strech, "*Spranger inventor*: Überlegungen zu Entstehung und Funktion von Stichen nach Sprangers Werken," in *Rudolf II, Prague and the World: Papers from the International Conference, Prague, 2-4 September, 1997*, ed. Lubomír Konečný, Beket Bukovinská, and Ivan Muchka (Prague: Artefactum, 1998), 201–203.

16. Leeflang, *Goltzius*, 82–83, cat. 28.

17. Cock also served as a northern conduit for Italianate landscapes, publishing several print series depicting Italian topography and Roman ruins; Boudewijn Bakker and Michael Hoyle, "*Pictores, Adeste!* Hieronymus Cock Recommending His Print Series," *Simiolus: Netherlands Quarterly for the History of Art* 33, nos. 1/2 (January 2007): 60–61.

Figure 27: Bartholomeus Spranger, *The Wedding Feast of Cupid and Psyche*, 1575–1587. Pen in brown, brush in grey, heightened with white gouache over a sketch in black chalk on paper coated with a light grey preparation, indented for transfer, 39.7 cm. x 83.4 cm. Rijksmuseum, Amsterdam

Figure 28: Hendrick Goltzius, after Bartholomeus Spranger, *The Wedding Feast of Cupid and Psyche*, 1587. Engraving, 43.5 cm. x 86.1 cm. Rijksmuseum, Amsterdam.

decades of the seventeenth century, Haarlem printmakers Claesz Jansz Visscher, Esaias van de Velde I, Willem Buytewech, Hercules Segers, and Jan van de Velde II, began to produce their own versions of the local, rustic landscape view heavily inspired by the *Small Landscapes* (Figure 30).[18] These images, which highlighted specific local landmarks as well as more generalized "Dutch" views, featured distinctive elements such as rolling dunes, canals, and signs of local industry such as linen bleaching.

This local turn in printmaking has been connected with the coalescing of a Dutch national identity during the course of the revolt against Spain between 1568–1648.[19] All of these printmakers joined the Haarlem guild in 1612, forming a critical mass of pioneering talent who each took up the printed landscape as their subject in one form or another. These landscapes ranged in specificity and style. They could take the form of specific locations, such as Esaias van de Velde's rendering of the fort at Tholen, a structure that may have held particular importance for viewers seeing it just a few years after the signing of a temporary truce between the United Provinces and Spain in 1609. (Figure 30). Other landscape prints by these Haarlem pioneers were more generalized, albeit indisputably "Dutch", views. (Figure 31) Nor was the Flemish influence on the Dutch landscape tradition limited to seemingly-real landscapes: Jan van de Velde II

18. On the relationship of the *Small Landscapes* to the printed landscape tradition in Haarlem, see Alexandra Onuf, "Envisioning Netherlandish Unity: Claes Visscher's 1612 Copies of the Small Landscape Prints," *Journal of Historians of Netherlandish Art* 3, no. 1 (2011): 1–13, doi:10 . 5092 / jhna . 2011 . 3 . 1 . 4; Alexandra Onuf, "Old Plates, New Impressions: Local Landscape Prints in Seventeenth-Century Antwerp," *The Art Bulletin* 96, no. 4 (December 2014): 424–440.

19. David Freedberg, *Dutch Landscape Prints of the Seventeenth Century* (London: British Museum Publications, 1980), 11–15; Catherine Levesque, *Journey through Landscape in Seventeenth-Century Holland: The Haarlem Print Series and Dutch Identity* (University Park: The Pennsylvania State University Press, 1994), ch. 6.

would commonly mix fantastic landscapes (Figure 32) in extended print series that also included both specific landmarks as well as generalized Dutch scenes.[20]

Figure 29: Johannes and Lucas van Doetecum after the Master of the Small Landscapes, *Village Road with Draw Well*, published 1559/1561. Etching, retouched with engraving, 13.3 x 19.5 cm. National Gallery of Art, Washington. (Image courtesy National Gallery of Art, Washington.)

This international flow of images and influence did not occur in a vacuum. In the late sixteenth century, the northern Netherlands entered a golden age of economic growth thanks to their unmatched control of international sea trade around the world. As their prosperity increased, many Dutch authors, musicians, and artists sought to add internationalizing elements to their works, as a way of asserting Dutch

20. Robert Fucci, "Arcadia Unbound: Early Dutch Landscape Prints and the *Amenissimae aliquot regiunculae* by Jan van de Velde II," *Art in Print: The Global Journal of Prints and Ideas* 4, no. 5 (2015): 4. http://artinprint.org/article/arcadia-unbound/.

Figure 30: Esaias van de Velde, *Fort with defenses at Tholen on the Scheldt*, 1615–1616. Etching, 8.3 x 16.9 cm. Rijksmuseum, Amsterdam.

Figure 31: Jan van de Velde II, *Winter Landscape*, c. 1615–1646. Etching. National Gallery of Art, Washington. (Image courtesy National Gallery of Art, Washington.)

Figure 32: Jan van de Velde II, *October* from the series *Twelve Months*, 1616. Etching. National Gallery of Art, Washington. (Image courtesy National Gallery of Art, Washington.)

cultural legitimacy in the broader world of early modern Europe.[21] Several waves of Dutch artists also traveled south to study and paint in Italy, establishing an expatriate community in Rome.[22] Prominent Dutch and Flemish portraitists found many patrons in the English court, and printmakers from the Low Countries were in particular demand in London. Likewise, foreign publishers and print sellers may have found the thriving Northern Netherlands a particularly attractive market.[23]

The political environment may not have been as conducive to the flow of prints across international borders, however. The start of the Dutch revolt against Spain in 1568 may have made it more difficult for artists in the Low Countries to conduct international business, from the early transmission of contracts and drawn designs to the large shipments of finished impressions required for a successful printmaking business. At the same time, the flourishing economy supported a blossoming print industry in Amsterdam in particular.[24] With avenues to international collaboration cut off, and an increasing amount of domestic supply *and* demand in centers like Haarlem and Amsterdam, Dutch printmakers and publishers may have been encouraged to make more domestic connections than ever before. Now, rather than having to turn to international partners to produce prints, Dutch artists, printmakers, and publishers could increasingly work with their own countrymen. In chapter 2, we found that

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21. On the interest in legitimizing Dutch culture on the European stage, see Alison McNeil Kettering, *The Dutch Arcadia: Pastoral Art and Its Audience in the Golden Age* (Totowa: Allanheld and Schram, 1983).

22. On seventeenth-century Dutch artists' interest in Italy, see Peter Schatborn, *Drawn to Warmth: 17th-Century Dutch Artists in Italy*, in collab. with Judith Verberne (Amsterdam: Rijksmuseum, 2001); Laurie B. Harwood, Christopher Brown, and Anne Charlotte Steland, *Inspired by Italy: Dutch Landscape Painting, 1600-1700* (London: Dulwich Picture Gallery, 2002).

23. Paul Hoftijzer, "Antwerp: Books, Publishing and Cultural Production Before 1585," in *Urban Achievement in Early Modern Europe: Golden Ages in Antwerp, Amsterdam, and London*, ed. Patrick Karl O'Brien (Cambridge: Cambridge University Press, 2001), 251–252.

24. Ibid., 249.

a flourishing Dutch art market, both in Amsterdam as well as in smaller towns like Utrecht and Delft, appears to have supported a more decentralized print production network than had existed in the late sixteenth century.[25] It is possible that this same decentralization may have spurred more domestic collaboration as well. To help illuminate how the balance of these incentives changed between 1550–1750, we can once again turn to network analysis.

3.2 Methodology: Measuring International Interaction

When, and to what extent, do actors who belong to one category make connections to each other, versus to actors in another? This is a common question in network analysis, and can be measured by using the group-external/group-internal index (hereafter EI index).[26] The EI index measures the balance between the number connections actors made within a specified group (in this case, nationality) versus those they made to actors outside that group.[27] (Figure 33) This index can work at several scales. It can be used to quantify an entire group's propensity to connect with other groups (e.g. Dutch artists connecting to non-Dutch artists). A positive EI index indicates that nodes within that group made most of their connections to nodes belonging to other groups, while a

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25. See section 2.4.

26. See, for example, Godinho de Matos et al., "Peer Influence in the Diffusion of the iPhone 3G over a Large Social Network," *Management Information Systems Quarterly* 38, no. 4 (May 28, 2014): 15, doi:10.2139/ssrn.2053420.

27. The EI index comprises the ratio of the difference between the number of a group's external (n_e) and internal (n_i) links to the total number of links the group makes:

$$\epsilon = \frac{n_e - n_i}{n_e + n_i}$$

Originally proposed in David Krackhardt and Robert N. Stern, "Informal Networks and Organizational Crises: An Experimental Simulation," *Social Psychology Quarterly* 51, no. 2 (June 1, 1988): 127–129, doi:10.2307/2786835; also see Hanneman and Riddle, *Introduction to Social Network Methods*, 128–132.

negative EI index indicates those nodes made most of their connections internally. One can also measure the EI index of a single individual, comparing the number of connections they make to members of their own group, versus to those belonging to another.

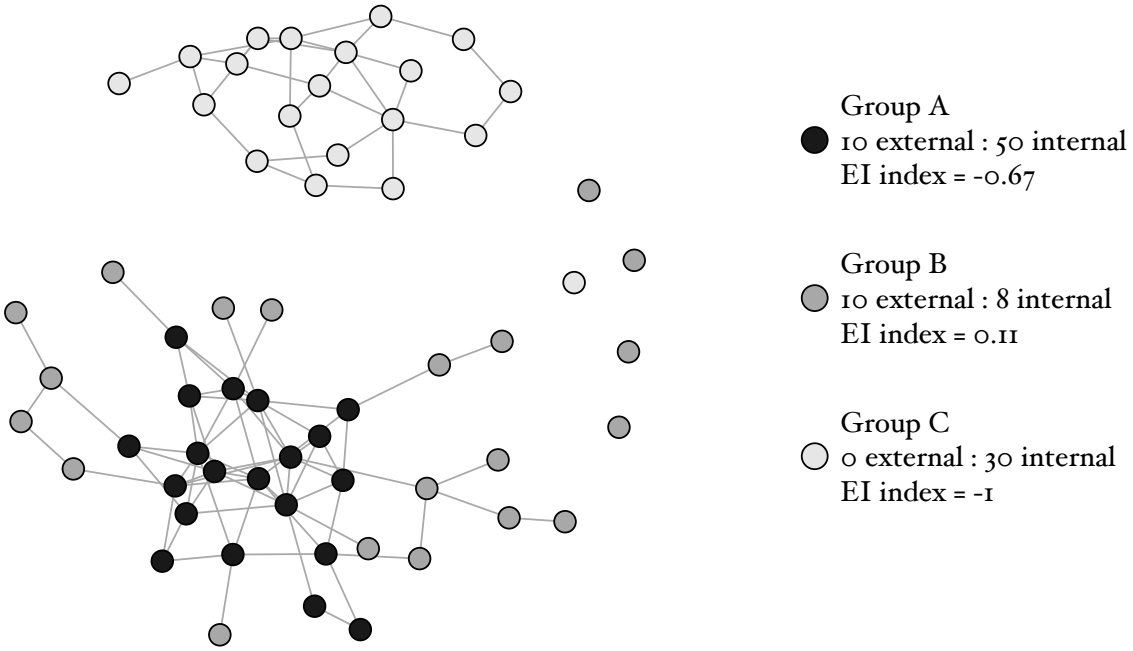

Figure 33: A network with three groups of 20 nodes each. Group A is densely interconnected, so while its members do make some external connections, by in large they connect to each other. Therefore, that group has a negative EI index. Nodes in group B, on the other hand, make a slim majority of their connections *externally*, giving that group a positive index. Nodes in group C connect exclusively to each other, and so that group has the lowest possible EI index of -1.

Just as network centrality could be measured at different points in time in the Dutch and Flemish printmaking communities in the previous chapter, an EI index can be measured for each regional/national community in the European network in this period.[28] Demarcating the "borders" of nationality in the early modern period is an inherently tricky problem, perhaps no more so than in the case of the Low Countries

28. See sections 2.2 on data, and 2.3 on inferring production networks.

during the age of the Eighty Years War.[29] The Dutch 1581 Act of Abjuration (in the wake of the Union of Utrecht two years prior) marks the official schism between the seventeen United Provinces in the northern Netherlands and the territories of the Spanish-controlled southern Netherlands. And while this break is a convenient historical landmark, it was soon followed by large waves of emigration from the south as Protestants and other non-Catholics fled religious persecution in Antwerp for the relatively more tolerant north. Many of these migrants were painters like Gillis van Coninxloo, Clara Peeters, and Roelandt Savery, who had an abiding impact on artistic development in the United Provinces.

Flemish printmakers also emigrated to the north, including Nicolaes de Bruyn and Jan van Londerseel, both of whom moved to Rotterdam (Londerseel by 1610, and De Bruyn by 1617).[30] As noted earlier, Flemish landscapes were a crucial inspiration for the popular idiom of local Dutch countryside print series that were popularized by Haarlem printmakers in the 1610s.[31] To split artists from these two countries can be an arbitrary division.[32]

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29. On the challenge of constructing the right national context for Netherlandish printmakers in particular, see Jan Piet Filedt Kok, "Early Netherlandish Prints in Dresden. Review: Tobias Pfeiffer-Helke, Mit den Gezeiten: Brühe Druckgraphik der Niderlande: Katalog der niederländischen Druckgraphik von den Anfängen bis um 1540/50 in der Sammlung des Dresender Kupferstick-Kambinetts," *Print Quarterly* 32, no. 3 (September 2015): 348.

30. Peter van der Coelen, *Patriarchs, Angels & Prophets: The Old Testament in Netherlandish Printmaking from Lucas Van Leyden to Rembrandt*, Studies in Dutch Graphic Art 2 (Amsterdam: Museum Het Rembrandthuis, Rembrandt Information Centre, 1996), 24.

31. On this influence, see Eric Jan Sluijter, "On Brabant Rubbish, Economic Competition, Artistic Rivalry, and the Growth of the Market for Paintings in the First Decades of the Seventeenth Century," *Journal of Historians of Netherlandish Art* 1, no. 2 (December 31, 2009), doi:10.5092/jhna.2009.1.2.4; Stephanie Porras, "Repeat Viewing: Hendrick Hondius's 'Effigies'," in *Picturing the Netherlandish Canon*, ed. Joanna Woodall (London: Courauld Institute of Art, 2013), http://www.courtauld.org.uk/netherlandishcanon/groups/essay01.html; Onuf, "Old Plates, New Impressions."

32. It is also worth noting that, for many foreign patrons, "Dutch" or "Flemish" was a distinction without a difference. See, for example, Italian disagreement over whether Dutch painter Gerrit van Honthorst should be referred to as Flemish ("Gerardo Fiammingo") or Dutch ("Gerardo Olandese"):

On the other hand, the distinction was important indeed for Dutch guild leaders who feared that the sudden influx of well-trained artisans from Antwerp at the turn of the century would flood the Dutch market. As a result, they planned regulations to protect native Dutch artists from this new competition.[33] The division has also remained undeniably useful for art historians, and is reflected in the datasets used for this analysis. Both the BM and the RKM database differentiate between "Dutch"/"Noord-Nederlands" and "Flemish"/"Zuid-Nederlands" artists.[34] For the purposes of this analysis, I will accept the present database classifications.[35] While this is an imperfect compromise, a benefit to this computational framework is that future, alternative classification schemes for artist nationality may be quickly substituted in this analysis, and their ramifications compared to the results presented here.

3.3 Results: Catalysts and Sudden Shifts

Figure 34 plots the changing EI index for Dutch, Flemish, French, British, German, and Italian printmaking communities between 1550–1750, comparing the trends observed from both the BM and RKM datasets. As in the study of centralization in chapter 2, we find that both museum databases return roughly equivalent results for both the Dutch and Flemish printmaking communities. Expanding our scope to look at other major

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Matthew D. Lincoln, "Sources for Gerrit van Honthorst's Italian Nickname," *Source: Notes in the History of Art*, Spring 2016,

33. Sluijter, "On Brabant Rubbish."

34. While the RKM assigns only one nationality per artist, the BM allows artists to take multiple nationalities, though only six printmaking artists have been tagged as both "Dutch" and "Flemish": Nicolas de Bruyn, Daniel van den Bremden, Egbert van Panderen, Gijsbert van Veen, and Hans Bol.

35. Both the RKM and BM begin to classify artists born in the Austrian Netherlands (post-1715) as "Belgian/Begisch", however there are only a small handful of such artists whose work falls into the 1550–1750 period examined here. For the purposes of this analysis, these few artists will be treated as Flemish.

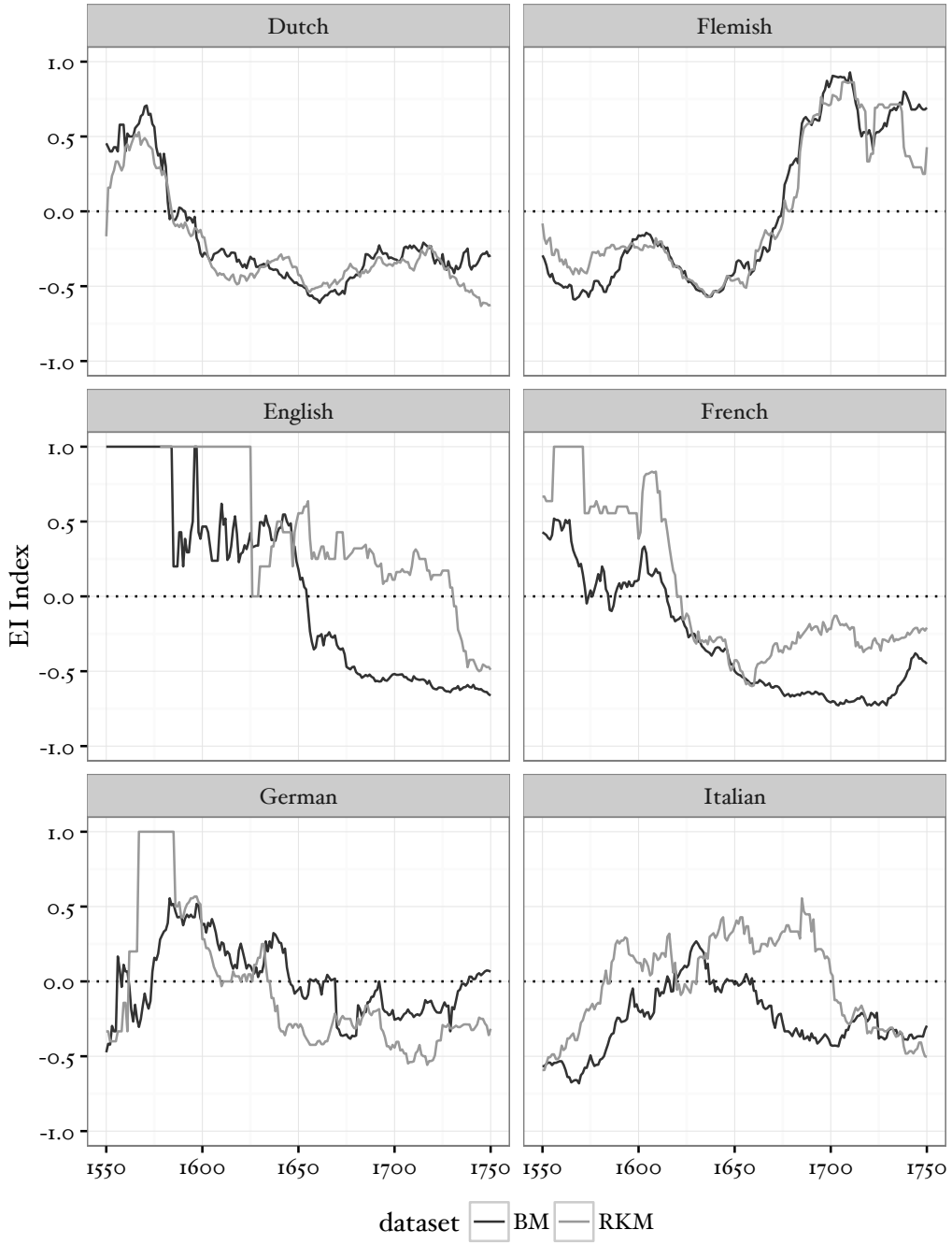

Figure 34: The EI Index for Dutch, Flemish, French, British, German, and Italian printmaking communities between 1550–1750. At 1, all connections made by an actor are to actors outside their national group. At 0, they have an equal number of internal and external connections. At -1, all their connections are to actors within their national group.

European regions, the BM and RKM datasets also roughly agree on the EI index for French, German, and Italian print production. The only major discrepancy between the two datasets is for the EI index of the English printmaking community. Given the vast superiority of the BM's holdings in English prints (Table 1), the trend observed from the BM data is likely more representative than that observed from the RKM.

Dutch artists primarily connected to foreign collaborators up until the 1570s, when they shifted quickly to a roughly even split between domestic versus foreign connections. After this sudden shift, Dutch artists and printmakers continued to favor mostly domestic collaborators, hovering around an EI index of -0.5, i.e. making at least 75% of their connections to fellow Dutchmen. The Flemish printmaking community presents a rough inverse of this pattern, making most of its connections internally in the sixteenth and early seventeenth centuries, before quickly shifting around 1675 to majority-external connections.

These results support the hypothesis that Dutch printmaking experienced a domestic "turn" not only in subject and style, but also in the infrastructure of print production itself. Dutch artists rapidly shifted in the late sixteenth century to having their designs reproduced by fellow Dutch printmakers and publishers, rather than by foreign engravers. Even more dramatically, Dutch printmakers who had worked almost exclusively with foreign publishers like Hieronymus Cock increasingly began to work more with Dutch publishers, many of whom had trained as engravers themselves before opening their own shops. It is somewhat surprising to note that this turn occurred in the 1570s, well before the commonly-acknowledged burst of particularly "domestic" subjects in Haarlem in the 1610s. Even more surprising is how swiftly this landscape of print production changed. Within just a few years, Dutch artists moved from making over three-quarters of their connections to foreign sources, to a roughly even split. As with centralization, changes the EI index, when they do occur, are precipitate.

The results for the Southern Netherlandish printmaking community further contextualize the changes observed in that community's centralization in the previous chapter. Around 1660, shortly after the number of print producers in the southern Netherlands began to decrease (Figure 12), Flemish printmakers and publishers suddenly began to make a great deal more external connections. It is possible that Flemish print producers began looking for work and collaborators outside their borders in response to the general stagnation of the Flemish artistic market in the mid-seventeenth century.

This evidence aligns with the rise in other Flemish luxury exports the latter half of the seventeenth century. In an analysis of seventeenth-century Zeeland toll records, Claartje Rasterhoff and Filip Vermeylen found that, due to Antwerp's general economic downturn and the comparative strength of the Dutch economy, Flemish artists and book publishers dramatically increased the amount of paintings, books, and tapestries they exported via the Northern Netherlands in the wake of the Treaty of Münster.[36] These results suggest that producers of artistic prints followed a similar pattern. However, this analysis grants startling insight into the speed of this impact. Rather than a gradual change in behavior played out over several generations, the shift was rapid.

One might point to events at particular points in Dutch and Flemish history to explain these regions' changing balance of domestic and international printmaking collaborations. The end of hostilities in 1648 was, to be sure, a significant milestone in

36. Claartje Rasterhoff and Filip Vermeylen, "The Zeeland Connection: The Art Trade Between the Northern and Southern Netherlands During the Seventeenth Century," in *Moving Pictures: Intra-European Trade in Images, 16th-18th Centuries*, ed. Neil De Marchi and Sophie Raux (Turnhout: Brepols, 2014), 136–140; Rasterhoff and Vermeylen suggest that the final destinations of many of these goods were actually markets in Iberia or the Baltic, which were most easily accessed via Dutch trade ships. Also see Bruno Blondé and Harald Deceulaer, "The Port of Antwerp and Its Hinterland: Port Traffic, Urban Economies and Government Policies in the 17th and 18th Centuries," in *Maritime Industries and Public Intervention: The Fourth North Sea History Conference, 10-20 August 1995*, ed. Randi Ertesvåg, David J. Starkey, and Anne Tove Austbø (Stavanger: Stavanger Maritime Museum, 2002), 25–27.

the history of the Low Countries. However, it is all too easy overdetermine explanations for changes in these types of social networks based on particular events. Indeed, we can observe rapid shifts from majority-external to majority-internal printmaking collaboration in the French and English communities that are quite similar to the pattern seen in the northern Netherlands. Both the French and English communities also begin this period making most of their connections externally, but each underwent their own separate, inward shifts at 1620 and 1650, respectively. The German and Italian print production networks, on the other hand, began this period internally-connected, only to trend gradually towards more external connections. Neither the German nor the Italian printmaking communities made changes as drastic as their European counterparts.

It seems little coincidence that the regional networks that were primarily inward-connecting or evenly connecting in the mid-sixteenth century (the southern Netherlands, Italy, and Germany) also had some of the longest-established printmaking traditions, dating back to the late fifteenth century.[37] Already possessing well-developed printmaking infrastructure, those regions may have had relatively self-sustaining print production networks, and artists were free to choose either domestic or foreign collaborators. Aspiring printmakers from areas with smaller, less developed printmaking communities, on the other hand, would have had little choice but to reach out to foreign centers with more established printmaking infrastructure.

As the analysis in chapter 2 showed, building up a viable regional production network took time and resources. Over time, these externally-dependent regions would begin to cultivate more native talent, knowledge, and physical resources, as experienced printmakers trained new students and transitioned from making prints to establishing their own publishing firms. As domestic capacity grew, so too would

37. Landau and Parshall, *The Renaissance Print*, ch 1.

the incentive for artists and printmakers to partner with domestic collaborators. The result: a shared pattern of a sudden "inward turn" at different points in time for the northern Netherlands, France, and England. Notably, the shifts were most abrupt in communities that were concentrated in particularly small geographic areas (the Northern and Southern Netherlands, England), with more gradual changes in the communities spread across a larger area (Italian, French, and German). This pattern suggests that larger structural and demographic causes may have been at play.

Indeed, the pattern of early printmaking mastery in Italian and German regions, giving way in the later seventeenth and eighteenth centuries to concentration in the Netherlands, France, and England, mirrors the general trends in European urban populations over this same period. (Figure 8) The share of urban populations living in Italian and German cities decreased between 1500–1800, while the share living in French and English cities increased. Dutch urban populations peaked in 1650, the same time that the Dutch printmaking network had the lowest EI index, i.e. the greatest preference for *internal* connections. These observed shifts in international interaction may have been driven less by particular disruptive historical moments or artistic movements, and more by gradually building structural incentives powered by changes in populations and the necessarily-collaborative nature of print production.

Although specific historical events may certainly have affected the ways that printmakers and publishers from different countries worked together, political changes or military conflicts were short-term happenings that occurred within a landscape of long-term incentives and population trends. The onset of the Dutch revolt, the blockade of the Scheldt, the end of the English civil war: each of these events may have tipped the balance of incentives and sparked a sudden shift in print producers' organization. However, if these events were *necessary* to cause these organizational changes, they were not *sufficient*. In other words, the effects of one specific conflict

or economic shift alone may not have powered the Dutch and Flemish shifts. Rather, certain events may have catalyzed the organizational transformation that had already been made possible, and indeed inevitable, by the buildup of incentives from prolonged international interaction. As in chapter 2, relatively simple network effects resulting from the gradual buildup of printmaking expertise in different regions can offer a broader explanation for why the internal/external connecting ratios of each of these national communities changed in the dramatic way that they did.

3.3.1 Random Networks Revisited: Identifying Disruptive Events

But these shifts were not *solely* due to gradually changing populations. It is possible to identify unexpected disruptions that signal the influence of shorter-term historical events, such as a blockade or a new monarch, that made it easier or more difficult for print producers to work across international borders.

As just noted in the results above, gradual changes in relative community size (in this case, the relative printmaking capacity of each of these different regions/countries) could produce dramatic shifts in the share of ties made within, versus between, different artists. We want to differentiate which EI indices of these communities are *to be expected* in any community of that size relative to its neighbors, and which are unexpectedly high (favoring international connections) or low (favoring domestic).[38] These baseline networks will be created in a manner similar to the previous chapter:

1. For each year, generate a series of unconnected networks, each with the same number of nodes and edges as found in each of the regional printmaking

38. On accounting for these properties of the EI index, see Peter Mariolis, "Concepts, Models, and Measures: Towards an Analytical Framework for Social Network Analysis," in *Sun Belt Social Network Conference* (Palm Beach, 1985); Hanneman and Riddle, *Introduction to Social Network Methods*, 220–223. See section 2.4.1 for a review of the rationale for comparing empirical to random graph output.

communities in the BM and RKM data. This will result in several national clusters without any bridging links. (Figure 35(a))

2. Add a second set of "international" edges by choosing several source nodes at random, and several target nodes based on a power law probability distribution.[39] (Figure 35(b))
3. Measure the EI index of each of these resulting communities, and compare with the results from the BM and RKM data.

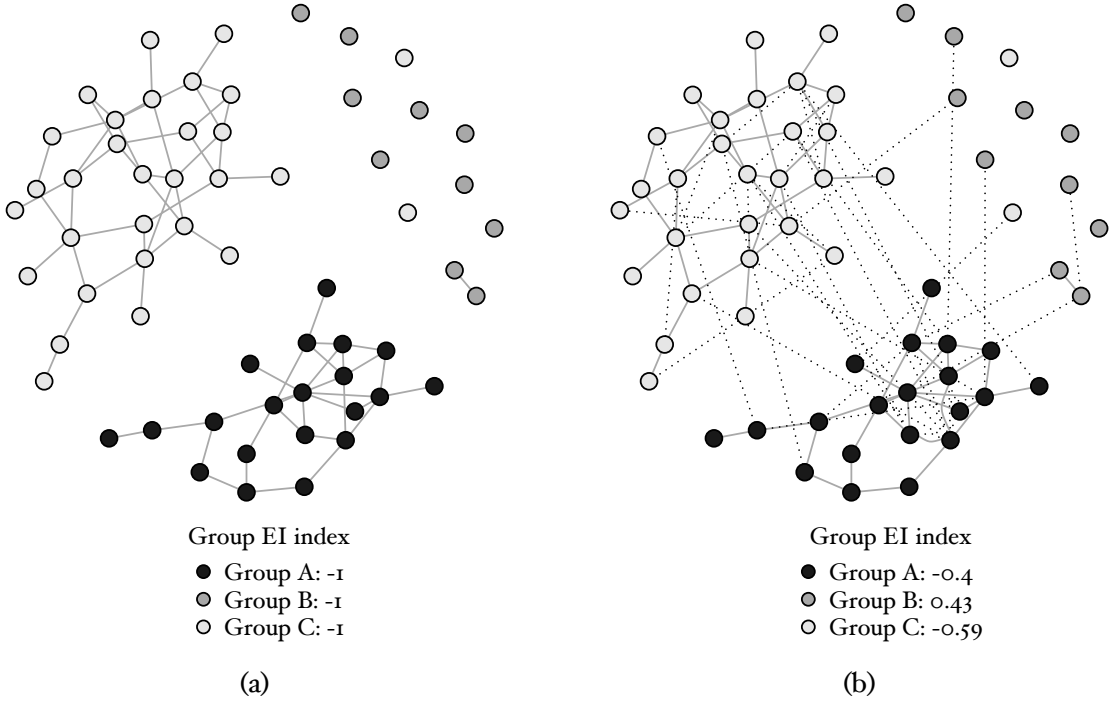

Figure 35: A visualization of the two-stage simulation of international print network interconnection. (a) shows the first stage of the simulation, in which several regional communities are created. (b) shows the result of the second stage, in which additional links (here shown as dotted lines) are added both within and between these regional clusters based on a probability distribution that favors well-connected nodes.

Figure 36 overlays the EI indices of these simulated networks on the results observed from the BM and RKM data. By in large, the simulated networks return

39. The importance of a power law probability distribution in random graph generation is explained in page 65, note 31.

similar results to those found in the empirical results. This underlines the major governing factor that regional print production capacity — in other words, the size of the network — had on any one community's balance of international versus domestic connections. However, there are several notable mismatches between the EI indices returned by these randomly generated networks, and those found in the BM and RKM data.

For example, in the northern Netherlands between roughly 1650 and 1675, both the BM- and RKM-based networks return a lower EI index than are predicted by randomized networks of the same relative size. In other words, Dutch print producers were making an unexpectedly large number of internal connections during this period, given their size relative to other communities. Could this be a consequence of the official end of the revolt in 1648 with the signing of the Treaty of Münster? It is possible that the close of the war, and a burgeoning sense of national Dutch pride, may have been expressed in prints through more domestically-centered production.[40] Conversely, in the southern Netherlands, a higher-than-expected EI index (i.e. more international connections than found in a random network of the same size) around 1580–1610 coincides with the Spanish invasion of Antwerp and the accompanying exodus of Flemish artists, including printmakers.[41]

One may also point (albeit with slightly less certainty, given the dissimilar results returned by the BM and RKM) to the possible influence of English and French monarchs' artistic priorities on their countries' printmaking communities. An unexpectedly high

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40. On the growth in privileges issued by the States General at this time, see P. G. Hoftijzer, "Nederlandse boekverkopersprivileges in de zeventiende en achttiende eeuw," *Jaarboek van het Nederlands Genootschap van Bibliofielen*, 1993, 49–62; Nadine M. Orenstein, "Sleeping Caps, City Views, and State Funerals: Privileges for Prints in the Dutch Republic, 1593–1650," in *In His Milieu: Essays on Netherlandish Art in Memory of John Michael Montias*, ed. Amy Golahny, Mia M. Mochizuki, and Lisa Vergara (Amsterdam: Amsterdam University Press, 2006), 313–346.

41. Sluijter, "On Brabant Rubbish."

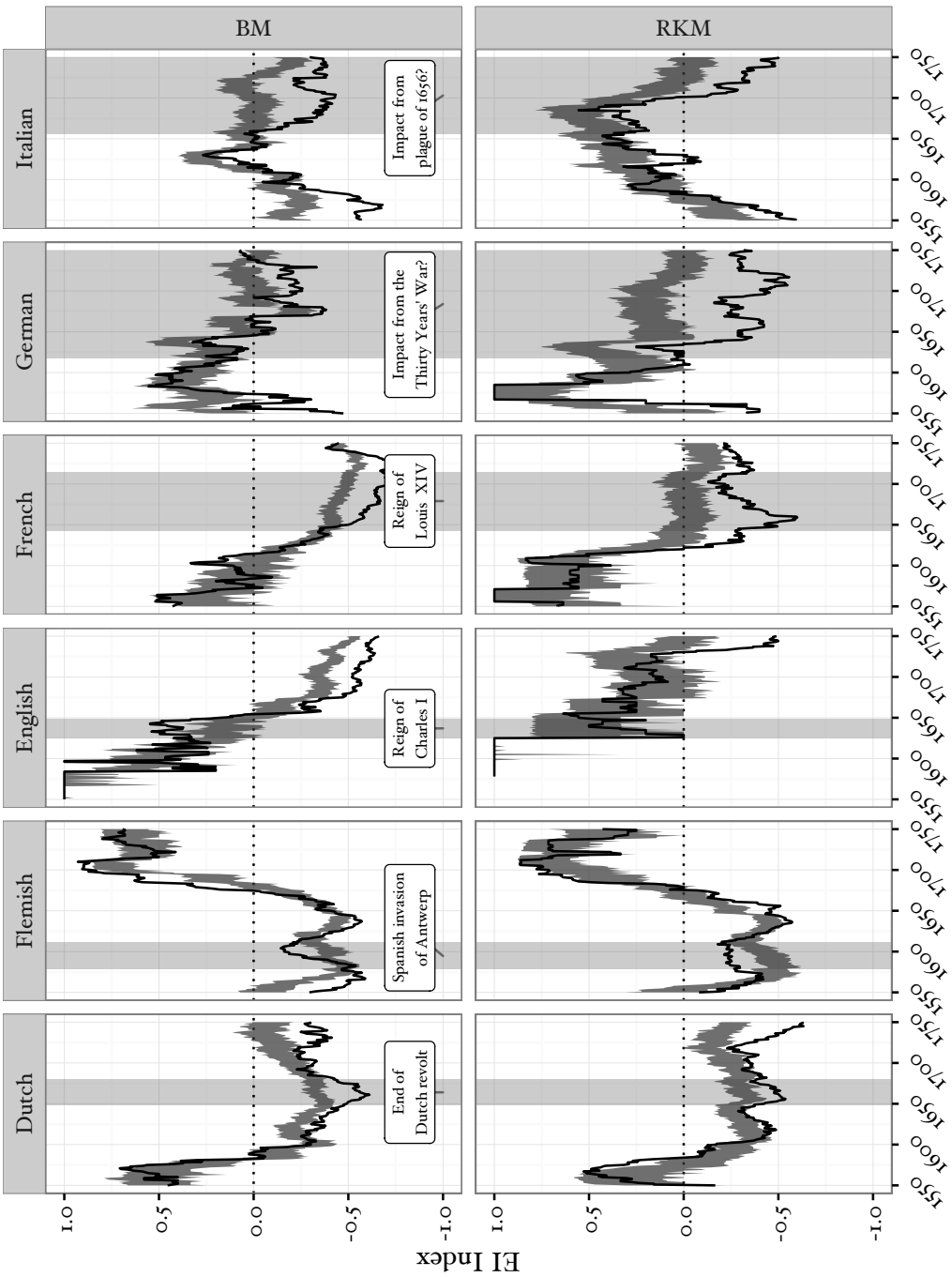

Figure 36: Random graph EI indices. The black lines show the EI indices observed in the BM and RKM data, while the gray ribbons show the range of results returned by the simulated networks. Some areas with diverging results are highlighted and annotated with some possible explanations.

number of international connections in the English printmaking community between 1625 and 1649 coincides with the reign of Charles I, who imported a wide range of both continental artworks and artists to London during his rule. In France, far more *internal* connections between French printmakers are found than expected are found during the reign of Louis XIV between 1643 and 1715. In 1655, the *Académie royale de peinture et sculpture* began to admit printmakers, legitimizing the medium as a fine art rather than a mechanical craft.[42] Moreover, the Sun King issued a large number of print privileges during his reign, and may have gone a long way towards promoting French artistic talent.[43]

Both the German and Italian printmaking communities show consistently fewer international connections in the late seventeenth and early eighteenth centuries than are found in simulated communities of equivalent size. (Again, these trends ought to be treated with more skepticism, given the somewhat different results returned by the BM and RKM.) The privations of the Thirty Years' War, which persisted in the German region long after the nominal end of the conflict in 1648, may have inhibited the German print production industry from establishing as many international contacts as a market of their size would have suggested.[44] As for Italian printmakers, their unexpectedly low number of external connections may have been due, in part, to

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42. Sue Welsh Reed and Alvin L. Clark, eds., *French Prints from the Age of the Musketeers* (Boston: Museum of Fine Arts, Boston, 1998), 18–19.

43. Peter Fuhring, "The Market for Prints under Louis XIV: Charles Le Brun," *Print Quarterly* 19, no. 1 (March 2002): 3–11.

44. Theodore K. Rabb, "The Thirty Years' War and the German Economy," *The Journal of Modern History* 34, no. 1 (March 1962): 40–151.

the plague of 1656 and the economic collapse that followed in its wake. The Italian peninsula would still be recovering from this disaster a century later.[45]

3.4 Case Studies of Traveling Printmakers

This long-term view of print production is a challenging one for traditional, artist-based perspectives on the history of artistic printmaking. At the scale of hundreds or thousands of artists working over two centuries, the broad contours of international print production appear to be determined more by demographic changes, rather than the impacts of specific artists, or turning points in political or military history. And yet, the individual experience of international collaboration and exchange varied widely in this period. Several case studies of artists hailing from both the southern and northern Netherlands will illustrate just how diverse these interactions could be.

3.4.1 The Sadelers' International Connections

Section 2.5.4 noted the core role that family dynasties played in the Flemish print production network. This broader European perspective reveals important distinctions between the comparative international reach of these families. While prominent engravers in the Galle, Wierix, and De Jode families tended to make most of their connections to Flemish collaborators, members of the Sadeler family consistently rank among the more internationally-focused Flemish print producers, with Jan (Johann) I Sadeler and Aegidius II Sadeler maintaining a roughly even split between collaboration with Flemish and artists and publishers versus foreign ones. (Figure 37)

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45. Guido Alfani, "Plague in Seventeenth-Century Europe and the Decline of Italy: An Epidemiological Hypothesis," *European Review of Economic History* 17, no. 4 (November 2013): 408–430, doi:10.1093/ereh/het013.

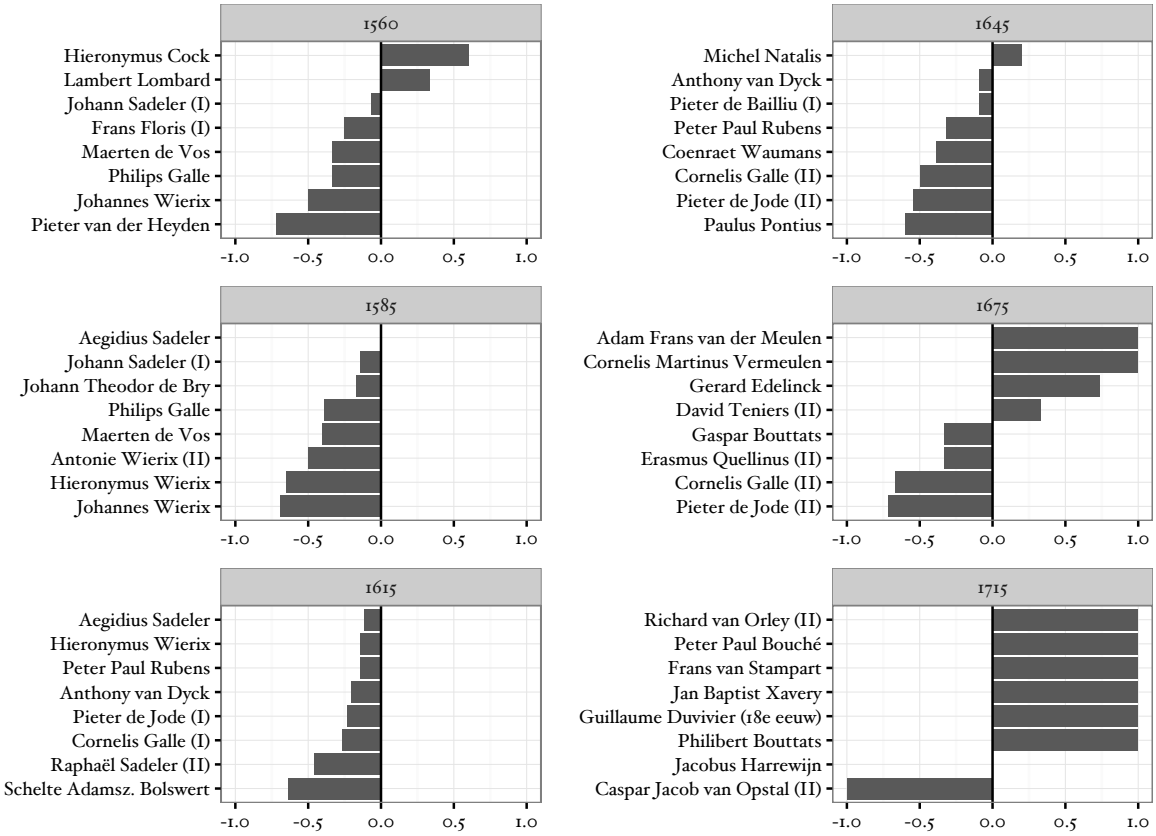

Figure 37: The individual EI scores of highly-central Flemish printmakers and publishers in 1560, 1585, 1615, 1645, 1675, 1715

The Sadelers leveraged their early displacement from Antwerp in 1586 into a highly successful dynasty connected not only to their original home in Flanders, but also to the Hapsburg court in Prague and to Italian circles in both Venice and Rome. In 1586, Jan I and his brother and fellow engraver, Raphael I, along with their nephew Aegidius I, fled political turmoil in Antwerp for Mainz, followed by Frankfurt and then to the court of Duke Wilhelm V in Munich.[46] The Sadelers continued to engrave and publish prints in each of these cities, as evidenced by the constantly changing addresses inscribed on each print.[47] Aegidius would travel to Italy between 1591–1593, possibly inspired by the Dutch engraver Hendrick Goltzius, who had visited Aegidius in 1590 during his own trip to Rome.[48]

Aegidius found his greatest success in Prague as a court engraver for the Hapsburg emperors Rudolf II, Matthias, and Ferdinand II. While there, he produced prints after court painters Bartholomeus Spranger, Joseph Heintz, and Hans von Aachen. Aegidius also exhibited his versatility of subject matter, engraving landscape prints after Paul Bril and Jan Brueghel (with whom he may have had contact when visiting from in 1593) as well as Roelandt Savery and Pieter Stevens, who had crafted many landscape drawings while working at Rudolf II's court.[49] (Figure 38) Even in his late career, however, Sadeler maintained an awareness of developments in Antwerp; his original print *Charity, or*

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46. See Dorothy Limouze, "Protestant Madonnas Revisited: Iconographic Duality in Works by Jan Sadeler and Joos van Winghe," in *A Tribute to Robert A. Koch: Studies in the Northern Renaissance*, ed. Barbara T. Ross (Princeton: Princeton University Press, 1994), for an account of Jan's early work in Mainz and Frankfurt; on Munich, see Dorothy Limouze, "From Bavaria to the Veneto, and Return: The Sadelers, Jacopo Bassano, and Italian Art in Munich," in *München - Prag um 1600*, ed. Beket Bukovinská and Lubomír Konečný (Prague: Artefactum, 2009), 117–124.

47. All of their impressions from this period list a Sadeler (usually Raphael) as *executor*; Limouze, "From Bavaria to the Veneto, and Return: The Sadelers, Jacopo Bassano, and Italian Art in Munich," 117–118.

48. Dorothy Limouze, "Aegidius Sadeler, Imperial Printmaker," *Philadelphia Museum of Art Bulletin* 85, no. 362 (April 1989): 4–6. doi:10.2307/3795429.

49. Ibid., 10.

Maternal Love, may well have been inspired by Rubens' own approach to rendering feminine beauty.[50] (Figure 39)

Figure 38: Aegidius Sadeler after Roelandt Savery, *Man and four goats before a waterfall*, from a series of six landscapes, 1597–1629. Engraving and etching, 22.2 x 28.6 cm. Rijksmuseum, Amsterdam

Though he does not rank among the most central Flemish print producers of the seventeenth century, Jan Sadeler's son Justus also played a significant role in building the family's ties to Italy.[51] Born in Antwerp 1583, a surviving contract places

50. Limouze, "Aegidius Sadeler, Imperial Printmaker," 16.

51. On Justus, see Philippe Sénéchal, "Justus Sadeler: Print Publisher and Art Dealer in Early Seicento Venice," *Print Quarterly* 7, no. 1 (March 1990): 22–35.

Figure 39: Aegidius Sadeler, *Charity, or Maternal Love*, c. 1620. Engraving, 30 x 21.4 cm. Biblioteca Nacional de Portugal, Lisbon.

Justus in Venice as early as 1599. There he established and engraving and publishing business that left a significant mark on Venetian print culture of the early seventeenth century.[52] Justus inherited most of his father's plates, and would continue to publish impressions of these older designs while working in Italy. Aegidius Sadeler even ensured that the print privilege he acquired from Emperor Matthias would extended to Justus' publications in Venice.[53] These bonds of family, combined with their shared talents with the burin, allowed the Sadelers to patch together a remarkably successful printmaking dynasty in spite of their itinerant lives.

3.4.2 Cornelis Bloemaert

In the north, traveling printmakers were also an exception to the overall preference by Dutch print producers for domestic collaborators in the seventeenth century. Figure 40 shows a sample of the most central participants in the Dutch printmaking network across several different periods.[54] While the *overall* Dutch EI index was negative in the mid-seventeenth century, it is easy to find examples of Dutch artists who did a great deal of international work, just as it is common to find ones who worked almost exclusively with other Dutch artists and publishers. That said, artists who were remarkably central in the European network at large tended to be ones that were also central "at home". No matter which nationality one looks at, the more central an artist was, the more likely they were to make most of their connections to artists from the same region. For example, major Dutch publishers like Hendrick Hondius I and Crispijn de Passe I increasingly turned to native Dutch artists for designs, while applying to the States

52. Anna Omodeo, *Mostra di stampe popolari venete del '500: catalogo* (Florence: Gabinetto disegni e stampe degli Uffizi, 1965), 8–9.

53. Sénéchal, "Justus Sadeler," 28.

54. Influence is ranked by degree centrality, the metric used in chapter 2, figures 15 and 22.

General, rather than foreign sovereigns, for privileges.[55] Only a handful of the most active and influential Dutch printmakers during the seventeenth century did much of their work with foreign artists and publishers. And still, interesting exceptions stand out.

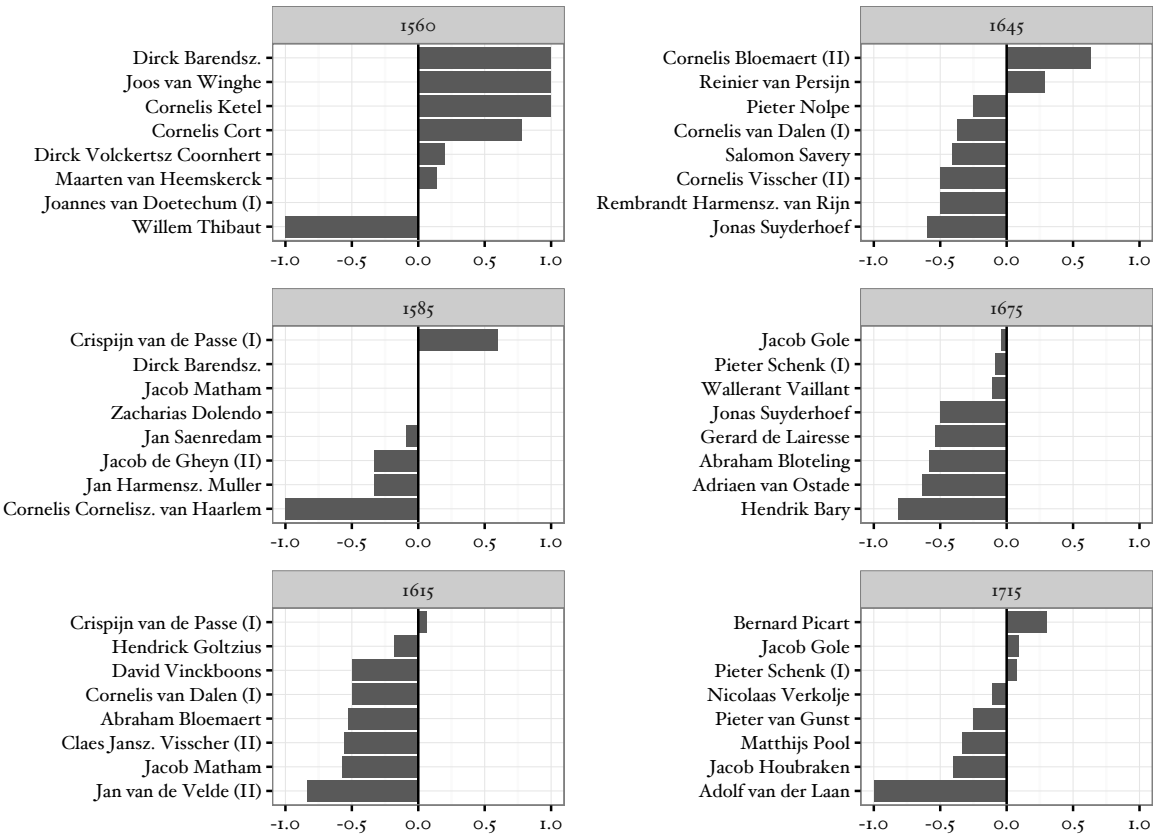

Figure 40: The individual EI indices of highly-central Dutch printmakers and publishers in 1560, 1585, 1615, 1645, 1675, 1715

55. Orenstein, *Hendrick Hondius*, 47.

One such printmaker was Cornelis Bloemaert the Younger, who was born in Utrecht around 1603.[56] He initially studied painting with his father, Abraham Bloemaert, but would later train as an engraver with Crispijn de Passe.[57] Bloemaert produced several prints after designs by his father during his early years in Utrecht, including both single-sheet prints as well as a series of small peasant scenes (Figure 41). He left his hometown for Paris in 1630, where he would work for three years engraving designs after various French masters. By 1634, he had arrived in Rome, where he joined the "Bentvueghels", an expatriate fraternity of northern European artists working in Rome. He was one of a handful of engravers who would come to join the group, including the Flemish engraver Michel Natalis, and Reiner Persijn from Alkmaar, who studied with Bloemaert while in Rome.[58] Following the tradition of members of the Bentvueghels, Bloemaert adopted the playful alias "Winter".[59] While in Rome, he made a living producing engravings mostly after Italian works. Bloemaert contracted with the Marchese Vincenzo Giustiniani to produce a series of plates depicting the Marchese's collection of antique statuary (Figure 42). Though this project was cut short by the Marchese's death, Bloemaert would continue to produce engravings primarily after the art collections of major patrons, producing prints after diverse Italian masters such as Pietro da Cortona, Andrea Sacchi, Guido Reni, and Raphael. He would work in Rome until his death in 1692.

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56. Marcel Roethlisberger and Marten Jan Bok, *Abraham Bloemaert and His Sons: Paintings and Prints* (Doornspijk: Davaco, 1993), 513–526.

57. Filippo Baldinucci, *Cominciamento e progresso dell' arte dell' intagliare in rame colle vite di molti de' più eccellenti maestri della stessa professione* (Florence, 1767), 131–138, http://hdl.handle.net/2027/gri.ark:/13960/t4gm9289m.

58. G. J. Hoogewerff, *De Bentvueghels* ('s Gravenhage: M. Nijhoff, 1952), 71.

59. While the meaning of some of these nicknames has been preserved, Bloemaert's remains a mystery; ibid., 132.

Figure 41: Cornelis Bloemaert II after Abraham Bloemaert, title page for *Otia delectant*, c. 1625. Engraving, 10.8 x 15.3 cm. Rijksmuseum, Amsterdam.

Figure 42: Cornelis Bloemaert II after a drawing by Giovanni Citosibio Guidi, *River God* from *Galleria Giustiniana del Marchese Vincenzo Giustiniani* (Rome, 1636). Engraving, 23.1 x 21.5 cm. Rijksmuseum, Amsterdam.

Bloemaert's unsurpassed commercial success in foreign territory can be ascribed to his professional networking prowess. Lacking the established professional network he could have accessed through his father had he remained in Utrecht, Bloemaert cultivated his own transnational network at each step in his career. Notably, many impressions of the Italian prints that Bloemaert engraved bear the address of Pierre Mariette I, a Parisian publisher Bloemaert had published with during his time there between 1630 and 1633.[60] Bloemaert would also build on his success making engravings for elite Roman collectors, contracting with the Barberini as well as with Cardinal Giulio Cesare Sacchetti. Surviving documents of Bloemaert's interaction with the cardinal reveal how detailed the breakdown of engraving expenses could be. A surviving letter from the painter Pietro da Cortona to Cardinal Sacchetti's steward enumerates separate line items owed to Bloemaert for the figural illustration of a particular engraving, listing a charge for the decorative border, another for the inscription, one for the coat of arms, as well as a line for the copper plates themselves.[61] Bloemaert's prints were valued enough to be displayed not only in albums, but also on walls: a series of illustrations Bloemaert engraved for Sacchetti's thesis would later be set in an elaborate frame in the Palazzo Sacchetti.[62]

3.4.3 Abraham Blooteling

Another of the handful of influential Dutch engravers who made most of his connections to foreign collaborators in the late seventeenth century was Abraham Blooteling,

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60. Mariette probably traveled to Rome in 1634 around the same time that Bloemaert arrived in the city; R.-A. Weigert, "Le Commerce de la gravure au XVIIe siècle en France: Les deux premiers Mariette et François Langlois, dit Ciartres," *Gazette des Beaux-Arts* 41, no. 6 (March 1953): 171.

61. Ruth Kraemer, "Pietro da Cortona and Cornelis Bloemaert: An Unpublished Document," *The Burlington Magazine* 131, no. 1035 (1989): 414.

62. Ibid., 415.

who would come to be known for his skill in the novel mezzotint technique.[63] Blooteling was born in Amsterdam, where he trained with Cornelis van Daelen I. Like Bloemaert, Blooteling's first international destination was Paris; he arrived there in 1660. He apprenticed with Pierre van Schuppen, member of a small group of Flemish engravers working in the city. Blooteling met another mezzotint innovator in Paris named Wallerant Vaillant. Blooteling and Vaillant would both return to Amsterdam in 1665, where they continued to work together closely, sharing *modelli* and print designs that Blooteling had inherited from Van Daelen.[64]

Blooteling made his biggest impact, however, in London. Dutch printmaking talent and Dutch prints had been in high demand in England since the sixteenth century, when Crispijn de Passe sold impressions to the London market while working in Cologne.[65] In the wake of the Restoration, Dutch painters and printmakers alike flocked to London as they followed Charles II (and the patronage of his court) when he returned from his exile in The Hague. Blooteling moved several years later, leaving Amsterdam in 1673 at the invitation of King Charles' cousin, Prince Rupert of the Rhine. The invitation may have been all the more attractive to Blooteling following the 1672 French invasion of the Netherlands, which had caused an economic contraction that likely depressed the Dutch art market. Blooteling was strategic in his planning, however. Mary Bryan Curd has convincingly demonstrated how Blooteling mobilized his network of students and patrons in order to establish himself in London. He ensured that his apprentice, Jan van Munnickhuijsen, would be able to accompany him to London and provide valuable

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63. For Blooteling's oeuvre, see J. E. Wessely, *Abraham Blooteling, Verzeichniss seiner Kupferstiche und Schabkunstblätter* (Leipzig: R. Weigel, 1867).

64. Mary Bryan H. Curd, *Flemish and Dutch Artists in Early Modern England: Collaboration and Competition, 1460-1680*, Visual culture in early modernity (Burlington: Ashgate, 2010), 129–133.

65. Eric Jan Sluijter, "The English Venture: Dutch and Flemish Artists in Britain 1550-1800," ed. Juliette Roding et al., *Leids kunsthistorisch jaarboek* 13 (2003): 15.

Figure 43: Abraham Blooteling, *Portrait of Rupert, Prince of the Rhine*, 1673. Engraving, 39 x 29 cm. Rijksmuseum, Amsterdam.

labor and financial support. Like Bloemaert in Rome, Blooteling also leveraged his print subjects and patrons to attract more business once in the new city. One of his first publications were engraved portraits of Rupert and Charles: gifts to those who had invited him, but also a signal to potential English clients of his ability to engrave refined likenesses. (Figure 43) Blooteling would continue to differentiate himself by introducing print portrait series (a staple of Dutch artistic printmaking) to London audiences.[66]

Bloemaert's other distinguishing trait was his unparalleled skill in mezzotint, from which he could extract remarkably subtle tonal gradations. Blooteling deployed this talent to great effect in his reproductive portrait prints after Van Dyck, in which he expertly captured the Flemish painter's gauzy brushwork. (Figure 44) The technique took late seventeenth-century London by storm, as the city lacked the mature engraving and etching talent that Holland had enjoyed for decades. Interestingly, Blooteling's patron Print Rupert was himself an amateur practitioner of mezzotint, and was erroneously credited with its invention by contemporaries.[67] Blooteling hired a range of apprentices in London who would have provided invaluable help in the laborious process of preparing mezzotint plates, supporting his prolific output. Like Bloemaert, Blooteling derived long-term benefits from local networks he worked to establish while abroad. Even after returning to Amsterdam in 1678, Blooteling continued to market his prints in England via his London contacts.[68] However, he clearly understood the distinct tastes of the Amsterdam market as well, producing more etchings and engravings after Dutch subjects in this final phase of his career. (Figure 45)

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66. Curd, *Flemish and Dutch Artists in Early Modern England*, 137.

67. Gerdien Wuestman, "The Mezzotint in Holland: 'Easily Learned, Neat and Convenient'," *Simiolus: Netherlands Quarterly for the History of Art* 23, no. 1 (1995): 71, doi:10.2307/3780782.

68. Curd, *Flemish and Dutch Artists in Early Modern England*, 153.

Figure 44: Abraham Blooteling, after Sir Anthony van Dyck, *The Apostle Paul*, 1652–1690. Mezzotint, 35.2 x 27.4 cm. Rijksmuseum, Amsterdam.

Figure 45: Abraham Blooteling, after Jacob van Ruisdael, *View of the Marina Outside the Blaubrug*, from the series *Amstelgezichten*, 1655–1690. Etching, 16.5 x 21.8 cm. Rijksmuseum, Amsterdam.

For all the international connections they made, it is interesting to note that both Bloemaert and Blooteling relied heavily on fellow expatriates when they made their moves to Paris, Rome, and London. This nuance is an important to bear in mind when looking at quantitative results that suggest both engravers did most of their work with foreigners. Both of these cases also demonstrate the importance of network connections that do not fall within the set of direct ties of artistic source, printmaker, and publisher captured by the datasets used for this study. The funding and social connections of family members, patrons, and even portrait subjects were integral to both Bloemaert's and Blooteling's success.

3.4.4 Turning Away from the Low Countries

While Dutch print producers' overall preference for domestic connections continued into the early eighteenth century (Figure 34), some central print producers increasingly maintained active international business. The French-born Bernard Picart dominated the print trade in Amsterdam soon after moving there in 1711 at the age of 38. Picart would train many Dutch engravers in a formally-regulated, French-style academy, the *Amsterdamse tekenschool*, emulating his own training in the French academic manner. And while he would spend the rest of his life building a successful publishing house in Amsterdam, he would maintain agents in Paris to promote his work; many of his prints published in the Netherlands have also been recorded in contemporary auctions in Paris.[69] Pieter Schenck is another name that ranks among the most central printmakers in 1715. He was an engraver and mezzotinter of German birth who came to the Amsterdam around 1683–4 and built a thriving business split between Amsterdam and

69. Nelke Barthelings, "Bernard Picart, a French Engraver in the Dutch Republic," in *Les échanges artistiques entre les anciens Pays-Bas et la France, 1482-1814*, ed. Gaëtane Maës and Jan Blanc (Turnhout: Brepols, 2010), 49.

Leipzig.[70] Though they were comparatively prolific, Picart and Schenck were counterbalanced by a "long tail" of domestically-inclined printmakers. These domestically-centered Dutch artists may only have produced a handful of prints each, but their output, in aggregate, outnumbered that of Picart and Schenck.

In the Northern Netherlands, passing economic depression in the late seventeenth century, and hence contraction in the local print market, may have spurred some artists to expand their business beyond the Dutch Republic. Yet, as we saw with Abraham Bloemaert, some returned home and brought their new international connections with them. Sustained economic stagnation in the southern Netherlands, on the other hand, gutted their printmaking industry. Without a critical mass of fellow print producers, many Flemish printmakers and publishers left the country entirely: Adam Frans van der Meulen, a painter and draughtsman who made designs for several prints, decamped to Paris by 1664, joining the service of Louis XIV in designing both prints and tapestries.[71] Likewise, Cornelis Martinus Vermeuelen (no known relation to Van der Meulen), a printmaker born in Antwerp in 1644, moved to Paris to produce prints (mostly formal portraits) after Pierre Mignard, Hyacinthe Rigaud, among others. Vermeulen also made several prints after Adriaen van der Werff, a Rotterdam painter heavily influenced by French prints. These shifts presaged a sea change in the importance of the Low Countries to European print production. By the mid-eighteenth century the center of gravity in the world of European printmaking had shifted from Antwerp and

70. Waller, *Biographisch woordenboek van noord Nederlandsche graveurs*, 287–288.

71. Everhard Korthals Altes, "French Prints in Dutch Collections and their Influence on Dutch Paintings (1675-1750)," in *Les échanges artistiques entre les anciens Pays-Bas et la France, 1482-1814*, ed. Gaëtane Maës and Jan Blanc (Turnhout, Belgium: Brepols, 2010), 181.

Amsterdam to Paris, where a regimented system of training, privileges, and regulations produced a wholly different ecosystem for making prints.[72]

3.5 Conclusion: Tipping Points in International Print Production

While literature on Netherlandish printmaking has plentiful examples of both international and domestic strains of Dutch and Flemish printmaking, most studies have focused on subject matter, rather than patterns of production. The detailed case studies of the sort that comprise most literature on artistic printmaking do not give clear answers to the simple, yet broad question: did Dutch and Flemish printmakers make most of their prints in collaboration with domestic partners, or foreign ones? And how did this balance change over time?

A data-driven analysis of these printmaking networks suggests that printmakers in the northern Netherlands did a majority of their collaborative work with artists and publishers outside of Holland, only shifting to majority-domestic work around 1570. Flemish printmakers and publishers, on the other hand, connected mostly internally up until around 1675, when they turned sharply outward. These production structure shifts present an alternative to the traditional stylistic histories of printmaking in the Netherlands: surprisingly, Dutch print producers inward shift occurred almost forty years before the "Haarlem pioneers" of the 1610s began to produce local Dutch landscape prints in large numbers. That both these shifts were rapid, rather than spanning multiple generations, is notable in itself.

What is more, similar "tipping points" from foreign to domestic production occur in French and English print communities. This pattern suggests that these inward

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72. See Peter Fuhring, "The Print Privilege in Eighteenth-Century France – I," *Print Quarterly* 2, no. 3 (1985): 175–193 and Peter Fuhring, "The Print Privilege in Eighteenth-Century France – II," *Print Quarterly* 3, no. 1 (1986): 19–33.

turns might not have been spurred solely by disruptive historical events, but may have been the result of the gradual spread of printmaking capacity across different European communities. Artists in countries with underdeveloped printmaking capacity — few printmakers producing few prints — would naturally gravitate towards more prominent and established centers, such as a major publishing house or court, outside their borders. As their home country began to develop more printmaking infrastructure, those artists could more easily find domestic collaborators. Not all the shifts in international print production can be explained through the changing size of these communities. Some historical events, like the invasion of Antwerp or the Italian plague of 1656, may have had a temporary effect on the ability of print producers to make either internal or external connections. However, like many complex systems, most of the larger structural changes these print production networks underwent, though unpredictable and sudden when viewed in the short term, can be understood as emergent consequences of slow-moving demographic change and the gradual transfer of technical and artistic knowledge between different European communities.

4 Diversity, Specialization, and the Uses of Prints

So far, this dissertation has only briefly touched on the question of prints' subject matter and how they might relate to the professional strategies of printmakers and publishers.[1] This question has occupied many scholars of painting in this period. Artistic, social, and economic reasons have been proposed to explain why so many Dutch and Flemish painters may have elected to concentrate their output in still lifes, domestic scenes, landscapes, or portraiture.

However, few studies have asked whether *printmakers* experienced the same pressured to specialize. Did professional printmakers also adopt this specialization strategy in an attempt to distinguish themselves in a crowded field? Or did the medium, which was often put to use making reproductions after other artists' designs, instead favor etchers and engravers willing and able to render the works of a wide variety of artists and subjects? Existing case studies of individual printmakers and publishers present conflicting evidence. How can we test this question at scale?

In a clever twist on Darwin, Larry Silver has referred to studies of artistic genres as tracing the "origins of pictorial species".[2] While Silver only invokes speciation as a metaphor, ecology offers a useful quantitative model for thinking about genre specialization. A common measurement of species diversity (Shannon's diversity metric) can be used to characterize artists' relative specialization or diversification in

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1. See, for example, Hendrick Hondius' diversification in the face of a decentralizing print production network, discussed in section 2.5.2.

2. Larry Silver, *Peasant Scenes and Landscapes: The Rise of Pictorial Genres in the Antwerp Art Market* (Philadelphia: University of Pennsylvania Press, 2006), ch. 1.

genre, thus allowing us to gain a broader perspective on printmakers' specialization or diversification strategies. After demonstrating that this diversity index can detect Dutch and Flemish painters' commonly-acknowledged trend towards genre specialization, the same measurement will be used to test whether or not a similar trend towards, or away from, genre specialization exists among printmakers. Two new data sources about paintings will be considered alongside the print databases used in the previous chapters: a corpus of seventeenth-century Dutch household inventories, and a database of Dutch paintings in modern-day museum collections.

This broader view of printmakers' strategies will help contextualize a closer examination of a few printmakers who had exceptionally specialized or diversified oeuvres. This analysis will ultimately suggest how not only commercial motives, but also period views of the use and function of prints in the sixteenth and seventeenth centuries may have steered printmakers to select subject matter differently than did painters, thus distinguishing the way that printmakers shaped their own professional and artistic identities.

4.1 Background: Why Specialize?

In the uniquely competitive, open art market in the sixteenth- and seventeenth-century Netherlands, some painters sought the opportunity to distinguish themselves from competitors through the subjects they depicted. Karel van Mander identified this motive in his 1604 *Schilder-boek*, remarking how the Mechelen artist Gregorius Beerincx attracted attention, as well as quick money, for the sheer novelty of his "pure" landscapes:

> Gregorius Beerings in de Schaar, from Malines, painter in watercolour; having been to Rome, he was very accomplished at ruins which he depicted very attractively. When he was in Rome and had wasted his money he

> decided, in order to get hold of some money quickly, to do the following: he made a canvas with a Deluge in which there was nothing other than a rainy sky, water and the ark without a figure in sight. When he was asked what it was and he replied: The Flood, then followed: Where are the people? He said: They have all drowned - if the water was to go down you would see them - and the rest of them are in the ark. Nearly everyone wanted to have one of these and as such pieces are rapidly completed he soon came into heaps of money; that was a beautiful stunt.[3]

Van Mander regretted that so many artists pursued this "by-way" of specialization in real-seeming landscapes, still lifes, or portraiture, rather than striving for the synthesis of all these modes via history painting.[4] Though specializing in particular genres did not conform to Van Mander's ideal of painterly achievement, he admits it was a commercially successful strategy, nevertheless.

Van Mander also recognized the two distinct business advantages that genre specialization offered to painters, advantages that John Michael Montias has framed as the result of *product* and *process* innovations.[5] Product innovations offer a novel product for which the current market had little or no established competition (e.g. we read that the Roman audience found Beerincx's paintings intriguing and desirable.) Specialization also offered process innovations, allowing painters to produce each painting in a more efficient manner ("such pieces," Van Mander noted, "are rapidly

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3. "Gregorius Beerings in de schaer, Mecchelaer, Schilder van Water-verwe, desen te Room hebbende geweest, was seer aerdigh van Ruwijnen, die hy oock playsant dede. Te Room wesende, en t'ghelt door ghebracht zijnde, om haest aen ghelt te comen, gingh toe, maeckte eenen doeck van een Diluvie, daer niet in quam als een regenende locht en water met de Arck, sonder datmen eenige personnagie sagh. Doe hem gevraeght was wat het was, en hy antwoorde de Diluvie, volghde daer op: Waer is dan het volck? Hy seyde, sy zijn al verdronken, alst water af soude gaen soudemense sien, en d'ander waren in d'Arck. Hier van wilde schier elck een hebben: en ghelijck dussche stucken haest ghedaen waren, raeckte weder aen den buydel vol ghelt, t'welck een schoon practijke was." Karel van Mander, *The Lives of the Illustrious Netherlandish and German Painters (1604)*, ed. Hessel Miedema, trans. Jacqueline Pennial-Boer and Charles Ford (Doornspijk: Davaco Publishers, 1994), fol. 228v.

4. E. K. J. Reznicek, "Realism as a 'Side Road or Byway' in Dutch Art," in *The Reniassance and Mannerism*, vol. 2 (Princeton: Princeton University Press, 1963), 247–253.

5. Montias, "Cost And Value," 456–457.

completed.") For example, a painter who focused largely on landscape would need to master fewer compositions and techniques than a generalist, and could liberally re-use practiced visual motifs from painting to painting. These innovations may have flourished, in part, by filling the market gap left by the decline of systematic church patronage after the late-sixteenth-century iconoclasm.[6] Netherlandish studio practices also helped foster this turn towards genre specialization. Major workshops, particularly those in Antwerp, often divided large painting projects among different artists, with flora, fauna, or landscape rendered by one artist, and the human figures by another. This tradition can be traced back to the collaborations between Quentin Metsys and Joachim Patinir, and saw its seventeenth-century culmination in the frequent partnerships between Peter Paul Rubens and Jan Brueghel I.[7] While less common in the northern Netherlands, this practice can be found among Dutch painters as well. For example, staffage in the church interiors of the Delft painter Bartholoemus van Bassen were likely added by Esaias van de Velde after Van Bassen had completed the main composition.[8]

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6. Hans Vlieghe, "The Fine and Decorative Arts in Antwerp's Golden Age," in *Urban Achievement in Early Modern Europe: Golden Ages in Antwerp, Amsterdam, and London*, ed. Patrick Karl O'Brien (Cambridge: Cambridge University Press, 2001), 175.

7. On Rubens, Brueghel and the tradition of collaborative painting in Antwerp, see Anne T. Woollett and Ariane van Suchtelen, *Rubens & Brueghel: A Working Friendship* (Los Angeles: J. Paul Getty Museum, 2006).

8. Montias, *Artists and Artisans in Delft*, 198; Axel Rüger and Rachel Billinge, "The Design Practices of the Dutch Architectural Painter Bartholomeus van Bassen," *National Gallery Technical Bulletin* 26 (2005): 38.

The climate surrounding specialization in printmaking is less clear. The pictorial and symbolic roots of particular genres of prints, from landscape,[9] to genre,[10] to scientific illustrations,[11] have been carefully charted. What evidence we have about print collecting practices in this period suggests that those who had the means to buy a large number of prints considered content carefully when they made their purchasing and display decisions. The Italian collector Giulio Mancini advised that both paintings and prints ought to be displayed according to subject matter, such that different parts of the collection were arrayed in different rooms.[12] By arranging their artworks in this way, the collector could harmonize the varied styles and subjects of their artworks with the genders and social positions of people inhabiting those rooms, and create an appropriate environment for the activities therein. In bedrooms: religious paintings; in garden galleries: mythologies; in rooms for conducting business or receiving visitors: allegories of war and peace. Mancini suggested that prints be kept in a private study, and presumably organized so that the owner could have complete control over their display and viewing. If a collection was properly organized, the owner could easily pull prints at will to suit the nature and business of his guests.

But did this attention to prints' subject matter lead to differentiation by printmakers and publishers? Some evidence suggests that print publishers found an advantage

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9. Freedberg, *Dutch Landscape Prints*.

10. Linda A. Stone-Ferrier, *Dutch Prints of Daily Life: Mirrors of Life or Masks of Morals?* (Lawrence, Kansas: Spencer Museum of Art, University of Kansas, 1983); de Jongh and Luijten, *Mirror of Everyday Life*.

11. Dackerman, *Prints and the Pursuit of Knowledge in Early Modern Europe*.

12. Michael Bury, "Giulio Mancini and the organization of a print collection in early seventeenth-century Italy," in *Collecting Prints and Drawings in Europe, c. 1500–1750*, ed. Christopher Baker, Caroline Elam, and Genevieve Warwick (Aldershot: Ashgate, 2003), 79–84; on the classification impulse in early modern collections, also see Paula Findlen, *Possessing Nature: Museums, Collecting, and Scientific Culture in Early Modern Italy* (Berkeley: University of California Press, 1994), ch. 1.

by offering as diverse a stock as possible. Hendrick Hondius deliberately diversified both the genres as well as the styles of prints that he published in reaction to a more competitive and distributed production environment.[13] Nadine Orenstein has also contrasted the varying specialization or diversification of genre in the oeuvres of Hondius, Claes Jansz Visscher, Jacob Matham, and Jacques Razet.[14] Orenstein suggests that print publishers had an incentive to diversify the subjects they kept in stock because they had to rely on a broad audience, with ever-shifting tastes, rather than a few select patrons. Because prints could be produced relatively rapidly, however, publishers could also be more responsive in the types of works that they offered.

This type of diversified publication was hardly a rule. Though Hondius had positioned himself as a generalist, there were also examples of specialist publishers who, instead, chose to distinguish themselves in one particular genre. Claes Visscher maintained a large stock of prints, but he had a particular strength in landscape prints. In addition to publishing his own etchings, Visscher was a key distributor for his Haarlem colleague Jan van de Velde, and became a secondhand distributor for printed landscapes by Pieter Bast and Willem Buytewech.[15] Even as he concentrated in selling landscape prints, however, Visscher and his progeny still maintained basic coverage of other print types, carrying a solid stock of genre prints, biblical and mythological histories, and allegorical series. Orenstein also highlights small publishers like Jacques Razet, for whom artistic print selling was only one aspect of their business.[16] Razet was also a calligrapher and schoolteacher. Because publishing was a relatively minor venture

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13. See section 2.5.2.

14. Orenstein, "Marketing Prints to the Dutch Republic."

15. Ibid., 153–154.

16. On the later Visscher family, see Leeflang, "The Sign of Claes Jansz Visscher and his Progeny."

for him, he may have had more freedom to specialize in the religious engravings of the Hendrick Goltzius school, including works by Jacques de Gheyn II, Jan Saenredam, Jacob Matham, Andries Stock, and Willem van Swanenburg.[17] As his livelihood was not wholly dependent on print publishing, he did not face the same pressure to please a wide spectrum of the market.

Surviving inventories of other print publishers support Orenstein's hypothesis that publishers benefitted by favoring diversity over specialization.[18] (Note that these inventories were not made by the publishers themselves, but by third parties such as estate heirs or notaries.) Though Crispijn de Passe may be best known for his moralizing print books, a 1639 inventory of his plates shows that he also maintained a broad stock with strengths in portrait and devotional series, as well as biblical and scientific illustrations.[19] A 1662 inventory of the possessions of Amsterdam publisher Rombout van den Hoeye also lists a broad variety of subject matter.[20] A section devoted to Van den Hoeye's maps opens the inventory, followed by portraits of kings and

17. Orenstein, "Marketing Prints to the Dutch Republic," 159.

18. Note that, unlike paintings, period documents about prints are sparse. Because prints were inexpensive, they generally were not documented as precisely as paintings were in commissions, dealer documents, or collector inventories; Parshall, "Prints as Objects of Consumption," 20–21. In inventories of individual households, entire albums of prints might be listed, but single sheets or series were listed with attributions only when they came from the hand of an acknowledged master. For example, of the 713 individual, attributed prints listed in the Montias Archives (described in section 4.2.1), the top five most-attributed artists were Albrecht Dürer (448 entries), Hendrick Goltzius (73), Antonio Tempesta (35), Lucas van Leyden (33), and Bartholoemus Spranger (25).

19. A detailed 1639 inventory of Crispijn de Passe's plates lists the following: allegory: 30 series (with 144 plates); biblical: 19 (95); genre: 9 (70); history: 6 (24); landscape: 7 (26); mythology: 16 (90); ornament: 1 (17); portrait: 38 (325); religion: 40 (142); scientific: 8 (266); still life: 3 (20); text: 2 (3); unidentified: 34 (284); Ilja M. Veldman, *Crispijn de Passe and His Progeny (1564-1670): A Century of Print Production* (Rotterdam: Sound & Vision Publishers, 2001), appendices 1 and 2; On Van de Passe's moralizing books, see Ilja M. Veldman, *Profit and Pleasure: Print Books by Crispijn de Passe* (Rotterdam: Sound & Vision Publishers, 2001).

20. The inventory was taken on the event of Van den Hoeye's separation from his wife; Amsterdam, Gemeentearchief, N.A. 1970A, not. D. Doornick, 2 december 1662, 368–380; van der Waals, *Prenten in de gouden eeuw*, appendix 1.

princes, followed by a long list of "*verscheide historien*" ("various histories") including bible illustrations, allegories, topographical and landscape prints, and mythological scenes. Clement de Jonghe's 1679 stock inventory only divided prints by subject matter when they were part of large series that could be bought piecewise: "*historien*" for a complete set of bible illustrations, "*devosie*" for a long list of devotional prints, "*sinnebeelden*" for moralizing emblems, as well as a handful of portrait subcategories ("*Admirels*", "*Coningen*", and "*Huys Nassauiae*").[21] As a general rule, these inventories are primarily organized by paper size (e.g. folio, half-folio), before any more granular subdivision by subject matter. One generally finds subsections devoted to maps and large illustration series (often for Bibles; these were generally bought piecewise), and perhaps another section devoted to portraits, while all other types of prints usually fell under a general heading of "*constprenten*", or art prints.

The published catalogue of art prints from the shop of Nicolaes Visscher, dated around 1680, is the only seventeenth-century stock list of individual art prints known today that was issued by the publisher himself as a way to advertise his holdings.[22] Though offering more precision than the third-party inventories listed above, Visscher's list follows a familiar format: maps and topographical views, followed by a long, mixed list of "*kusnt-printen*" encompassing genre scenes, landscapes, mythologies, allegories, and devotional prints. The catalog also has a special section detailing all the Bible illustrations Visscher had for sale, divided between Old and New Testament stories. Unlike inventories made by third parties, Visscher's catalog not only credited the

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21. This inventory was taken after De Jonghe's death in 1677. Notably, the inventory also carries headings especially for prints by Hans Bol and Rembrandt. Amsterdam, Gemeentearchief, NA 4528, not. J. Backer, 11 februari 1679, 117–146; van der Waals, *Prenten in de gouden eeuw*, appendix 3.

22. *Catalogus Van groote en kleene Land-Kaerten, Steden, Print-Kunst En Boecken Van Nicolaes Visscher Van Amsteldam. 't Amsteldam, Op den Dam, in de Visscher*; see van der Waals, *Prenten in de gouden eeuw*, appendix 5 for a transcription; van der Coelen, *Patriarchs, Angels & Prophets*, 38–61, discusses the structure of this catalog and the Visscher family's marketing strategies.

artists whose artworks were being reproduced, but also frequently lists the engraver.[23] And, as with all the other major publishers, Visscher offered a bountiful variety of genres.

The small number of pictorial print publishers in Antwerp in the sixteenth century covered a wide range of the emerging market for dedicated "art" prints. Pieter de Wale turned out a tremendous variety of pictorial prints, from book illustrations to devotional series and political prints.[24] Hieronymus Cock found safety in diversity as well. Though no published stock list for Cock's house *Aux Quatre Vents* survives, a survey of prints bearing his address illustrates the wide breadth of his offerings.[25] Even as he cultivated an image as the premiere provider of fine reproductions after old masters, he always kept a core stock of maps and reproductions of antiquities and ruins. Moreover, he cultivated contemporary talent in the emerging specialization of "pure" local landscapes.[26]

Producing a wide array of genres did not necessarily ensure a successful *printmaking* career, however. Elizabeth Wyckoff's survey of three little-known Haarlem engravers Willem Akersloot, Cornelis van Kittensteyn, Gillis van Scheyndel, presents examples of printmakers whose careers failed *in spite* of the wide range of genres they produced.[27] Wyckoff suggests that the three suffered financial setback because they all attempted to support themselves entirely via printmaking, rather than branching out into painting,

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23. Jonas Suyderhoef, for example, is frequently cited as an engraver for Visscher's stock. See chapter 2, page 82, note 52

24. Van der Stock, *Printing Images in Antwerp*, 186.

25. Van Grieken, Luijten, and van der Stock, *Hieronymus Cock*, 23.

26. Ibid., 52–58.

27. Wyckoff, "Innovation and Popularization," 194.

print publishing, or art dealing.[28] While it is clear from the wild success of professional engravers like the Wierix brothers or the Sadeler family that it was indeed possible to build a career entirely as a platecutter, the lives of Akersloot, Van Kittensteyn, and Van Scheyndel are reminders of the rump majority of artists who would never see great fortune or fame.

Lorena Baines presents another counterexample in her study of Nicolaes de Bruyn, a prolific printmaker working between 1592 and 1650.[29] De Bruyn, a Flemish-born engraver who worked in Antwerp and Rotterdam, built an exceptionally long and successful career by making one particular type of engraving up until his death at the age of 85. After starting his career by making reproductive prints after designs by Gillis van Coninxloo and David Vinckboons, virtually all of De Bruyn's original print designs made between 1610 and his death in 1656 were large wooded landscapes featuring biblical scenes. (Figure 46) It would appear that, having successfully defined and filled a specialized subject matter niche, De Bruyn felt little incentive to diversify his output. Unlike the engravers cited by Wyckoff, De Bruyn found exceptional professional success by specializing in just one genre, rather than relying on diversification of subject matter as insurance against changing market tastes.

From these examples, it is clear that a seventeenth-century printmaker could have found success via either strategy — genre diversification, or genre specialization. Understanding which strategy was adopted more frequently by printmakers versus painters will allow us to better understand whether specialists like Dr Bruyn, or generalists like Hondius, were the norm, and who were exceptions to it.

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28. Both engravers as well as print publishers frequently had additional means for supporting themselves, often as art dealers. On publishers' alternate careers, see van der Stock, *Printing Images in Antwerp*, 143–145; Michael Bury, *The Print in Italy, 1550-1620* (London: British Museum, 2001), 9–10; Orenstein, *Hendrick Hondius*, 12–13.

29. Baines, *Nicolaes de Bruyn*.

Figure 46: Nicolaes de Bruyn after Gillis van Coninxloo (II), *Moses found by the daughter of the pharoh*, 1601. Engraving, 65.5 x 41.5 cm. Rijksmuseum, Amsterdam.

4.2 Data on Subject Matter in Painting and Prints

While the RKM database contains subject classifications for prints, one needs to turn elsewhere to find suitable information about sixteenth- and seventeenth-century Netherlandish paintings. This section will introduce two new datasets, the Montias Inventories and the image database of the Rijksbureau voor Kunsthistorische Documentatie/Nederlands Instituut voor Kunstgeschiedenis. For each dataset, I will describe their origins, potential biases and shortcomings, and outline how one can reconcile their different systems for classifying subject matter. Table 2 summarizes the numbers of relevant records from each source.[30] In addition to presenting these new datasets, this section will also address how the RKM database, used in earlier chapters, classifies subject matter for prints.[31]

Table 2: Number of artists and (in parentheses) number of dated, attributed, and described artworks in each the Montias, RKD, and RKM databases, partitioned by artist birth year.

artist birth	MDI	RKD	RKM
1500-24	9 (63)	50 (889)	12 (323)
1525-49	14 (122)	52 (893)	16 (1,150)
1550-74	23 (177)	96 (2,949)	37 (2,821)
1575-99	53 (607)	305 (10,916)	66 (2,302)

30. Because the Montias inventories stop at 1700, they do not contain any entries attributed to artists born after 1680. Thus, it is necessary to restrict this analysis to 1500–1700, as compared to the range 1550–1750 used in the previous chapters.

31. Because the BM database does not contain consistent descriptions of its prints' subject matter, it cannot be used to corroborate findings from the RKM data as was done in chapters 2 and 3. Future work may involve mapping what descriptive text the BM *does* provide to larger subject headings used by other collections. More suggestions for addressing these and other lacunae in artistic print data will be presented in the conclusion of this dissertation.

artist birth	MDI	RKD	RKM
1600-24	104 (1,225)	489 (13,940)	91 (3,103)
1625-49	177 (1,232)	379 (10,525)	72 (4,312)
1650-74	64 (380)	172 (3,799)	50 (2,069)
1675-99	2 (7)	162 (3,014)	17 (156)

4.2.1 The Montias Database of 17th Century Dutch Art Inventories

The Montias Database of 17th Century Dutch Art Inventories (hereafter MDI), maintained by the Frick Art Reference Library, contains information on 1,220 household inventories from Amsterdam that were recorded between 1575 and 1700.[32] The database was compiled over several decades by John Michael Montias from his research in the Amsterdam Gemeentearchief. These inventories come from three main classes of documents: notarial death inventories drawn up for estate valuations, public auction records by the Orphan Chamber, and bankruptcy inventories.

It is important to recognize that the Montias database is a sample, *not* a comprehensive repository. Writing in 1991, Montias suggested that there may be on the order of seven or eight thousand such inventories surviving in the Amsterdam archives today, at least five times the number indexed in the MDI. Nor can the MDI be considered an unbiased sampling of all household inventories from Amsterdam in the seventeenth century. Due to the original purpose of these archival documents, the MDI is weighted heavily towards well-off households large enough to have warranted attention from

32. John Michael Montias and the Frick Art Reference Library, "The Montias Database of 17th Century Dutch Art Inventories," The Frick Collection, 2015, http://research.frick.org/montias/home.php.

creditors. Montias also restricted his sample to households that owned at least one attributed painting, further skewing his results towards richer households.[33]

This skew would prove troublesome for a study of low-end, anonymous artistic production in the seventeenth-century Netherlands. However, because this analysis focuses on the genre specialization of individual artists, Montias' focus on inventories with at least some attributed paintings is a strength, rather than a flaw. That said, these results will only be relevant for understanding the echelon of painting production valuable enough to be attributed to named artists, rather than anonymous painters.[34]

The MDI describes 34,147 paintings, of which 26,349 (about 77% of the total) have an identified subject (the rest are labeled "unknown"), with 4,377 of those described paintings (about 13% of the total) attributed to a specific artist. (Table 3) This limited level of description is common in collection inventories from the seventeenth century. For identification and valuation purposes, notaries prioritized describing the subject of the painting and its size, only making attributions if the name of the painter would have significantly impacted the painting's monetary value. Montias assigned one of 86 different subject headings to each artwork. I have grouped these subject headings into a more general set that will guide the way subjects from the other data sources are characterized in this chapter.[35]

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33. Montias, "Works of Art in Seventeenth-Century Amsterdam," 331–332.

34. On specialization in the low-end of the Dutch painting market, see Angela Jager, "'Everywhere illustrious histories that are a dime a dozen': The Mass Market for History Painting in Seventeenth-Century Amsterdam," *Journal of Historians of Netherlandish Art* 7, no. 1 (February 2015), doi:10.5092/jhna.2015.7.1.2.

35. The number of subject headings detailed by Montias are small enough that it was feasible to manually generate a concordance between the 86 original subject headings and the twelve subject headings used by Van der Woude in his study of the same database: "old testament", "new testament", "other religious", "mythology-allegory", "history", "landscape", "genre", "still life", "portrait", "animals", "other", "unknown"; Ad van der Woude, "The Volume and Value of Paintings in Holland at the Time of the Dutch Republic," in *Art in History, History in Art: Studies in Seventeenth-Century Dutch Culture*,

Because the current study focuses on characterizing artist genre diversity, only attributed artworks are used when calculating diversity. To understand how this might bias our conclusions, we can compare the distribution of genres by attributed versus unattributed artists in the Montias archives. The distribution of genres in the set of attributed works versus the distribution in the set of unattributed works is unequal. (Figure 47) For example, portraits, and those artworks with no identified subject, were significantly more likely be unattributed in the Montias inventories. It is thus important to note that portraitists will be under-reported in this dataset. Conversely, genre and landscape paintings were more likely to have been given an attribution, meaning that painters specializing in those subjects will be over-reported in the diversity calculations.

Table 3: Number of artworks (and their percent of the total) broken down by attribution and subject description. Only attributed records with an identified subject (around 13% of the total number of object records) can be used for characterizing artist specialization.

MDI paintings	unattributed	attributed	total
unknown subject	6,874 (20.1%)	924 (0.3%)	7,798 (22.8%)
known subject	21,972 (64.3%)	4,377 (12.9%)	26,349 (77.2%)
total	28,846 (84.5%)	5,301 (15.5%)	34,147 (100%)

4.2.2 *RKDimages*

RKDimages (hereafter RKD) is a database compiled by the Rijksbureau voor Kunsthistorische Documentatie. Originating from the original bequest in 1923 of the papers

ed. David Freedberg and Jan De Vries (Santa Monica: Getty Center for the History of Art & The Humanities, 1991), 285–329.

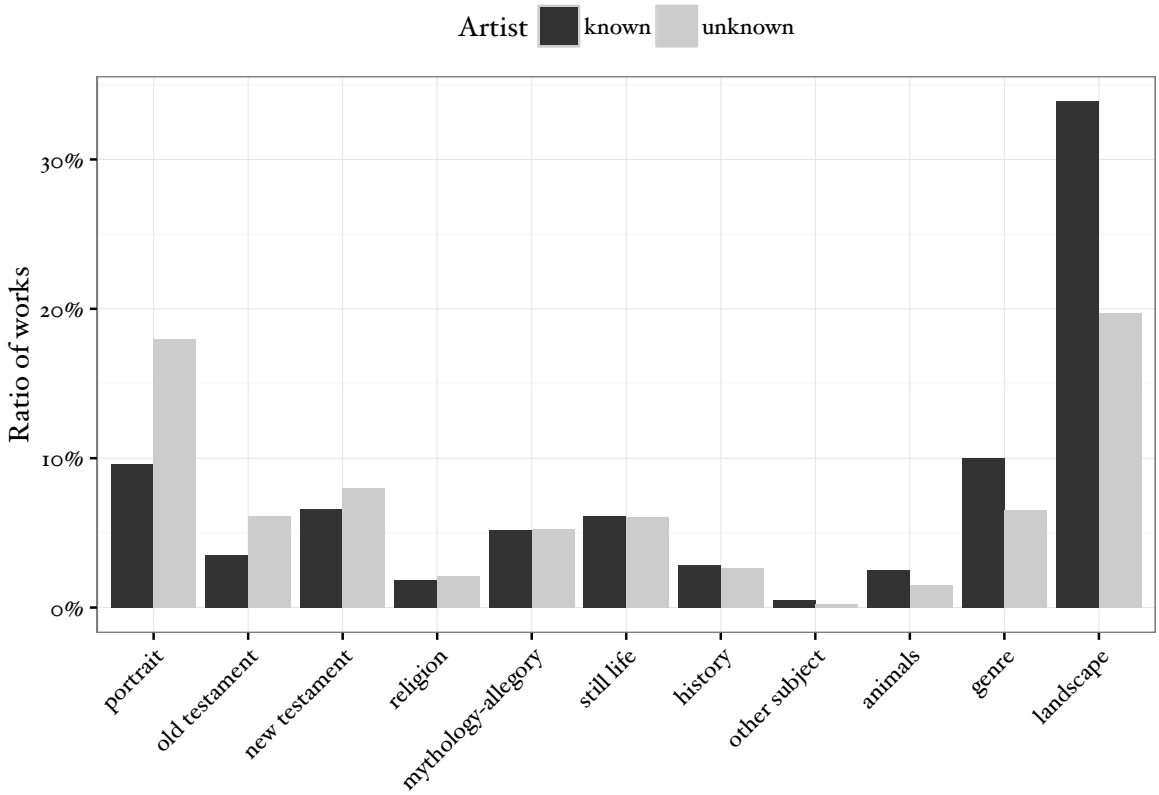

Figure 47: Ratio of genres in the Montias inventories broken down by paintings with an attributed artist versus those without.

of Cornelis Hofstede de Groot (1863–1930), this research collection was expanded and digitized over the next several decades into a catalogue of primarily Dutch and Flemish artworks from 1400 to the present compiled from public and private collections around the world.[36] Of the over 200,000 objects documented in this database, there are 47,456 dated, attributed, and categorized paintings made by artists born between 1500 and 1700. Each of these records has been tagged with a series of keywords (on average between six to seven keywords per painting) describing the artwork's subject matter. These keywords have been assigned by hand by researchers at the RKD, building on the keywords listed on Hofstede de Groot's original typewritten index cards. The scale of the RKD database makes it infeasible for an individual researcher to manually categorize each artwork into a single broad subject category. Computer-aided classification, however, does allow one to identify clusters of paintings that shared groups of keywords, thus assigning a single subject heading to each painting.[37] These clusters align relatively well with the broad subject headings used for the MDI records, roughly encompassing: portraits, still lifes, landscapes, religious paintings, and a final category of other works that featured multiple figures (generally genre scenes or history subjects).

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36. This database is located at https://rkd.nl/en/explore/images. On the RKD in general, see Sibylle Appuhn-Radtke, "Das Rijksbureau voor Kunsthistorische Documentatie in Den Haag," *Kunstchronik* 47, no. 4 (1994): 181–188; Jan H. E. van der Starre, "Automation at the RKD: A Short Overview," *Art Libraries Journal* 23, no. 2 (1998): 15–17.

37. To designate clusters of paintings with related keywords, I created a network graph where each object was connected to others based on shared RKD subject keywords. A community detection algorithm optimized for large graphs was used to partition objects into groups that were highly connected to each other, i.e., that shared more keywords with each other than with objects outside of those partitions. I then checked the resulting groups manually to confirm that they did, in fact, correspond relatively well to common genre categories.

On the community detection algorithm, see Vincent D. Blondel et al., "Fast Unfolding of Communities in Large Networks," *Journal of Statistical Mechanics: Theory and Experiment* 2008, no. 10 (October 1, 2008): P10008, doi:10.1088/1742-5468/2008/10/P10008; implemented in R by Csardi and Nepusz, "igraph."

Like the MDI, the RKD data is an imperfect reflection of seventeenth-century painting production. Nearly all of the paintings made between 1500 and 1750 in the RKD data are attributed, a much higher ratio than the MDI. However, this is partly a consequence of selection bias. Because the RKD data has been compiled from museum collection indexes, auction catalogues, and other published sources, it is distinctly slanted towards those artworks that eighteenth-, nineteenth-, and twentieth-century collectors found worthy of preserving. However, if both the historical MDI dataset and the modern RKD dataset reveal similar patterns, this would strengthen the case for claiming that a trend towards specialization did indeed exist historically.[38]

4.2.3 Subjects in the Print Data of the RKM

The Rijksmuseum has classified their artworks based on the Iconclass system for categorizing iconography in European art.[39] The Iconclass notation system is hierarchical by design, with each successive character of the notation defining a more specific iconographic subject. For example, the notation "71C217" describes, in increasing specificity:

- 7 (Bible)
- 71 (Old Testament)
- 71C (Genesis: the patriarchs)
- 71C2 (story of Isaac)
- 71C21 (Rebekah sought in marriage)

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38. Jan De Vries argues for this approach in De Vries, "Art History," 259–260.

39. H. van de Waal, *Iconclass: An Iconographic Classification System*, in collab. with L. D. Couprie, Rudi Fuchs, and E. Tholen (Amsterdam: North-Holland Pub. Co, 1973); Jochen Becker, "Review of Iconclass: An Iconographic Classification System by H. van de Waal; L. D. Couprie; R. H. Fuchs; E. Tholen," *Simiolus: Netherlands Quarterly for the History of Art* 9, no. 1 (January 1977): 45–47, doi:10.2307/3780424. See section 2.2 for a full overview of the RKM database.

- 71C217 (marriage of Isaac and Rebekah).

By grouping objects based on the first digit of their Iconclass label, it is possible to sort the objects into broad thematic groups similar to those used for the MDI and RKD. Because this diversity metric is sensitive to absolute numbers of prints made per artist, multiple impressions of the same print will not be counted, but will instead be treated as one artwork.[40] Similarly, print series will also be counted as single artworks, which will prevent, for example, identifying an artist as a portrait specialist when they created just one series of portraits during their career.[41] As this analysis is specifically focused on the decisions of printmakers who actually cut or etched plates, only those prints for which an artist made a plate (and not, for example, ones that an artist merely published) will be counted when characterizing their oeuvre diversity.

4.3 Methodology: Characterizing Diversity

Whether looking at the diversity of species within an ecosystem, or the variety of different industries within a state, diversity measures have to account for two dimensions:

1. Categorical: How many discrete classes are observed?
2. Allocation: How even is the distribution of units among categories?

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40. Although the RKM does not explicitly mark which object records are impressions of the same print, duplicate impressions, or different states of the same print, can be roughly grouped when they share the same title, description, start and end dates, and creators.

41. When RKM objects belong to a larger series, this series title is listed as one of the alternative titles for the object. Prints that share a series title are treated as one artwork for the purposes of calculating their maker's oeuvre diversity.

Shannon's measurement of diversity (D_s), a widely-used metric, captures both of these dimensions of diversity.[42] Originally developed to characterize entropy in information transmission, this metric of diversity has been applied to the studies as diverse as ecological diversity, economic specialization, and racial segregation.[43] To measure whether specialization or generalization was more favored by painters and printmakers, each artist's oeuvre is treated as a "population" with a single diversity score calculated per artist. By this measure, a population whose members are distributed evenly across several different species/categories (in Figure 48, artist B, with a D_s of 1.1) will have a higher diversity index than a population whose members are largely concentrated in just one category (artist C, with a D_s of 0.83).

This method has drawbacks. For example, it cannot characterize whether or not an artist changed their choices of subject matter over the course of their career. Most paintings in the RKD database are not dated with the precision that would be required to claim an accurate measurement of a single artist's changing specialization over time. The MDI data, moreover, includes no dates for individual works. However, by looking at how artists' total oeuvre diversity changes based on their date of birth, we can get a

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42. Shannon's diversity index D_s is defined as the negative sum of the proportions of every class size within the population multiplied by their logged equivalents, where n_i is the number of observations in class i, and N is the total population size:

$$D_s = -\sum \frac{n_i}{N} \ln \frac{n_i}{N}$$

For the original derivation of Shannon's diversity, see Claude Elwood Shannon and Warren Weaver, *The Mathematical Theory of Communication* (Urbana: University of Illinois Press, 1949); for the R implementation of this formula, see Jari Oksanen et al., "vegan: Community Ecology Package" (R Pakcage [version 2.2-1], 2015), http://CRAN.R-project.org/package=vegan.

43. For an early example, see Jack P. Gibbs and Walter T. Martin, "Urbanization, Technology, and the Division of Labor: International Patterns," *American Sociological Review* 27, no. 5 (October 1962): 667–677, doi:10.2307/2089624; more recent work includes: Gianmarco I. P. Ottaviano et al., *Bio-Ecological Diversity vs. Socio-Economic Diversity: A Comparison of Existing Measures*, SSRN Scholarly Paper ID 389043 (Rochester, NY: Social Science Research Network, January 1, 2003), http://papers.ssrn.com/abstract=389043.

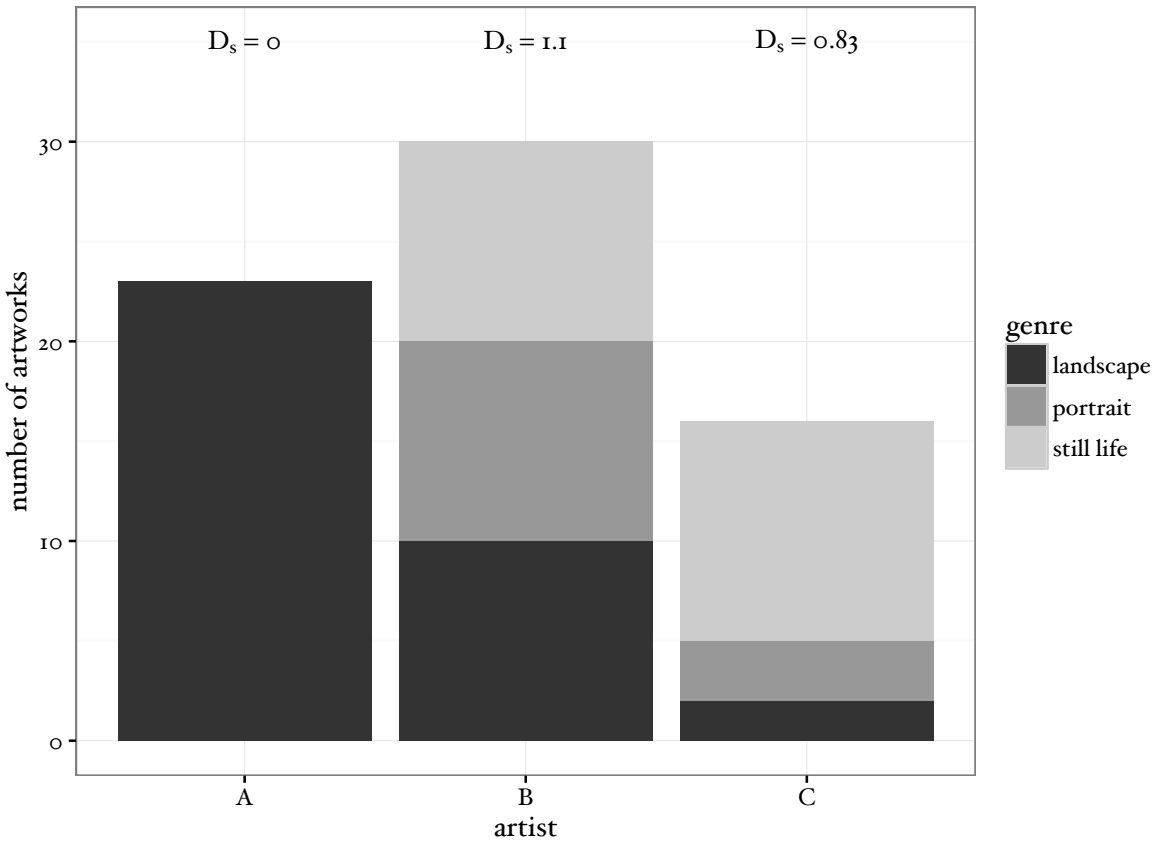

Figure 48: Illustrating Shannon's measurement of diversity (D_s) on sample data. Having made only landscapes, artist A has a D_s of 0. Note that, although artist B and C each painted at least one painting with from each category, artist B has a more even distribution of works across those categories, and so has a higher D_s.

sense of generational changes in artistic strategies that would have been driven not only by changing market demands, but also by habits and norms imparted to young artists during their training. It is this generational scale that will clarify whether painters and printmakers did indeed tend to specialize more over the course of the seventeenth century.

4.4 Results: Specialist Painters, Generalist Printmakers

Figure 49 contrasts the oeuvre diversities calculated from each of these three data sources across eight 25-year-long periods between 1500 and 1700. Both the MDI and RKD paintings datasets confirm conventional art historical wisdom: starting with painters born between 1575–1599, both sources exhibit an increasing skew towards specialization, or low diversity. Continuing through the entire seventeenth century, the median of this distribution dropped lower as fewer and fewer painters took the generalist route, and more and more painters trended towards specialization. That said, it is also important to note that generalists hardly disappeared from the world of Dutch and Flemish painting: both MDI and RKD datasets show the consistent presence of a handful of painters with a high diversity index over this period.

On the other hand, the median oeuvre diversity of printmakers in the RKM dataset remains consistently higher than that of painters between 1500–1700, with only a slight downward dip entering the seventeenth century. As with painters, there were clearly exceptions to the overall average: in each period we do find a handful of specialist printmakers at the low range of the diversity scale. However, they are far outnumbered by generalist printmakers with high oeuvre diversity. The results support the hypothesis that, by in large, printmakers favored making prints after a wide array of artworks, and that printmakers who did define highly specialized niches appear to have been the exception, rather than the norm.

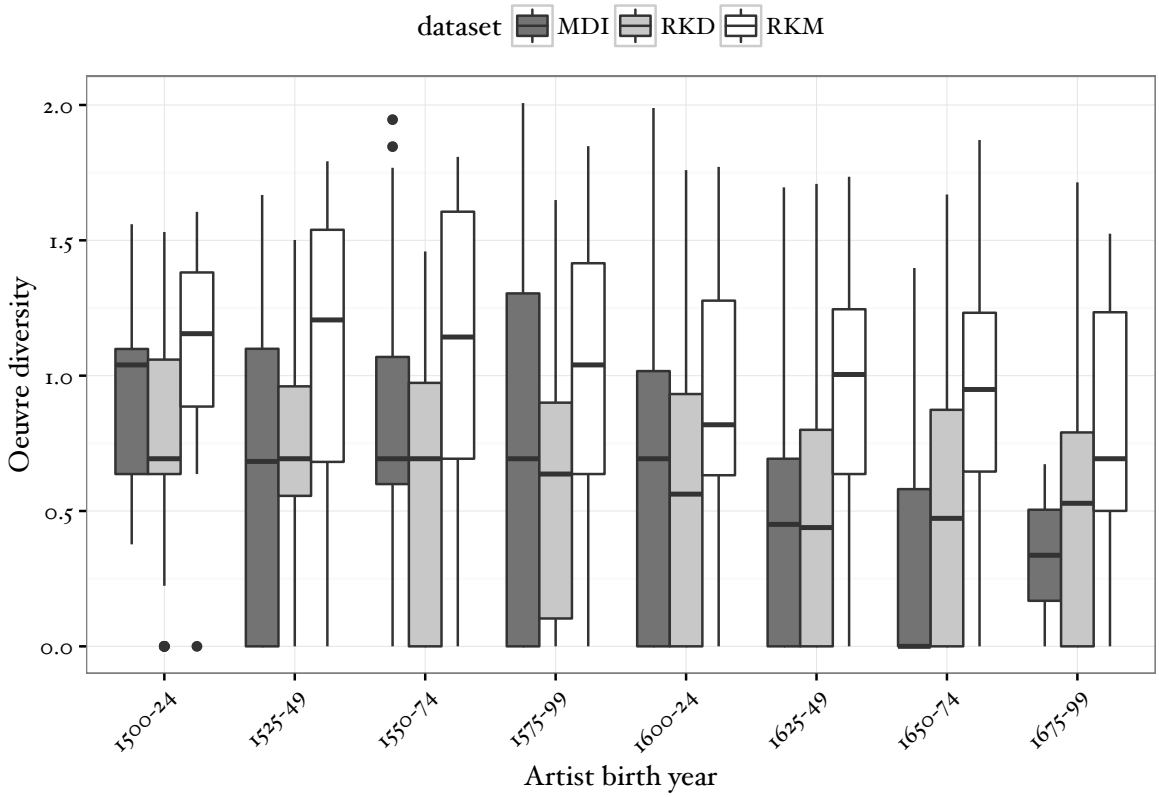

Figure 49: Boxplots showing the distribution and skew of oeuvre diversity for artists born between 1500 and 1700, based on the MDI, RKD, and RKM datasets. Higher boxes indicate that more artists born in that period tended to have diverse oeuvres, while lower boxes indicate a greater number of specializing artists. Longer boxes indicate that there was a wide range of artistic strategy (many specialists *and* many generalists) while shorter boxes indicate that more artists' oeuvre diversity fell within a small range of values. (This is a Tukey boxplot, in which the the middle line showing the median diversity value, and the top and bottom of the box mark the 75th and 25th percentiles. The ends of the whiskers mark the values within 1.5 times the interquartile range beyond the box. Outlier values beyond that range are marked with dots.)

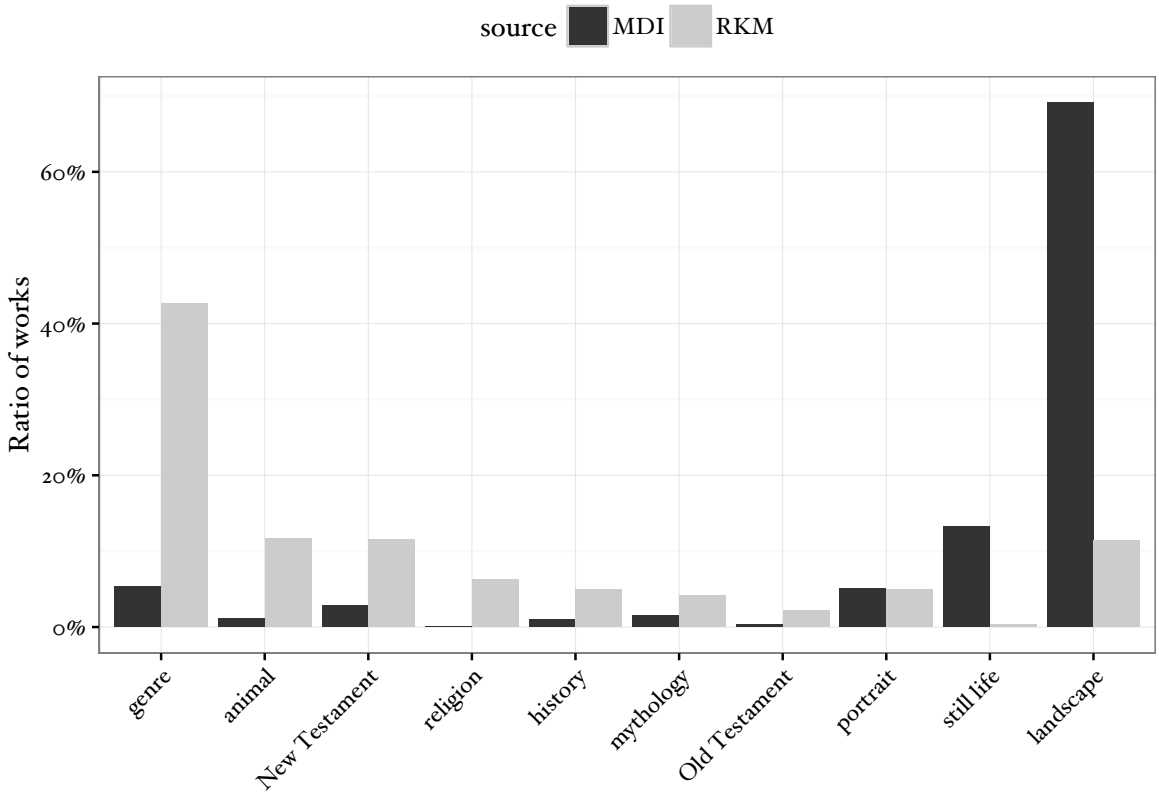

Figure 50: Comparing the subjects treated by the top 25% most specialized painters from the MDI dataset and the top 25% most specialized printmakers from RKM dataset. Specialist painters overwhelmingly favored landscapes, while specialist printmakers were just as likely to produce genre prints, landscapes, biblical illustrations, or renditions of historical or current events.

This approach to measuring diversity in the MDI and RKD data validates the well-established fact that those painters who *did* specialize overwhelmingly favored landscapes: of those artists in the bottom diversity quartile (i.e. the 25% most specialized painters in the MDI database), almost half of their paintings were landscapes. (Figure 50) Though landscape painting had a wide range of styles and subjects, it was common for artists like Jan van Goyen or Meindert Hobbema to produce nearly endless variations on the same general set of tried-and-tested motifs and painterly effects.[44] As a genre, landscape was also amenable to an efficient painting techniques. Certain styles of landscape could be rendered in broad brushwork with a limited palette and still be an aesthetic success.[45]

Still life and genre paintings in this period were also, by in large, the purview of specialists, though they took a distant second place to the speciality in landscape. Still lifes may comprise a much smaller share of the total number of paintings in the Montias database because, unlike landscapes, the aesthetic effect of still lifes was often dependent on the painter's mimetic skill and illusionistic finish — not a technique conducive to speedy production. Nevertheless, still life paintings still comprised around fifteen percent of archives surveyed between 1650–1670.[46]

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44. On conventionality in Dutch landscape painting, see Lawrence O. Goedde, "Naturalism as Convention: Subject, Style, and Artistic Self-Consciousness in Dutch Landscape," in *Looking at Seventeenth-Century Dutch Art: Realism Reconsidered*, ed. Wayne E. Franits (Cambridge: Cambridge University Press, 1997), 129–143.

45. Montias has argued that, whatever its additional aesthetic attractions, the tonal style of landscape painting popularized in the 1630s and 1640s by Van Goyen and Pieter Molijn, among others, was a type of *process* innovation that gave its adherents a business advantage: Montias, "Cost And Value," 460; Jonathan Israel has suggested, furthermore, that painters may have favored these restricted palettes at this particular time because of the increased price of vibrant, foreign pigments during the continuing war between the United Provinces and Spain: Jonathan Irvine Israel, "Adjusting to Hard Times: Dutch Art During Its Period of Crisis and Restructuring (c. 1621 - c. 1645)," *Art History* 20, no. 3 (September 1997): 449–476

46. On the market for still life painting, see Alan Chong and Wouter Kloek, *Still-Life Paintings from the Netherlands, 1550-1720* (Zwolle: Waanders Publishers, 1999), 87–102.

These data also support the unsurprising conclusion that generalist painters produced largely figurative, narrative paintings. A painter who rendered New Testament scenes was also likely to produce mythological images, and portraiture, too. Among these highly diversified artists, we find figural masters such as Jan Lievens, David Teniers, Gerard Honthorst, Caspar Netscher, and, of course, Rembrandt van Rijn and Peter Paul Rubens. Artists capable of painting classical mythologies or biblical stories would have needed enough mastery of the human figure to create a portrait, enough understanding of perspective and color to produce a convincing landscape, and enough facility with brush work to render convincing representations of diverse materials. Karel van Mander recognized this, enumerating in his *Schilder-boek* all the elements that this highest form of painting required, including "Concerning the Attitude, Fitness, and Beautiful Execution of a Figure", "Of the Ordering and Invention of Histories", "About Reflection, Reverberation, Glittering, or 'Return-Seeing'", and "Concerning Landscape".[47]

4.4.1 Specialist Printmakers

But what of specialist printmakers? Of those printmakers who *did* concentrate in particular subjects, landscape does not dominate as absolutely as it did with specialist painters. Rather, specialist printmakers were inclined towards a variety of subjects: not only landscapes, but also genre prints, historical prints on political or military events, and portraiture. Table 4 lists the ten most prolific Dutch or Flemish printmakers with a below-median oeuvre diversity index; in other words, printmakers with a sizable production who were more specialized than most of their colleagues. This section will briefly explore the similarities and differences between this sample of artists.

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47. *Den Grondt der Edel vry Schilder-const* in Karel van Mander, *Het schilder-boeck* (Haarlem, 1604), fol. 11-57v.

Table 4: The most productive Dutch and Flemish specialist printmakers (those falling above the 80th percentile of works produced, and below the 45th diversity percentile) arranged in order of decreasing diversity. Note that the count of "works" treats print series as a single work (see section 4.2.3).

artist name	works	div	subjects
Allaert van Everdingen	113	0.77	landscape, animals
Cornelis Dusart	57	0.76	portraiture
Abraham Dircksz Santvoort	123	0.74	topographical views, history prints
Theodoor van Thulden	52	0.68	antiquity, mythology
Adriaen van Ostade	85	0.67	genre, low-life
Anthonie Waterloo	35	0.67	landscape
Cornelis Pietersz Bega	36	0.62	genre
Reinier Nooms	72	0.58	seascape
Isaac Vincentsz van der Vinne	82	0.23	heraldry

A common trait shared by the most specialized etchers and engravers is that printmaking was, by in large, not their main occupation. The landscapist Allaert van Everdingen, for example, did not support himself primarily through printmaking, but rather through painting. Van Everdingen was born in Alkmaar in 1621, and, according to Houbraken, studied with Roelandt Savery in Utrecht and Pieter de Molijn in Haarlem.[48] He traveled to Norway and Sweden in 1644, a trip he documented in extensive annotated sketches. On returning to the Netherlands, he settled in Haarlem, where he joined the St. Luke Guild in 1646 along with his brother Caesar. In his early landscapes, Van Everdingen used a bright and diverse color scheme, coupled with compositions dominated by dark repoussoirs reminiscent of Savery and the

48. Arnold Houbraken, *De groote schouburgh der Nederlantsche konstschilders en schilderessen* (Amsterdam, 1718), 2:95–6; Alice I. Davies and Frederik J. Duparc, *Allart Van Everdingen 1621-1675: First Painter of Scandinavian Landscape: Catalogue Raisonne of Paintings* (Doornspijk: Davaco, 2001), 24–25.

Flemish landscape tradition. In his mature works he transitioned to a more muted palette of pastels and browns, and distinguished himself through his specialization in Scandinavian landscapes, particularly waterfalls in vertical format.[49] Although Van Everdingen did not work with a known publisher, his production of plates was voluminous. His prints also enjoyed posthumous popularity.[50] Van Everdingen favored etching entirely over engraving, and in a few highly experimental, brooding prints, he even tried his hand at an amateurish form of mezzotint.[51] (Figure 52) However, he did not produce his prints with an eye towards large-scale distribution: none of his etchings bear the address of a publisher.

Anthonie Waterloo is yet another landscape painter and draughtsman who invested heavily in etching. He was born in 1609 in Lille, but was living in Amsterdam by 1640.[52] In more than 130 prints, Waterloo depicted the most unremarkable subjects and scenery — simple buildings, bridges, and fences, and unassuming rivers and forests — with a remarkable stylistic consistency.[53] (Figure 53) Though he is mostly known today by his prints, he also produced several paintings and was a prolific draughtsman. Like Van Everdingen, Waterloo did not work with any publishers; many of his prints bear the inscription *AW ex.*, suggesting that they were self-published. His etched output is

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49. Peter C. Sutton and Albert Blankert, eds., *Masters of 17th-Century Dutch Landscape Painting* (Boston: Museum of Fine Arts, 1987), 307–312.

50. Hollstein, *Dutch and Flemish*, 6:153–204. In 1696, the Amsterdam publisher P. van de Boom published a book of Van Everdingen's landscape etchings; Allart van Everdingen, *Recueil de cent paysages inventées et gravées à l'eau forte par A. van Everdingen* (Amsterdam: P. van den Boom, 1696); Davies and Duparc, *Allart van Everdingen 1621-1675*, 37.

51. On Van Everdingen's experiments in mezzotint, see Elizabeth Mansfield, "Allart van Everdingen's Mezzotint Incunabula," *Print Quarterly* 12, no. 2 (June 1995): 169–178.

52. B. P. J. Broos, "'Anthoni Waterlo f(ecit)' in Maarsseveen," *Jaarboekje Oudheidkundig Genootschap Niftarlake*, 1984, 18–48.

53. Freedberg, *Dutch Landscape Prints*, 55–57.

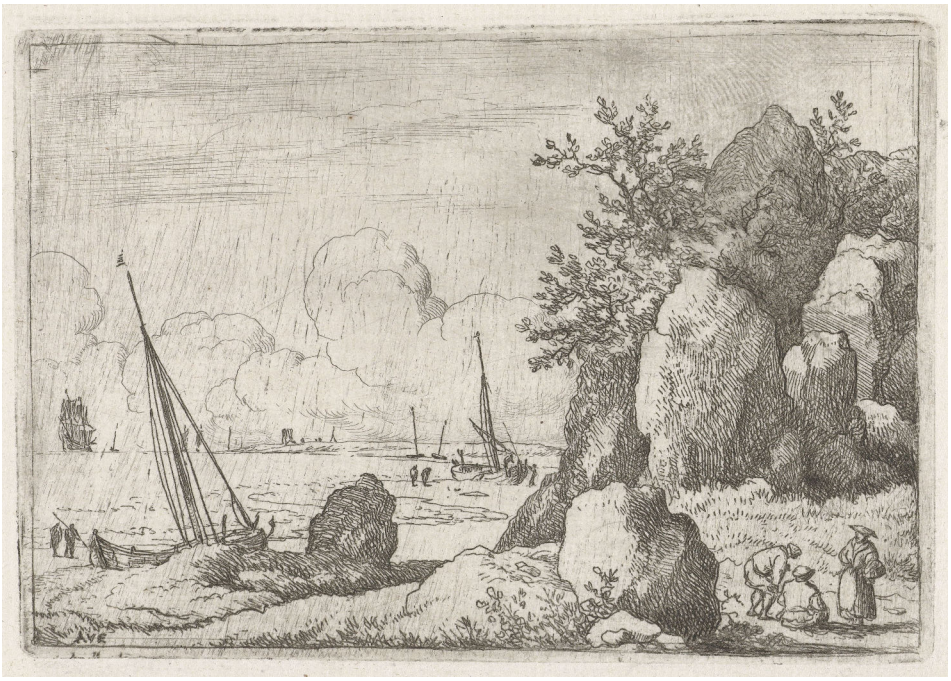

Figure 51: Allaert van Everdingen, *Seascape with sailing ships*, 1631–1675. Etching, 7.4 x 11.8 cm. Rijksmuseum, Amsterdam.

Figure 52: Allaert van Everdingen, *Landscape with buildings at night*, 1631–1675. Etching and mezzotint, 12.5 x 16.2 cm. Rijksmuseum, Amsterdam.

only rivaled by his drawings. Some of his largest sheets depicting topographical views of Amsterdam were not studies or designs for prints, but were rather intended for sale. (Figure 54) Again, Waterloo's specialization in painted and drawn landscapes appears to have driven his subject specialization in etching.

Figure 53: Anthonie Waterloo, *View of a village with a water mill*, 1630–1633. Etching, 9.8 x 14.5 cm. Rijksmuseum, Amsterdam.

What prints Reinier Nooms made were exclusively devoted to seascapes. Nooms was a painter who centered his professional identity on his preferred subject matter, going so far as to adopt the surname "Zeeman". He spent his early career as a Dutch merchantman, painting marine scenes and views of ports in Europe, the Mediterranean, and the North African coast. Nooms' first-hand experience as a sailor is apparent in the wealth of, precisely-painted, accurate details that fill his paintings of ships.[54] In addition to his large output of paintings, Nooms produced etched series depicting

54. Laurens J. Bol, *Die holländische Marinemalerei des 17. Jahrhunderts* (Braunschweig: Klinkhardt & Biermann, 1973), 289–296.

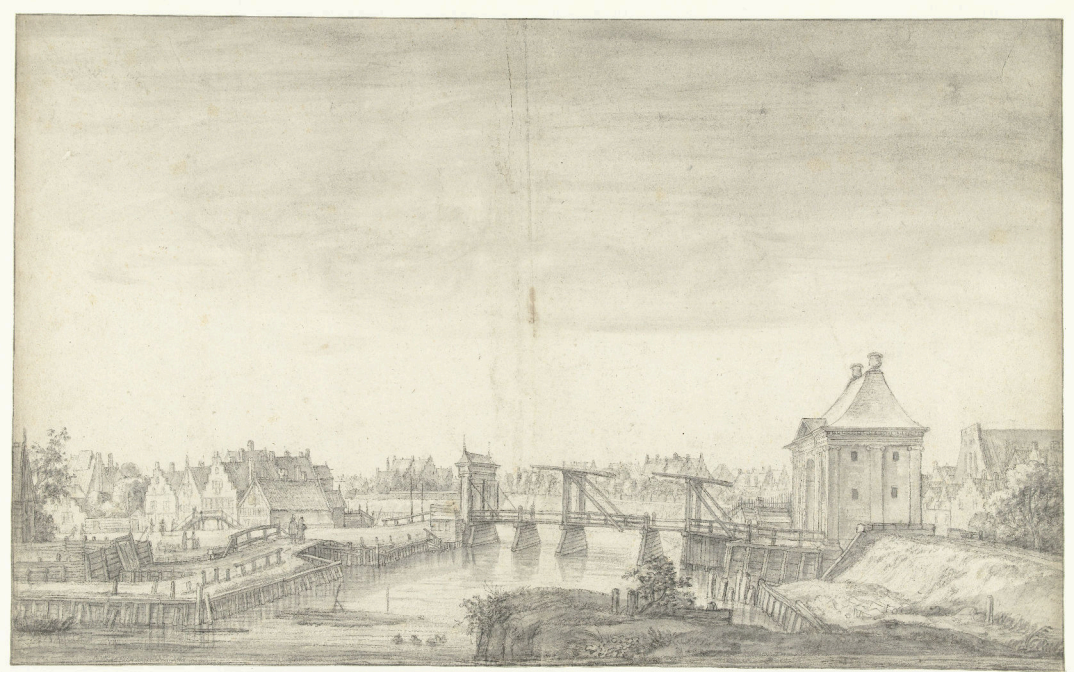

Figure 54: Anthonie Waterloo, *Heiligewegspoort, Amsterdam*, 1636–1664. Brush in gray, with black chalk, 40.2 x 64.9 cm. Rijksmuseum, Amsterdam.

different models of ships, as well as two major series of views of Amsterdam. While Van Everdingen's and Waterloo's etchings appear to have been self-published, Nooms worked with a wide range publishers over his career.[55] He produced several print series with the distinguished Amsterdam publisher Clement de Jonghe, including an evocative series of the four elements rendered through the idiom of seascape and landscape. (Figure 55) Nooms also published many of his etchings with Cornelis Danckerts I of the Danckerts publishing dynasty. In addition to De Jonghe and several members of the Danckerts family, his contemporary publishers included

55. On Nooms' prints in general, see Freedberg, *Dutch Landscape Prints*, 60–61; George S. Keyes, *Mirror of Empire: Dutch Marine Art of Seventeenth Century* (Minneapolis: Minneapolis Institute of Arts, 1990), 413; Hollstein, *Dutch and Flemish*, vols. 56–57.

Frederik de Wit (Amsterdam), Gerard Valck (Amsterdam)[56], Lodewyck Lodewycksz (Amsterdam)[57], and Jacques van Merlen (Paris).

Figure 55: Reinier Nooms, *The Four Elements*, published by Clement de Jonghe, 1651–1662. Etchings, *Air*: 8.7 x 20.4 cm.; *Earth*: 8.3 x 20.5 cm.; *Water*: 8.3 x 20.7 cm.; *Fire*: 8.7 x 20.6 cm. Rijksmuseum, Amsterdam.

Adriaen van Ostade was another painter whose etched oeuvre reflected his painting specialization. Working in Haarlem between 1647–1649, Van Ostade produced prints of peasant fiugres based on his own paintings and drawings.[58] He avoided direct images of hard labor, instead focusing on moments of leisure and merrymaking. His etchings feature intimate scenes of village and family life both quiet and boisterous, but always depicted warmly and with a feeling of dignity, neither lampooning nor criticizing his

56. In 1661, Valck republished the series *Nieuwe Scheeps Batalien in het licht gebracht door Reinier Zeeman* that Frederick de Wit had issued in 1656; Hollstein, *Dutch and Flemish*, 1-5(7).

57. Lodewyck Lodewycksz was an Amsterdam broadside publisher, book binder, and art dealer who published panegyrics of admirals Michiel Adriaansz de Ruyter and Maarten Tromp in 1654 and 1655 featuring portraits engraved by Michiel Mosijn and etched seascapes by Nooms. On this, see van der Waals, *Prenten in de gouden eeuw*, cat. 167.

58. Peter van der Coelen, *Everyday Life in Holland's Golden Age: The Complete Etchings of Adriaen Van Ostade* (Amsterdam: Museum Het Rembrandthuis, 1998).

Figure 56: Reinier Nooms, *Zaagmolenpoort*, from *Nieuwe en Eygentlycke Afbeelbeeldinghe Der Stadts-Poorten van Amsterdam*, published by Cornelis Danckerts (I), 1652–1656. Etching and drypoint, 17.8 x 30.2 cm. Rijksmuseum, Amsterdam.

subjects.[59] Two of Van Ostade's pupils also continued his tradition of painting and etching low-life genre scenes: Cornelis Bega and Cornelis Dusart.[60] Bega produced several dozen etchings during his career, as well as a few experiments with monotype.[61] Dusart was the more prolific printmaker of the two students, with almost 120 known surviving etchings and mezzotints. His etchings had a markedly satirical bent, possibly derived from the stock characters found in *rederijker* plays.[62] (Figure 57)

Another specialist painter-etcher was Theodor van Thulden, a Flemish artist active in Antwerp in the first half of the seventeenth century.[63] In his early years in Antwerp, Van Thulden largely focused on commissions for mythological and allegorical cycles, most notably collaborating with Rubens on the decorations for the Triumphal Entry of Cardinal-Infante Ferdinand of Spain in 1635. Van Thulden is one of the only specialists here who focused on engravings and etchings of classical and mythological subjects, many of which were done on commissions from the same patrons who engaged his painterly services.[64]

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59. De Jongh and Luijten, *Mirror of Everyday Life*, cats. 55, 63.

60. Ostade's etchings also had a long afterlife of their own; see S. William Pelletier, "Van Ostade's Etchings Published by 'La Veuve Jean'," *Print Quarterly* 11, no. 4 (December 1994): 395–401.

61. According to Houbraken, Bega was Ostade's "first and best pupil"; Houbraken, *De groote schouburgh*, 1:350.

62. Stone-Ferrier, *Dutch Prints of Daily Life*, 89–94; de Jongh and Luijten, *Mirror of Everyday Life*, cat. 80.

63. On Van Thulden, see Alain Roy, ed., *Theodoor van Thulden: een zuidnederlandse barokschilder: 's-Hertogenbosch, 1606-1669* (Zwolle: Waanders, 1991); for his prints, see Hollstein, *Dutch and Flemish*, 30:101–134.

64. The town councillors who had commissioned Van Thulden to paint Rubens' designs for Ferdinand's 1635 entry also commissioned an engraved festival book commemorating the occasion; Stijn Bussels, "Making the Most of Theatre and Painting: The Power of Tableaux Vivants in Joyous Entries from the Southern Netherlands (1458–1635)," *Art History* 33, no. 2 (April 2010): 243–245.

Figure 57: Cornelis Dusart, *The Famous Shoemaker*, published by Pierre François Basan, 1695. Etching, 25.1 x 17.8 cm. Rijksmuseum, Amsterdam.

Two other specialists on this list were not painters. But printmaking also made up just a part of their artistic careers. Isaac Vincentsz van der Vinne specialized almost exclusively in engraved heraldic designs, emblems, trademarks, and personalized *imprese*.[65] (Figure 58) However he, too, made a great part of his income as a bookseller rather than as a printmaker. Moreover, Van der Vinne appeared to have conducted an outsize portion of his business with the Mennonite community in Haarlem, which may have contributed to his ability to specialize in his highly particular products.[66]

Figure 58: Isaac Vincentsz van der Vinne, trademark for Jan van Wesbusch, 1686. Woodcut, 7.6 x 5.5 cm. Haarlem Municipal Archives. (*Hollstein* 36:102, no. 140)

The other, Abraham Dircksz van Santvoort, was an engraver and sometime-publisher who specialized in topographical history prints, depicting scenes from the war or other political events. Little is known about his life, though he was likely the brother of the Amsterdam portrait painter Dirck Dircksz Santvoort. He built

65. Hollstein, *Dutch and Flemish*, 37:75–233; on Van der Vinne's trademarks in particular, see Christiaan Schuckman, "Gebruiksgrafiek bewaard: handelsmerken door Izaak Vincentsz. van der Vinne (1665-1745)," *Doopsgezinde bijdragen* 14 (1990): 155–176.

66. Schuckman, "Gebruiksgrafiek bewaard," 172–176.

his own print publishing business, issuing many history prints by his own hand from both Amsterdam as well as Breda, where he was active between 1648 and 1653. Most notably, Van Santvoort collaborated with Cornelis Danckerts in Amsterdam to publish a large-scale etched map of Frederick Hendrick's 1645 siege of Hulst with narrative and topographical vignettes and a textual narrative. (Figures 59 and 60) Van Santvoort would etch several printed city-view maps in this vein.[67] Producing a satisfactory map demanded additional skills above and beyond conventional etching skills, requiring enough fluency in geometry to project a convincing topographical representation onto a flat plane, as well as experience composing and printing large-scale compositions across multiple plates.[68] In this particular printed genre, unlike others, specialization may have been all but required.

By in large, however, specialist printmakers tended to fit into Bartsch's idea of the *peintre-graveur*: a painter who produced original designs and also happened to create their own engravings or etchings. In the case of the landscapists above (Nooms, Van Everdingen, Waterloo) and the genre painters (Van Ostade, Dusart, Bega) their concentration in particular print subject matter largely paralleled their painting careers.

4.4.2 Generalist Printmakers

Such specialized printmakers were outnumbered, however, by those who were able and willing to render a wide variety of subjects. Table 5 shows the top ten most generalist printmakers from the RKM dataset. As with Table 4, this is not intended

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67. Hollstein, *Dutch and Flemish*, 23:173–175.

68. It is notable that even the prolific *seller* of maps Hendrick Hondius did not cut the plates himself, but rather published maps rendered by others; On printmaking challenges peculiar to mapmaking, see Kees Zandvliet, *Mapping for Money: Maps, Plans, and Topographic Paintings and Their Role in Dutch Overseas Expansion During the 16th and 17th Centuries* (Amsterdam: Batavian Lion International, 1998), 42–49, 246–249; Marco van Egmond, "The Secrets of a Long Life: The Dutch Firm of Covens & Mortier (1685-1866) and Their Copper Plates," *Imago Mundi* 54 (2002): 67–86.

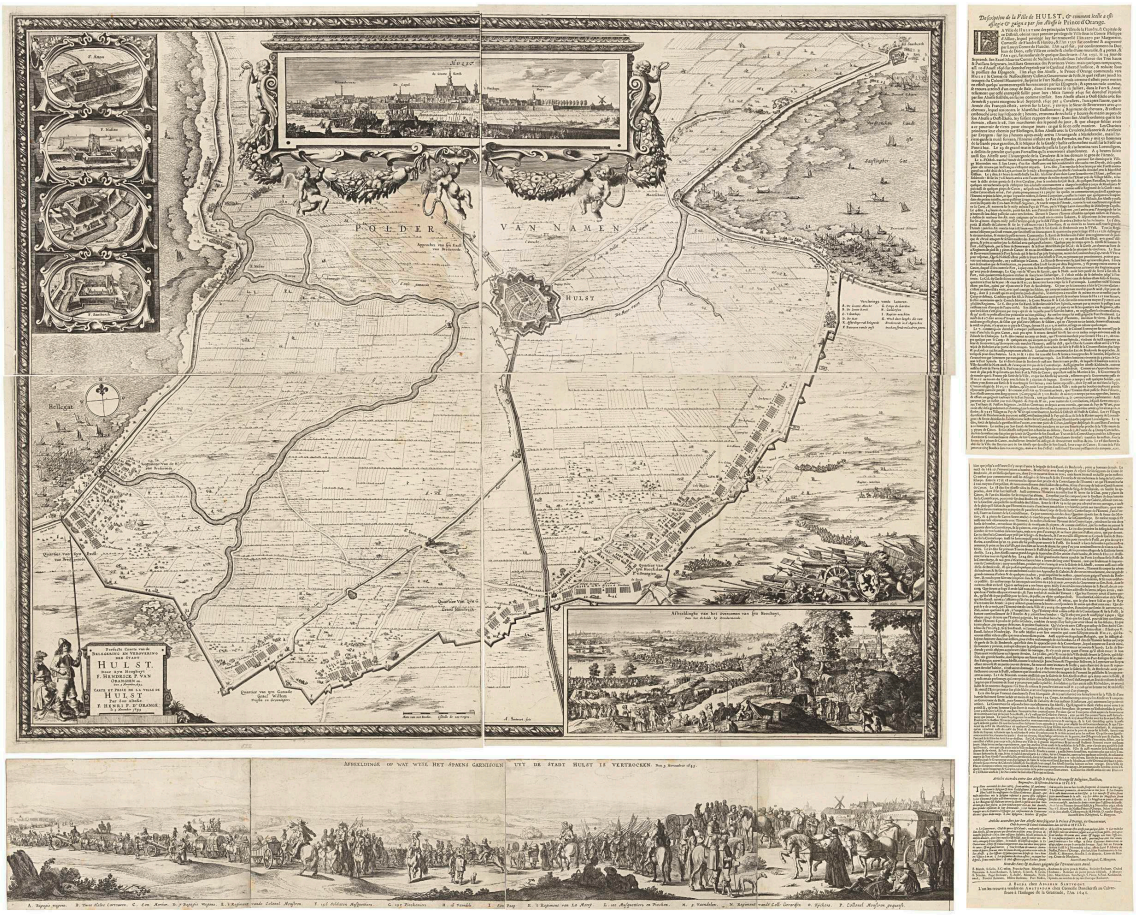
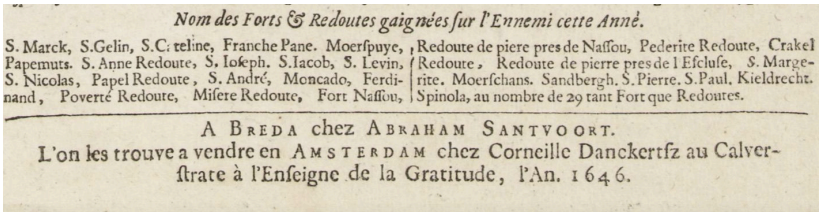


Figure 59: Abraham Dircksz van Santvoort, *Siege and Capture of Hulst by Frederick Hendrick, 1645*, 1646. Etching and textblock, 100 x 122 cm. Rijksmuseum, Amsterdam.



Nom des Forts & Redoutes gaignées ſur l'Ennemi cette Anné.

S. Marck, S.Gelin, S.C: teline, Franche Pane. Moerſpuye, Redoute de piere pres de Naſſou, Pederite Redoute, Crakel Papemuts. S. Anne Redoute, S. Ioſeph. S.Iacob, S. Levin, Redoute, Redoute de pierre pres de l'Eſcluſe, S. Margerite. Moerſchans. Sandbergh. S. Pierre. S. Paul. Kieldrecht. S. Nicolas, Papel Redoute, S. André, Moncado, Ferdinand, Poverté Redoute, Miſere Redoute, Fort Naſſou, Spinola, au nombre de 29 tant Fort que Redoutes.

A Breda chez Abraham Santvoort.
L'on les trouve a vendre en Amsterdam chez Corneille Danckertſz au Calverſtrate à l'Enſeigne de la Gratitude, l'An. 1646.

Figure 60: Detail of *Siege and Capture of Hulst* showing the publisher's credit to Abraham van Santvoort in cooperation with Cornelis Danckerts.

to be a comprehensive list reporting on the oeuvre diversity of all well-known Dutch and Flemish printmakers. (Rembrandt, for example, ranks 90th in diversity out of 420 different printmakers for whom oeuvre diversity was calculated. He was a diverse printmaker, but not *exceptionally* so.) Rather, it offers a sample of the most remarkably wide-ranging printmakers in these data.

Table 5: The most generalist Dutch and Flemish printmakers (those falling above the 85th diversity percentile) arranged in order of decreasing diveristy.

artist name	works	div	subjects
Aegidius Sadeler	238	1.80	landscape, portraiture, allegory, mythology, religious
Hendrick Goltzius	228	1.80	biblical, portraiture, allegory, antiquity, mythology, landscape
Crispin van de Passe (I)	203	1.80	moralizing allegories, portraiture, devotional, botanical, biblical
Caspar Luyken	454	1.74	bible, landscape, historical, genre, maps
Jacob Matham	229	1.73	allegory, mythology, portraiture, biblical
Abraham Bloteling	188	1.72	landscape, genre scenes, portraiture, mythological
Cornelis Bloemaert (II)	180	1.69	saints & other religious, biblical, portraiture
Jan Luyken	2,047	1.64	bible scenes, seascape, genre, historical, architecture, titlepages
Raphaël Sadeler (I)	156	1.57	devotional series, biblical, allegory, mythology, titlepages
Johannes Wierix	215	1.54	portraiture, biblical, allegory, genre, mythology, devotional,

The one trait shared by the printmakers in this sample was that they almost exclusively devoted their careers to cutting plates. Such flexibility may have presented

an attractive insurance policy both for printmakers themselves, but also for print publishers, who had to continually react to the demands of a quickly-moving market for artistic prints and illustrations. For example, it is hardly surprising to find Abraham Blooteling among the generalist engravers, given the wide array of relationships he maintained both in Amsterdam as well as in London. The same can be said of Cornelis Bloemaert, whose success as an international printmaker working between Utrecht, Paris, and Rome depended on his willingness to work with a wide array of artists.[69]

A wholly-market-based explanation for printmaking generalization does not tell the entire story, however. Sixteenth- and seventeenth-century attitudes towards printmaking also contributed to this distinction between specializing painters and generalizing printmakers. The most diverse printmaker in this analysis, Aegidius Sadeler, presents an interesting case in point.

4.4.3 Rudolf II, Aegidius Sadeler, and the Use of Prints

The Holy Roman Emperor between 1576 and 1612, Rudolf II is famed for his imperial *kunstkammer*, a collection of fine art and curiosities both natural and man-made.[70] Many of the masterpieces in this collection were produced by court artists whom Rudolf recruited from Prague, Germany, and the Low Countries. Art from the Rudolfine court spanned an exceptionally broad range of visual modes, from stylized and idealized, to highly naturalistic. Thomas DaCosta Kaufmann has convincingly argued that the key to understanding this diversity lies in the fact that individual painters at the court appear to have been assigned to particular genres. Following humanist models of rhetorical eloquence, where the style of speech is appropriately matched to its content,

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69. Further discussion of Blooteling's and Bloemaert's careers is found in sections 3.4.2 and 3.4.3.

70. For a general history of Rudolf II and his intellectual sphere, see Robert John Weston Evans, *Rudolf II and his World: A Study in Intellectual History 1576-1612* (Oxford: Clarendon Press, 1973).

Prague painters rendered subjects in styles appropriate to each: learned allegories in a highly mannered style, and pictures of country peasants in a grittier realism.[71]

Bartholomeus Spranger, for example, devoted his energies to painting allegories; Hans von Aachen, mythologies; Josef Heintz, devotional paintings; and Joris Hoefnagel, various *naturalia*. The emperor also recruited separate artists for landscapes, summoning the Flemish painters Pieter Stevens and Roelandt Savery to Prague in 1604.[72]

Whereas Spranger, Von Aachen, Savery, and the rest specialized by genre, Sadeler received the novel designation of imperial *kupferstecher*. Sadeler came to work for

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71. Thomas DaCosta Kaufmann, "The Eloquent Artist: Towards an Understanding of the Stylistics of Painting at the Court of Rudolf II," *Leids kunsthistorisch jaarboek* 1 (1982): 119–148. Kaufmann later revisited this essay and suggested that specialization by Flemish and Dutch artists should be seen as parallel to, if not derived from, the early separation of genres in sixteenth-century Prague. However, he also distinguishes between the eastern European and northern Netherlandish manifestations of this separation, claiming that the strict hierarchy of stylistic decorum that ruled Rudolfine Prague did not obtain in the Netherlands. Dutch artists were more likely to produce allegorical or mythological compositions in a naturalistic mode, instead of adopting the mannered ideal that Prague artists would have used for the same subjects; Thomas DaCosta Kaufmann, "Perspective on Prague: Rudolfine Stylistics Reviewed," in *The Eloquent Artist* (London: Pindar, 2004), 82–83. On low-life pictures at the court, see Thomas DaCosta Kaufmann, "'*Gar lecherlich*': Low-life Painting in Rudolfine Prague," in *The Eloquent Artist* (London: Pindar, 2004), 106–118

72. Rudolf was an ardent collector of both Pieter Bruegel the Elder and his son Jan Bruegel the Elder, and may have admired Savery's responses to these Flemish forbears. Savery had painted his own version of Pieter Bruegel's *Tower of Babel* in 1602, Ekkehard Mai and Kurt J. Müllenmeister, eds., *Roelant Savery in seiner Zeit* (Köln; Utrecht: Wallraf-Richartz-Museum; Centraal Museum, 1985), no. 1; Kurt J. Müllenmeister, *Roelant Savery: Kortrijk 1576-1639 Utrecht: Hofmaler Kaiser Rudolf II. in Prag: die Gemälde mit kritischem Œuvrekatalog* (Freren: Luca Verlag, 1988), no. 2; on Stevens, see An Zwollo, "Pieter Stevens, ein vergessener Maler des Rudolfinischen Kreises," *Jahrbuch der Kunsthistorischen Sammlungen in Wien* 64 (1968): 119–180.

Notably, Savery's role was codified in a Prague court register that specifically refers to him as "*Ruelandt Seuerin, landschaftmaler*", while another, unnamed artist, is listed as a *Conterfetter*, or portraitist; Heinrich Zimmermann, "Urkunden, Acten und Regesten aus dem Archiv des K. K. Ministeriums des innern," *Jahrbuch der Kunsthistorischen Sammlungen des Allerhöchsten Kaiserhauses* 7 (1888): no. 4706. On the rise of terms for "painter" tailored by subject matter at the turn of the century, see Lydia de Pauw-de Veen, *De begrippen 'schilder,' 'schilderij' en 'schilderen' in de zeventiende eeuw* (Brussels: Paleis der Academiën, 1969), ch. 5

Rudolf II from 1597.[73] Sadeler set to work producing engravings after paintings, drawings, and designs made specifically for prints, of Spranger's allegories, Von Aachen's mythologies, Josef Heintz's religious compositions, and Savery's and Stevens' landscapes.[74] (Figure 61) Savery also invented and engraved portraits, a flexibility of subject matter that may have helped him maintain his position at Prague under Rudolf's less artistically-minded successors Mathias (r. 1612–1619) and Ferdinand II (r. 1619–1637).[75] The emperor also directed Sadeler and his assistants to create works after artists outside the court, including Paul Bril and Jan Brueghel.[76] In this way, Rudolf used prints as a two-way conduit: a medium to disseminate images of court members, events, and collections to the outside world, as well as a means to assemble images from artists across Europe within Prague via printed representations.[77]

Sadeler also made several prints after some of Rudolf's most prized collections of old masters, including drawings by Albrecht Dürer. Sadeler skillfully remade the calligraphic pen work and subtle, tonal modeling of Dürer's drawing of *Head of the*

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73. Dorothy Limouze, "Aegidius Sadeler (c. 1570-1629): Drawings, Prints and Art Theory" (PhD diss., Princeton University, 1990), 142–143. For a discussion of the larger Sadeler dynasty, see section 3.4.1.

74. Sadeler did not work exclusively for Rudolf while serving as imperial *kupferstecher*. While at the court, he fulfilled commissions for the Archbishop of Prague and for Jacob Chimarreus, a Canon of St. Gereon in Olomouc; Dorothy Limouze, "Aegidius Sadeler's Post-Rudolfine Career: New Beginnings in an Artist's Late Oeuvre," in *Rudolf II, Prague and the World: Papers from the International Conference, Prague, 2-4 September, 1997*, ed. Lubomír Konečný and Beket Bukovinská (Prague: Artefactum, 1998), 211.

Court painters were also not bound to work exclusively with Sadeler. Outside engravers and publishers were still doing reproductions after painters like Spranger during Sadeler's tenure. For a discussion of prints after Spranger in particular, see Strech, "*Spranger inventor*: Überlegungen zu Entstehung und Funktion von Stichen nach Sprangers Werken."

75. Limouze, "Aegidius Sadeler, Imperial Printmaker," 15.

76. Sadeler may have known both artists personally from his visit to Rome in 1593; ibid., 7–10.

77. Robert John Weston Evans and Eliška Fučiková, *The Stylish Image: Printmakers to the Court of Rudolf II* (Edinburgh: National Gallery of Scotland, 1991), 21; on printmaking in the Rudolfine court in general, see Dorothy Limouze, "Engraving at the Court of Prague," in *Rudolf II and Prague: The Court and the City*, ed. Eliska Fucíková (Prague: Prague Castle Administration, 1997), 172–178.

Twelve-Year-Old Christ. (Figure 62) While the work is a brilliant display of Sadeler's own technical talent, it also offers a striking homage to Dürer. Sadeler illusionistically renders the print's descriptive text as if carved on a stone plinth. This credits Dürer's original invention with far more visual fanfare than the customary *invenit* text tucked into the lower corner of a reproductive print. Sadeler also added Dürer's distinctive *AD* monogram in the upper right corner of his print, although the original drawing does not include it.[78] Even as he celebrates Dürer's original invention, Sadeler reinforces his own transformative abilities as an engraver.

Rudolf's interest in artistic transformation extended across all media, as can be seen in the two reproductions he commissioned after another sheet by Dürer in the Prague collections: a watercolor of the *Madonna Among a Multitude of Animals*. (Figure 63) From this watercolor, Rudolf commissioned both an oil painting from Jan Brueghel the Elder, who visited Prague in 1604, as well as a print from Sadeler. Unlike his engravings after contemporary paintings in Prague, Sadeler ensured that his print was the same size as the original source, compounding the emulative effect.[79] Brueghel followed suit, matching the scale of his panel to the Dürer's watercolor. Through his commission, Rudolf celebrated the artistic legacy of Dürer at the same time as he highlighted the artistic talents he could command as the Holy Roman Emperor. Moreover, the paired translation from watercolor into both engraving and oil painting rewarded the

78. Evans and Fučiková, *Stylish Image*, cat. 43.

79. Sadeler's other prints after Dürer's drawings, including the *Head of Christ*, follow the same principle; Kayo Hirakawa, *The Pictorialization of Dürer's Drawings in Northern Europe in the Sixteenth and Seventeenth Centuries* (Bern: Peter Lang, 2009), 115–117; Andrea Bubenik, *Reframing Albrecht Dürer: The Appropriation of Art, 1528-1700* (Burlington: Ashgate, 2013), 106–109.

discerning viewer who could simultaneously appreciate the similarities and differences between each of the three artworks.[80]

Sadeler's prints after the *Head of the Twelve-Year-Old Christ* and the *Madonna Among a Multitude of Animals* prints carry out two functions. They each reproduce a singular object, making the quality of Rudolf's collection known outside of Prague. At the same time, they provide the viewer a virtuosic performance of engraving skill, appealing to art lovers who were just as interested in the artistry of imitation as they were in seeing an image of the original object. Rudolf was certainly one such viewer.[81] To fulfill both these functions as imperial *kupferstecher*, Sadeler had to master all possible styles, subjects, and painterly hands.

This dual value of prints, and the dual role of printmakers, is implicit in Karel van Mander's 1604 biography of the master engraver Goltzius.[82] Van Mander highlights Goltzius' ability to seamlessly refashion his own style in the form of the artists he wishes to emulate, while also praising his ability to invent entirely new artistic techniques that highlight, rather than subsume, the hand of the printmaker.[83]

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80. Dagmar Eichberger has advanced the argument that, by focusing on a Dürer artwork that celebrated the harmonious elements of nature, Rudolf was implicitly celebrating his own encyclopedic collections — a motive that would also have been enhanced by the double commission of engraver and painter to realize the Dürer composition in two different formats; see Dagmar Eichberger, "*Naturalia* and *artefacta*: Dürer's Nature Drawings and Early Collecting," in *Dürer and his Culture*, ed. Dagmar Eichberger and Charles Zika (Cambridge: Cambridge University Press, 1998), 36; also Bubenik, *Reframing Albrecht Dürer*, 108.

81. On Rudolf's fascination with engraving techniques and dissimulative artistry, see Lawrence W. Nichols, "The 'Pen Works' of Hendrick Goltzius," *Philadelphia Museum of Art Bulletin* 88, no. 373 (1992): 4–56; Madeline Viljoen, "To Print or not to Print? Hendrick Goltzius's 1595 *Sine Baccho et Cerere Friget Venus* and Engraving with Precious Metals," *Zeitschrift für Kunstgeschichte* 74 (2011): 45–76.

82. Van Mander, *The Lives of the Illustrious Netherlandish and German Painters (1604)*, 281v-287r.

83. Further analysis of this biography is offered by Walter S. Melion, "Karel van Mander's 'Life of Goltzius': Defining the Paradigm of Protean Virtuosity in Haarlem around 1600," *Studies in Art History* 27 (1989): 113–133.

Figure 61: Aegidius Sadeler after Bartholomeus Spranger, *The Triumph of Wisdom*, c. 1600. Engraving, 49.5 x 35 cm. Rijksmuseum, Amsterdam.

Figure 62: Aegidius Sadeler after Albrecht Dürer, *Head of the Twelve-Year-Old Christ*, 1598. Engraving, 35.7 x 22.7 cm. Rijksmuseum, Amsterdam.

Figure 63: Three versions of *Virgin Among a Multitude of Animals*. (Top) Albrecht Dürer, 1503. Pen and ink and watercolor on paper, 32.1 x 24.3 cm. Albertina, Vienna. (Lower left) Jan Brueghel I after Albrecht Dürer, 1604. Oil on panel, 24 x 26 cm. Galleria Doria Pamphilij, Rome. (Lower right) Aegidius Sadeler after Albrecht Dürer, after 1597. Engraving, 34.3 x 24.2 cm. Rijksmuseum, Amsterdam.

Roger de Piles made explicit these implicit values of prints in a 1699 essay "On the Usefulness and Use of Prints."[84] He enumerated six core uses:

1. Offer a way to transmit visual knowledge, rather that text alone: images, in de Piles mind, were more efficient for teaching and learning. He particularly advocated the use of prints by young students, on whose malleable minds such images could be imprinted.[85]
2. Allow for easier recollection: a collector could index their prints so that they might quickly locate a relevant image when needed. Monks, for example, should jog their memories by studying devout histories, while philosophers could use illustrations of *naturalia* as memory aides.
3. Represent absent or distant things: travelers, for example, could benefit by looking at views of far-off cities; artists, by seeing works by the old masters that they otherwise could not visit.
4. Allow easy comparison: Collectors may easily search for connections between images by physically rearranging their prints, or flipping through pages in an album.
5. Give a wide grounding of cultural knowledge: De Piles describes a network-like approach to building a collection of history prints, starting with a core subject

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84. "De l'utilité des Estampes, & de leur usage," in Roger de Piles, *Abrégé de la vie des peintres, avec des reflexions sur leurs ouvrages, et un Traité du peintre parfait; De la connoissance des desseins; De l'utilité des estampes* (Paris: Jacques Estienne, 1699), http://gallica.bnf.fr/ark:/12148/bpt6k111893d, 74–92; translated to English in Roger de Piles and Bainbrigg Buckeridge, *The art of painting, with the lives and characters of above 300 of the most eminent painters...* (London: T. Payne, 1754), 49–60, http://archive.org/details/artofpaintingwit00pile. For commentary on this essay, see William B. MacGregor, "The Authority of Prints: An Early Modern Perspective," *Art History* 22, no. 3 (September 1999): 395, doi:10.1111/1467-8365.00163.

85. On the use of engraving as a metaphor for cognition, see ibid., 404. This use also touches on William Ivins' thesis that the true transformative power of visual prints in the sixteenth century was their ability to engender an entirely new system of communication that could depend upon a mechanical means for disseminating visual knowledge; William Mills Ivins, *Prints and Visual Communication* (New York: Da Capo Press, 1969).

like portraits of kings and their notable deeds, augmenting that with maps of their countries, and eventually adding all sort of peripheral material like festival books, and procession prints. The same might be done by a student of the arts, who should collect a core group of prints after the old masters before branching out to prints after their students.

6. Provide pleasure by their artistry and ingenuity in making representations: Prints were worthwhile not only for their content, but for their style. One might choose to collect prints not according to which artists' works they reproduce, but according to the engravers who cut them. De Piles argues that printmakers themselves could benefit from collecting prints and building a history of their own profession. Prints could thus constitute a history of their own making. This underlines the importance of prints' artistry in addition to their informational content.

It is striking that all of de Piles' uses of prints are couched in rhetoric of abundance. For de Piles, printmaking is distinguished by both its wide adoption, as well as its representative reach:

> Since Marcantonio, a vast number of engravers have made themselves famous, in Germany, Italy, France, and the Low Countries, and have published, as well by engraving as etching, and infinite number of prints on all sorts of subjects, histories, fables, emblems, devises, medals, animals, landscapes, flowers, fruits, and in general all the visible products of art and nature.[86]

Prints, in de Piles' eyes, are useful in so many ways *precisely* because they could offer the viewer both a world's worth of subjects as well as a protean showcase of artistic

86. "Depuis Marc-Antonie un grand nombre de Graveurs se sont rendus recommandables, en Allemagne, en Italie, en France, & dans les Païs-Bas, & ont mis au jour, au burin, & à l'eau-forte une inifinité de sujets de tous genres, Histories, Fables, Emblêmes, Desvises, Médailles, Animaux, Païsages, Fleurs, Fruits, & généralement toutes les productions visibles de l'Art & de la Nature."; Piles, *Abrégé de la vie des peintres*, 77; translation adapted from Piles and Buckeridge, *The art of painting*, 51.

styles. It is little surprise that professional printmakers would strive to produce as many genres as they could when collectors viewed prints as vessels of both encyclopedic knowledge and stylistic variety.

Hendrick Goltzius embraced and cultivated this identity as a protean artist. His renowned Haarlem print studio issued a massive range of genres, from formal portraits and antique sculpture to biblical scenes and allegories, and would continue to do so into the seventeenth century under the guidance of his stepson Jacob Matham. While he did not produce dedicated landscape engravings, Goltzius did make several forays into the genre. In a series of chiaroscuro woodcuts, Goltzius rendered small landscapes in a manner reminiscent of Venetian *vedute*.[87] His interest in landscape is also seen in his silvery, panoramic drawings depicting the Haarlem dunescapes, and which anticipated the etched topographical views of the Haarlem innovators of the 1610s.[88] (Figure 64) And while he did not issue any dedicated still life prints (a rare specialty in printmaking, anyway), he did produce many drawn nature studies. (Figure 65) Carefully-observed still life passages also feature prominently in the paintings that he made late in his career.[89] That Goltzius mastered a wide array of genres aligns with his carefully-honed artistic identity as a "Proteus" of art, able to shift his burin technique and graphic manner to perfectly fit the visual style of any artist.[90]

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87. Nancy Bialler, *Chiaroscuro Woodcuts: Hendrick Goltzius and his Time* (Amsterdam: Rijksmuseum, 1992), no 49; Leeflang, *Goltzius*, cat. 70.

88. Leeflang, *Goltzius*, cat. 74.

89. See, for example, his 1603 portrait of Jan Goverts van der Aar (Museum Boymans van Beuningen, Rotterdam) as a shell collector; Leopoldine van Hogendorp Prosperetti, "'*Conchas Legere*': Shells As Trophies Of Repose In Northern European Humanism," *Art History* 29, no. 3 (June 2006): 387–413, doi:10.1111/j.1467-8365.2006.00507.x; on Goltzius and nature studies in general, see Leeflang, *Goltzius*, ch. 7.

90. Goltzius' friend and biographer Karel van Mander famously refers to him as "a rare Proteus or Vertumnus in Art"; van Mander, *The Lives of the Illustrious Netherlandish and German Painters (1604)*, fol. 285r. Van Mander derived this imagery from a verse by Cornelis Schonaeus, a poet who provided

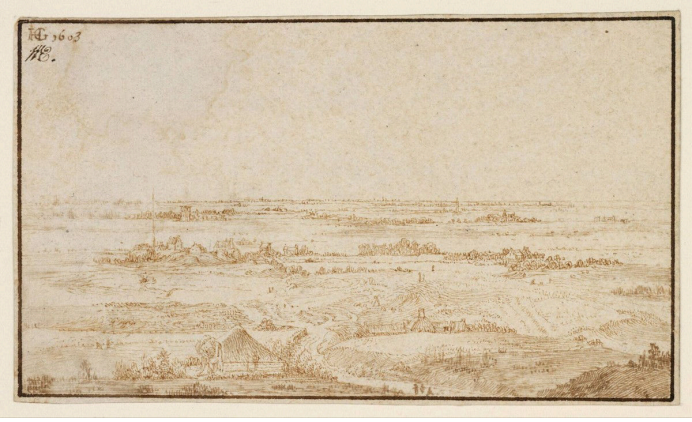

Figure 64: Hendrick Goltzius, *Dune landscape near Haarlem*, 1603. Pen and brown ink, 9.1 x 15.4 cm. Museum Boijmans van Beuningen, Rotterdam

Figure 65: Hendrick Goltzius, *A Foxglove in Bloom*, 1592. Pen and brown ink on laid paper, 17.5 x 9.8 cm. National Gallery of Art, Washington. (Image courtesy National Gallery of Art, Washington.)

4.4.4 The Luyken Family's Diverse Book Illustrations

While Goltzius, Wierix, Van de Passe, and the Sadelers all produced a combination of standalone *constprenten* as well as book illustrations, Jan and Caspar Luyken were exceptional for their single-minded focus on making book illustrations. Jan Luyken was a prodigious printmaker born in Amsterdam in 1649. Working in the capital of the European publishing universe in the second half of the seventeenth century, Jan and his son Caspar established themselves as the most productive Dutch illustrators of the century.[91] Jan produced a wealth of book title pages and author portraits, as well as innumerable illustrations, mostly as etchings. He worked for over a dozen publishers across Amsterdam: etching over six hundred plates of biblical illustrations for Pieter Mortier; more than one hundred maps for Johannes van Keulen; modern histories and illustrations for anatomical and horticultural treatises for Pieter van der Aa and for Jan Claesz ten Hoorn; and illustrated histories of the Holy Land for Willem Goeree and François Halma.[92] Most distinctive may have been the series of emblem books Jan and his son Caspar engraved after designs of Jan's own invention. One of his most copied and adapted series was *Het Menselyk Bedryf* ("The mirror of human trades"), an illustrated volume depicting a range of professions in emblem/motto pairs in the tradition of the sixteenth-century books of trade. These designs were first published

inscriptions for many of Goltzius' engravings: "Just as Proteus, captivated by eager love for the graceful Pomona, transformed himself in the midst of the waves, so too through his mutable art Goltzius, astonishing engraver and inventor, transforms himself." On the importance of this imagery to Goltzius' artistic identity, see Melion, "Karel van Mander's 'Life of Goltzius'"; Walter S. Melion, "Love and Artisanship in Hendrick Goltzius's *Venus, Bacchus and Ceres* of 1606," *Art History* 16, no. 1 (March 1993): 60–94

91. P. van Eeghen and Johan Philip van der Kellen, *Het werk van Jan en Casper Luyken* (Amsterdam: F. Muller & Co., 1905); Hollstein, *Dutch and Flemish*, 11:118–144.

92. Nel Klaversma and Kiki Hannema, *Jan en Casper Luyken te boek gesteld: catalogus van de boekencollectie van Eeghen in het Amsterdams Historisch Museum* (Hilversum: Verloren, 1999); on Holy Land histories in particular, see Anemone Bekemeier, *Reisen nach Jerusalem: Das Heilige Land in Karten und Ansichten aus fünf Jahrhunderten* (Wiesbaden: L. Reichert, 1993).

in 1694 by Christoph Weigel in Nuremberg, though they would soon be republished in Amsterdam.[93] Caspar spent his early career training with his father in Amsterdam, before traveling to Nuremberg in 1699 to produce prints for Weigel. Caspar returned to Amsterdam by 1704, and continued to produce illustrations for a fantastic variety of publications, though he would not match his father in sheer productivity.

Other printmakers who also focused intently on book illustration also had relatively diverse oeuvres, such as Romeyn de Hooghe or Salomon Savery (both more diverse than 67% of all other printmakers in these data). As discussed in chapter 2, sourcing suitably adaptable engraving talent appears to have been a pressing concern for publishers not only of *constprenten*, but also books with intaglio illustrations.[94] Given the challenges of locating a capable *and* reliable engraver or etcher who could accommodate the challenging logistics of producing and illustrated book, it would follow that publishers would have been particularly happy to establish a relationship with an engraver who could be regularly called upon to produce a wide range of work.

4.5 Conclusion: The Encyclopedic Printmaker

While the phenomenon of seventeenth-century specializing painters in the Low Countries has been thoroughly studied, existing case studies of printmakers offered conflicting evidence about whether printmakers also found it advantageous to distinguish themselves from a crowded field through distinctive subject matter. This analysis suggests that, while an increasing number of painters took the specialist route over the course of the seventeenth century, the output of most printmakers stayed consistently diverse over the same period. Publishers' own desire to produce a wide array of

93. Donna R. Barnes, *The Butcher, the Baker, the Candlestick Maker: Jan Luyken's Mirrors of 17th-Century Dutch Daily Life* (Hempstead, N.Y.: Hofstra Museum, Hofstra University, 1995), 16–19.

94. See section 2.1.

Figure 66: Caspar Luyken after Jan Luyken, *De Pastiebakker*, in *Spiegel van het menselyk bedryf: vertoonende honderd verscheiden ambachten, konstig afgebeeld en met godlyke spreuken en stichtelyke verzen verryke*, published by Kornelis van der Sys, Amsterdam, 1730. Emory University, Pitts Theology Library, Atlanta.

subjects, coupled with the difficulty of locating reliable printmakers, appears to have incentivized artists who made most of their livelihood from producing prints to work in a wide variety of genres. Those etchers or engravers who *did* focus one particular subject shared a common trait: printmaking was not their sole profession. Many of the specialist printmakers identified in this analysis were also specialist painters who also produced prints (usually etchings) that went hand in hand with their paintings.

However, it was not only commercial motives that spurred printmakers to diversify, but also the period understanding of the use and value of prints. Theory and economics did not always see eye-to-eye in Dutch and Flemish art. Academically-minded writers like Karel van Mander or Gérard de Lairesse advised artists to master the synthesis of all specialities in history paintings, and denigrated those who specialized in the so-called "byways" of landscape, still life, or portraiture out of laziness or greed. And yet many painters, whether responding to economic incentives or to their own artistic interest, found both financial success as well as acclaim and fame for their prowess in rendering specialized subjects. With prints, however, commercial and theoretical considerations converged. An outlook that regarded prints as a medium of universal knowledge also celebrated printmakers with the technical range to produce and reproduce virtually any image that was desired, whether by a patron, a publisher, or by the artist themselves.

Conclusion

This dissertation opened with two representations of print production: first, a sixteenth-century anecdote that highlighted the professional interdependence of printmaker, draftsman, and coordinating publisher; and second, a print that depicted the teaching of novice copperplate engravers within a thriving print publishing house. (Figure 1) These representations highlight core, interconnected issues raised by printmaking's unique demands as a medium: that of the need for experienced collaborators, and that of the slow spread of printmaking ability and capacity throughout Europe. The network analyses in this dissertation have clarified how these simple forces drove a great many of the seeming-revolutions and disruptions in print production in the Netherlands, and in Europe more broadly, between 1550–1750.

To produce prints at scale demanded collaboration, or at least co-production. A printmaker could only get so far based on their individual talent with the block knife, burin, etching needle, or mezzotint rocker. Printmakers also needed social capital in the form of connections to publishers who could pay them for their plates, and to artists with artworks or designs whose reproductions were marketable. Publishers, in turn, needed access to capable (and reliable — note the constant laments of Christoph Plantin!) printmakers and artists in order to turn a profit in a difficult business. Designers likewise relied on printmakers and publishers to promote and disseminate their artworks such that their name, in Hoogstraten's words, might "sooner fly over the world."[1] This need for well-connected collaborators may have driven mid-sixteenth-century Dutch engravers like Philips Galle to build his career in Antwerp rather than in

1. See section 3.1.

his hometown of Haarlem, or prompted Cornelis Cort to move his practice to Rome. Projecting from this incentive alone, print historians have argued that printmaking inevitably required large centralized houses, like that of Hieronymus Cock, who could dominate the market through economies of scale, a case of the rich getting richer as large centers attracted more talent, becoming even larger and attractive in the process.

But this dissertation has shown that this incentive could be persistent and *still* result in a dynamic landscape of print production. The chance for any of these parties to succeed — to locate capable and well-connected partners — was very much dependent on the maturity and capacity of the print production marketplace in their immediate environment. And that capacity was not static. It did not rise up overnight, but instead was gradually cultivated over generations as experienced engravers, like the one shown in Stradanus' print, trained the next generation of artists. While Cort and Galle had to leave the northern Netherlands to find established printmaking partners, novice Dutch printmakers in the 1580s could instead flock to Hendrick Goltzius' Haarlem studio. They did so in numbers that were exceptional, given the size of the Dutch print production network at the time.

Even though the incentives for local centralization remained the same, the growing capacity of both Dutch and Flemish print production meant that a highly centralized environment dominated by one major house would *not* be replicated in following generations. Instead, marginal growth in the number of active printmakers in both regions meant a precipitate *decentralization* of both the Dutch and Flemish print production networks that affected the strategies of publishers and printmakers alike. Publishers like Hendrick Hondius worked harder than ever to assemble a diverse stock list, but conversely may also have found it easier than ever to fill those stocks with plates by and after fellow Dutch artists. Meanwhile, in the southern Netherlands, a contracting market helped protect long-running printmaking dynasties to a degree

not seen in the north. This novel analysis has also highlighted the importance of professional Dutch engravers like Jonas Suyderhoef in the mid-seventeenth century. Though largely unnoticed by art historians, this Haarlem artist produced reproductions after a wide array of artists and disseminated them via multiple publishers, playing a crucial, yet unacknowledged, role in disseminating artistic images.

Expanding this view to the wider European network of print production revealed a similar story, albeit from a different perspective. Measuring the changing balance of domestic versus international printmaking collaborations across Europe again suggested that the gradual spread of print production capacity could result in seeming-revolutions. Those regions with the longest histories of intaglio printmaking (Flemish, German, and Italian) made mostly domestic print production connections in the mid-sixteenth century. By contrast, those regions with less well-established capacity (Dutch, English, and French) made most of their connections externally, only shifting inwards, often precipitously so, once they had built up enough printmaking capacity to support a largely domestic artistic print industry. This analysis offered two surprises. First, that gradual changes in relative printmaking capacity, combined with the need for print producers to seek out experienced and well-connected collaborators, could drive the rapid emergence of regional printmaking industries and "domestic turns" in print production more than any one historical event or individual. And second, that only a few such external events disrupted the ability of European printmakers to work internationally.

While these continuous incentives in printmaking resulted in discontinuous changes in production, painters were undergoing their own revolution. Starting around the turn of the seventeenth century, an increasing number of painters began to specialize in single genres, producing landscapes, or still lifes, or portraits almost exclusively. Painters stood to benefit by promoting their mastery of a particular type of painting

because it allowed them to stand out in a competitive field. Yet I have shown that this same incentive did not hold true for professional printmakers. Instead, most remained generalists who were flexible enough to fulfill the varying demands of publishers and print buyers. This generalizing tendency must also be understood in the context of period understandings of the use and function of prints. Prints were held in high regard for their unique ability to offer an encyclopedic representation of the world. One could gather a wide array of subject matter and amass representatives of all kinds of artistic styles within a few well-composed print albums. Printmakers who could inventively reproduce myriad artworks and also emulate a broad range of hands and manners could achieve both commercial success as well as fame in the form of court postings and laudatory literary recognition. These expectations and demands — unique to printmaking — helped distinguish the way printmakers defined their oeuvres, and with it, their artistic identities.

Future Work: Art Historical Data Issues

Data-driven computation enabled these novel approaches to studying artistic print production in the early modern Low Countries. But, as is well known, an analysis is only as good the data powering it. In the course of investigating certain questions about printmaking history, this dissertation has highlighted shortcomings in the way that museums collect, edit, and publish information about their collections. For example, as discussed in chapter 2, because the British Museum and the Rijksmuseum follow different spelling conventions, it is difficult to comprehensively cross-reference their two databases by artist: to the computer, "Hendrick Hondius I" in the Rijksmuseum and "Hendrik Hondius (I)" in the British Museum are two entirely different individuals. In chapter 3, we encountered disagreements over assigning a nationality to artists; in chapter 4, varying approaches to tagging the "subject matter" of a given artwork. These

are challenges in museum data because they are challenges in art history, full stop. However, producing more interoperable and detailed art historical data can support ever more creative analyses.[2] And prints may serve as the most useful object case for enhanced museum data infrastructure.

Prints have traditionally been a major blind spot in museum databases because, unlike libraries, which generally deal with interchangeable copies of books, museums assume the *uniqueness* of their objects. Thus, they follow description and cataloguing standards suitable for standalone artworks.[3] This approach is clearly lacking in the description of hybrid objects like engravings or photographs that are both unique objects as well as multiples. Neither the BM nor the RKM, for example have structured their collections data to explicitly link together impressions of the same print. Their collection management systems simply were not built to track conceptual objects like "prints", of which the museum may own several physical impressions.[4] This makes it difficult to track phenomena like the trade of plates from one publisher to another.

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2. Two major reviews of art historical research practices and digital technology have been commissioned in the past five years, both of which comment on the research barriers presented by siloed data: Diane M. Zorich, *Transitioning to a Digital World: Art History, Its Research Centers, and Digital Scholarship* (New York: The Samuel H. Kress Foundation and The Roy Rosenzweig Center for History and New Media, May 2012), http://www.kressfoundation.org/research/transitioning_to_a_digital_world/, esp. p. 27, and Matthew P. Long and Roger C. Schonfeld, *Supporting the Changing Research Practices of Art Historians*, Ithaka S+R (ITHAKA, April 30, 2014), http://sr.ithaka.org/research-publications/supporting-changing-research-practices-art-historians.

3. Zorich, "Library and Museum Information: Beauty and the Beast," 3.

4. Jennifer Trant has summarized the genealogy of museum databases as an evolution from:

1) accountability-oriented (ensuring a basic and complete inventory
2) process-oriented (insurance, movement tracking, loans, wall labels, exhibitions)
3) (currently) knowledge-oriented (public access to museum data for unanticipated uses).

The data design and architecture principles that informed the first two iterations of museum databases define the limits of those databases for serving the third purpose, and it is against these limitations and their technical debt that institutions now struggle. Jennifer Trant, "Curating Collections Knowledge: Museums on the Cyberinfrastructure," in *Museum Informatics: People, Information, and Technology in Museums*, ed. Paul F. Marty and Katherine Burton Jones (New York: Routledge, 2008), 277–278.

This is not a new problem, of course. The Bartsch and Hollstein series have provided this connective tissue for more than a century, indexing prints and their states with a catalogue of locations where actual impressions of a given print state may be found. But for the museum collections management system, these references are just human-readable text, rather than structured information that can be easily computed. However, the technology exists to support an online, openly accessible digital authority database for European prints. This database could contain unique identifiers for prints and their states, serving as a digital reference point for museums when they catalog their print collections.[5] (Figure 67) Museums would be able to focus on the specific description of individual impressions, preparatory drawings or surviving print plates, including their unique materials, markings, and provenance, while relying on this authority for larger knowledge about the history of the print and its other impressions and states. By creating explicit references for prints and states separate from the physical impressions and related objects, it would become easier to describe complex relationships such as later reworking and republishing of plates. In the past, such projects demanded an enormous amount of labor, expense, and time. However, improved systems for finding matches between images and metadata promise to streamline much of the monotonous work of matching existing records, allowing expert researchers to focus on producing new information about prints and printmakers.

Larger datasets that encompass more than the two institutions used for this project could bring in the full spectrum of visual print culture, from book illustrations to fugitive artifacts like broadsides and calendars. Combined with more nuanced and

5. The formal term would be a Linked Open Data (LOD) repository; the same format as used by the British Museum. On LOD and cultural heritage, see Dominic Oldman, Martin Doerr, and Stefan Gradmann, "Zen and the Art of Linked Data: New Strategies for a Semantic Web of Humanist Knowledge," in *A New Companion to Digital Humanities*, ed. Susan Schreibman, Raymond George Siemens, and John Unsworth (New York: Wiley-Blackwell, forthcoming 2016), 251–273.

detailed data, these larger sources could open up new analytical opportunities for the study of artistic prints. Such a project also offers a revolutionary opportunity for bridge-building between many different collecting institutions, who deal with multiples in photography, sculpture, and the decorative arts as well.

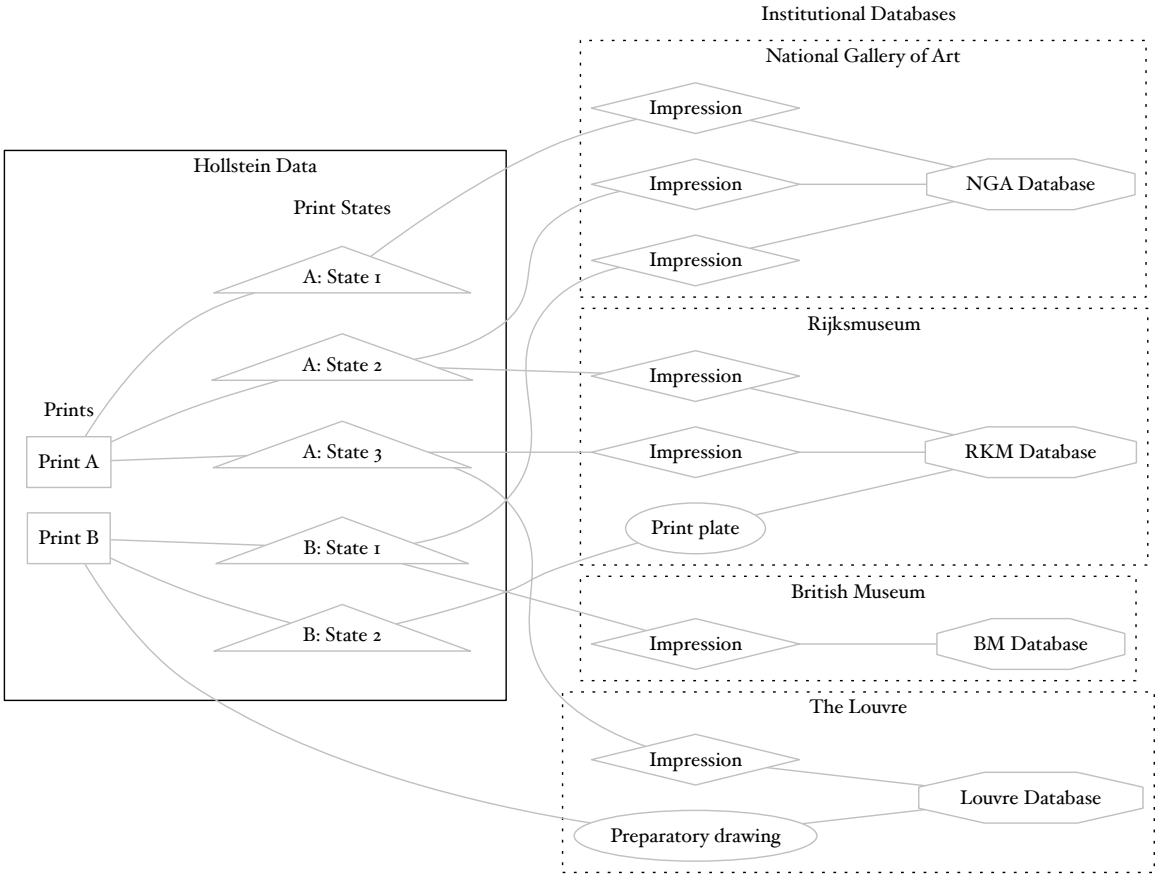

Figure 67: Schematic diagram for a hypothetical "Digital Hollstein" Linked Open Data authority, and its relationship to museum databases. While museums would still maintain their own separate collections databases, they would be able to reference their individual entries on print impressions and other related objects to the unique records for prints and their states maintained by the central database.

Another promising opportunity is in dealing with the images themselves. This dissertation has focused on data adjacent to the art object: the print's creators and production information, its dating, or textual descriptors like subject keywords.

Computer vision (CV) techniques open up the possibility of charting the visual relationships between hundreds or thousands of artworks in a way that a human observer, manually comparing pictures, could not. Low-level features like average hue and brightness have been shown to capture stylistic clusters within artists' oeuvres, while higher-level feature detection, such as facial recognition, can be used to measure facial symmetry, or recognize similar passages present in two otherwise-different artworks.[6] With these data, it could be possible to compare the stylistic distances between these artworks to the network distances of the printmakers who made them. In turn, one might assess the degree to which the collaborative clusters of artists described by network analysis align with, or differ from the visual/stylistic clusters of artworks detected by image processing techniques. In other words, did collaboration directly affect particular aspects of style?

Higher-level feature detection may also be able to aid the detection of visual quotations (e.g. a copied figures or reused decorative motif), which could, in turn, describe a network of visual influence that existed parallel to the production network considered in this study. In combination with careful metadata processing (common artists, dates, descriptions, etc.), CV techniques could help automate the matching of impressions of the same print in different collections.[7] (Figure 68) It is likely that this process might also reveal object relationships that have not yet been noted in the literature, or within museum databases. In particular, automated image matching

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6. On low level features, see Lev Manovich, "Style Space: How to Compare Image Sets and Follow Their Evolution," Software Studies Initiative, August 4, 2011, http://lab.softwarestudies.com/2011/08/style-space-how-to-compare-image-sets.html; on facial recognition: Javier de la Rosa and Juan-Luis Suárez, "A Quantitative Approach to Beauty. Perceived Attractiveness of Human Faces in World Painting," *International Journal for Digital Art History*, no. 1 (June 26, 2015), doi:10.11588/dah.2015.1.21640.

7. Such image matching work is already being pursued by the Frick Photoarchive; John Resig, "Using Computer Vision to Increase the Research Potential of Photo Archives," *Journal of Digital Humanities* 3, no. 2 (October 14, 2014), http://journalofdigitalhumanities.org/3-2/using-computer-vision-to-increase-the-research-potential-of-photo-archives-by-john-resig/.

might shed further light on under-studied practices such as plate re-use and re-issue under different titles.[8]

Figure 68: (Left): Cornelis Visscher (II) after Gerrit van Honthorst, published by Pieter Claesz Soutman. *Portrait of Charles II*, 1650. Engraving, 41.6 x 30.8 cm. Rijksmuseum, Amsterdam. (Right): Anonymous printmaker, published by Hugo Allard. *Portrait of William III*, 1670–1684. Engraving, 41.2 x 30.6 cm. Rijksmuseum, Amsterdam. The reused plate was detected via automated image matching by Baumann 2015.

That said, the concept of "vision" in CV can, at times, seem even more alien to an art historian's conception of vision than network analysis' conception of networks is to our colloquial sense of the term. Seemingly simple visual descriptions such as "linear", "idealized", or "loosely painted" do not have easy surrogates in the world of CV. Likewise, image properties commonly used in CV such as entropy and spatial frequency are difficult to map to meaningful concepts in traditional visual analysis. As calls grow ever louder for museums and universities to incorporate new technologies into their

8. Preliminary work on finding such matches has been done by Ryan Baumann, "Finding Near-Matches in the Rijksmuseum with Pastec," Ryan Baumann - /etc, November 3, 2015, https://ryanfb.github.io/etc/2015/11/03/finding_near-matches_in_the_rijksmuseum_with_pastec.html. On the re-use of portrait prints with different inscriptions, see George Somes Layard and H. M. Latham, *Catalogue Raisonné of Engraved British Portraits from Altered Plates,* (London: P. Allan & Co., 1927); Craig Hartley and Catharine MacLeod, "Supposititious Prints," *Print Quarterly* 6, no. 1 (1989): 49–54.

day-to-day work, art historians must diligently engage with these techniques in order to ensure they remain useful and relevant for our research.

Digital Scholarship And the Two Art Histories

The challenges facing this research are more than just technical, however. The collaboration between publishers, academic researchers, and museums that would be required to support a project like the "Digital Hollstein" suggested here is daunting.[9] Indeed, such a project would never be the work on a solitary scholar, but would require long-term collaboration and funding between multiple institutions.

Perhaps the greatest difficulty for an art historical data project such as the one proposed here will be bridging the persistent disconnect between discussions held in the sphere of museum technology, and those in the academic "digital humanities." There remains a rift between academic art historians' understanding of the digital future of our field, and the digitally-inflected work that has been done in museums for decades.[10] Digital strategies in museums have generally been siloed in separate departments, their brief often focused on visitor services and outreach rather than producing or supporting art historical research. For example, Peter Gorgels, Internet Manager at the Rijksmuseum, has explicitly stated that their priority audience is the "culture snacker" (i.e., the casual visitor), not the academic researcher.[11] The digital

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9. On the challenge of inter-museum digital infrastructure projects, see Richard Rinehart and Layna White, "Challenges to Museum Colalboration: The MOAC Case Study," in *Museum Informatics: People, Information, and Technology in Museums*, ed. Paul F. Marty and Katherine Burton Jones (New York: Routledge, 2008), 239–266.

10. On this divide, see Sheila Brennan, "DH Centered in Museums?," Lot 49, March 16, 2015, http://www.lotfortynine.org/2015/03/dh-centered-in-museums/.

11. Peter Gorgels, "Rijksstudio: Make Your Own Masterpiece!," in *MW2013: Museums and the Web 2013* (Portland: Museums and the Web, April 2013), http://mw2013.museumsandtheweb.com/paper/rijksstudio-make-your-own-masterpiece/.

"labs" at the Cooper-Hewitt Museum[12] and the Metropolitan Museum of Art[13] are likewise focused creative community engagement. These are laudable goals, and understandable for public-facing institutions, but perhaps not the ones that academic scholars would see prioritized to the exclusion of all else. The Online Scholarly Catalog Initiative funded by the Getty Foundation is one of the few initiatives explicitly geared towards producing scholarly research through digital means.[14]

Meanwhile, universities have continued to invest in so-called "digital humanities centers" focused on supporting digitally-inflected research and teaching in the humanities. These DH centers may exist as standalone units within the university, or embedded within the university libraries, or (more rarely) as part of an academic department. Though these centers have tended to focus on text and literary studies, many are now striving to connect with a wider variety of departments, including history and art history.[15] However, as Diane Zorich and Neil Fraistat have both noted, because DH centers are built primarily to service the university, rather than specific disciplines, they are incentivized to silo themselves off from sustained collaboration with seemingly-natural extra-institutional partners like museums.[16] Without sustained

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12. Sebastian Chan, "Strategies Against Architecture: Interactive Media and Transformative Technology at Cooper Hewitt," in *MW2015: Museums and the Web 2015* (Chicago: Museums and the Web, April 8–11, 2015), http://mw2015.museumsandtheweb.com/paper/strategies-against-architecture-interactive-media-and-transformative-technology-at-cooper-hewitt/.

13. Metropolitan Museum of Art, "The MediaLab," 2015, http://www.metmuseum.org/about-the-museum/museum-departments/office-of-the-director/digital-media-department/medialab.

14. Online Scholarly Catalogue Initiative, *Moving Museum Catalogues Online: An Interim Report from the Getty Foundation* (Los Angeles: The Getty Foundation, 2012), http://www.getty.edu/foundation/initiatives/current/osci/osci_report.html.

15. See, for example, the partnership between the University of Maryland's Department of Art History & Archaeology and the Maryland Institute for Technology in the Humanities in hosting a conference on the Digital Dimensions of Art History in 2016, funded by the Kress and Getty Foundations.

16. Diane M. Zorich, *A Survey of Digital Humanities Centers in the United States* (Washington: Council on Library and Information Resources, 2008), vi–vii, 4–5; Neil Fraistat, "The Function of Digital Humanities

attention to larger institutional structures in our discipline, it is entirely possible that new digital approaches may simply re-inscribe the "two art histories" that have long shaped the practice of art history here in the U.S.[17]

I argued in chapter 1 that art historians have "always been digital," in the sense that we have always collected and categorized information about art objects. Considerations about how, where, and for whom, to compile art historical knowledge have an equally long history. Future work in data-driven, computational art history thus transcends particular classes of objects, like prints, as well as particular methodologies like network or image analysis. As we grapple with new scales of knowledge, and new approaches for weaving evidence into historical argument, we will also have to face anew longstanding questions about how to *do* art history across its diverse institutions. It is in these core questions that the present "digital turn" in art history may have its greatest impact.

Centers at the Present Time," in *Debates in the Digital Humanities*, ed. Matthew K. Gold (New York: City University of New York, 2012), http://dhdebates.gc.cuny.edu/debates/text/23.

17. The existence, and degree, of this conflict between academic and museum approaches to scholarship and exhibitions was famously debated in a 1999 conference at the Clark Art Institute; Charles W. Haxthausen, ed., *The Two Art Histories: The Museum and the University*, Clark Studies in the Visual Arts (Williamstown: Clark Art Institute, 2002).

Appendix A Network Construction Methodology

This appendix discusses several of the technical considerations when projecting an affiliation network from historical data. A high-level discussion of network construction for this study is discussed in 2.3

A.1 Unknown Creators

Because this study is focused on the interactions between individuals, it is not possible to include artworks that have no identified creators. For example, some artworks in the RKM dataset are listed with as created by "anoniem" ("anonymous") or "onbekend" ("unknown"). These links are ignored. However, if the same object includes links to any other identified creators, those creators are duly connected in the network model. The BM dataset does not attempt to mark anonymous or unknown artists.

Similarly, artworks with no date whatsoever cannot incorporated into this analysis.

A.2 Production Roles

There are other avenues for participation in the production of a print besides designer, platecutter, and publisher. These include a sovereign issuing a privilege to a publisher, or an intermediate draughtsman, or a calligrapher providing an inscription. However, it would be difficult to usefully incorporate such orthogonal roles into the macro-scale analysis that is the subject of this work. For one, the amount of richly described links between, for example, prints and the poets whose inscriptions have been used for them

is small indeed. Moreover, the outputs of network analysis become less intelligible the more heterogeneous their nodes are.

The RKM uses a more granular set of terms to designate that an artwork was done after the design of an artist, by a publisher, or by an engraver. For this project, I categorize these into three major classes:

1. after: "naar ontwerp van", "naar tekening van", "naar schilderij van", "naar schildering van", "naar eigen ontwerp van", "naar prent van", "naar beeld van", "ontwerper", "cartograaf", "tekenaar", "inspirator"
2. printmaker: "prentmaker", "vervaardiger", "graveur", "bloksnijder"
3. publisher: "uitvoerder", "supervisie", "verkoper", "boekverkoper", "handelaar", "uitvoerder", "prentverkoper", "boekhandelaar"

The RKM also indicates when associations between objects and artists have been rejected — these relationships are not incorporated into the network data examined here. Many of their artist-object links have qualifiers, e.g. "documented on the object", or "forgery after". Of these qualifications, this study has accepted the following: "vermeld op object", "eigenhandig gesigneerd", "mogelijk", "toegeschreven aan", "kopie naar", "naar", "mogelijk kopie naar".

A.3 Link Direction

Networks may be constructed with either directed or undirected edges between nodes. The decision to construct a network as either directed or undirected will affect many different network metrics, and has a direct bearing on the mapping between network concept and real-world meaning. A directed edge is appropriate when the relationship being represented is one-way, or asymmetrical; for example, a letter sent from individual A to individual B is a directed connection. In an affiliation network such as the one that

we have constructed based on artists' involvement with objects, we are dealing with symmetric relationships ("printmaker A participated with publisher B" ⇔ "publisher B participated with printmaker A"). For this reason, the print production networks in this study will be undirected.

A.4 Link Weight

What of the cases where two individuals are tied together by multiple objects? This is where edge weight must be considered. As with directionality, the weight, or strength of connections between any two nodes, can affect many different measures of network properties. The printmaking network presents a challenging weighting problem. On the one hand, it would be easy to weight each connection between two individuals based on the number of prints they were both involved in during a certain span of time; 1 for 1 print, 10 for 10 prints, 100 for 100 prints. However, this raises two issues:

1. This analysis is based on two collection databases, therefore the basic object is not a print *per se*, but an impression *of* that print. Because of this foundation, edge weights based on the number of indexed impressions would be inordinately sensitive to the vagaries of collecting histories in the BM and the RKM. To claim an edge weight based solely on the number of surviving impressions would be to base that weight on a generally arbitrary number subject to a great number of historical contingencies;[1]
2. Even if we were able to count how many distinct prints (as opposed to surviving impressions) connected two individuals, to weight edges based on this number would be equivalent to arguing that two individuals who happened to be involved

1. Parshall, "Prints as Objects of Consumption," 20–21.

in a book illustration project with fifty different prints are, in a directly meaningful way, *fifty times* as connected to each other as two individuals who are linked by one print alone. This is a dubious claim to make, especially in light of the previous issue.

Therefore, in this study I will be constructing *unweighted* networks that describe only the existence or non-existence of a relationship, and make no claims about its relative strength. This is, undoubtedly, a simplification of reality. However, I argue that, within the bounds of the data now available, it is sufficient to use unweighted networks, as it will still capture the most important aspect of the network (when and between whom a connection existed) while avoiding introducing premature complexity based on problematic assumptions. This simplified network preserves the basic network topology (the existence or non-existence of a relationship between two parties at a certain point in time) while removing the biased weighting of a particular collection, which may have many impressions of the same print.

Bibliography

Ahnert, Ruth, and Sebastian E. Ahnert. "Protestant Letter Networks in the Reign of Mary I: A Quantitative Approach." *English Literary History* 82, no. 1 (2015): 1–33. doi:10.1353/elh.2015.0000.

Alberich, R., J. Miro-Julia, and F. Rossello. "Marvel Universe Looks Almost Like a Real Social Network," February 11, 2002. http://arxiv.org/abs/cond-mat/0202174.

Alfani, Guido. "Plague in Seventeenth-Century Europe and the Decline of Italy: An Epidemiological Hypothesis." *European Review of Economic History* 17, no. 4 (November 2013): 408–430. doi:10.1093/ereh/het013.

Anderson, Carrie. "Material Mediators: Johan Maurits, Textiles, and the Art of Diplomatic Exchange." *Journal of Early Modern History* 20, no. 1 (January 26, 2016): 63–85. doi:10.1163/15700658-12342489.

Appuhn-Radtke, Sibylle. "Das Rijksbureau voor Kunsthistorische Documentatie in Den Haag." *Kunstchronik* 47, no. 4 (1994): 181–188.

Bailey, Jefferson, and Lily Pregill. "Speak to the Eyes: The History and Practice of Information Visualization." *Art Documentation: Journal of the Art Libraries Society of North America* 33, no. 2 (September 1, 2014): 168–191. doi:10.1086/678525.

Baines, Lorena A. *Nicolaes de Bruyn*. Edited by Nadine Orenstein. 2 vols. Ouderkerk aan den IJssel: Sound & Vision Publishers, 2014.

———. "Nicolaes de Bruyn (1571–1656) and the Art of the Professional Engraver." PHD diss., University of Delaware, 2011.

———. "Revisiting the Life and Work of the Flemish Engraver Nicolaes de Bruyn (1571-1656)." Works in Progress, National Gallery of Art, Washington, D.C., April 28, 2015.

Bakker, Boudewijn, and Michael Hoyle. "*Pictores, Adeste!* Hieronymus Cock Recommending His Print Series." *Simiolus: Netherlands Quarterly for the History of Art* 33, nos. 1/2 (January 2007): 53–66.

Baldinucci, Filippo. *Cominciamento e progresso dell' arte dell' intagliare in rame colle vite di molti de' più eccellenti maestri della stessa professione*. Florence, 1767. http://hdl.handle.net/2027/gri.ark:/13960/t4gm9289m.

Barabási, Albert-László, and Réka Albert. "Emergence of Scaling in Random Networks." *Science* 286, no. 5439 (October 15, 1999): 509–512. doi:10.1126/science.286.5439.509.

Barnes, Bernadine Ann. *Michelangelo in Print: Reproductions as Response in the Sixteenth-Century*. Burlington: Ashgate, 2010.

Barnes, Donna R. *The Butcher, the Baker, the Candlestick Maker: Jan Luyken's Mirrors of 17th-Century Dutch Daily Life*. Hempstead, N.Y.: Hofstra Museum, Hofstra University, 1995.

Barr, Alfred H., Jr. *Cubism and Abstract Art [1936]*. Reprint. New York: Museum of Modern Art, 1966.

Barthelings, Nelke. "Bernard Picart, a French Engraver in the Dutch Republic." In *Les échanges artistiques entre les anciens Pays-Bas et la France, 1482-1814*, edited by Gaëtane Maës and Jan Blanc, 33–54. Turnhout: Brepols, 2010.

Baumann, Ryan. "Finding Near-Matches in the Rijksmuseum with Pastec." Ryan Baumann - /etc. November 3, 2015. https://ryanfb.github.io/etc/2015/11/03/finding_near-matches_in_the_rijksmuseum_with_pastec.html.

Bearman, Peter S., and Katherine Stovel. "Becoming a Nazi: A Model for Narrative Networks." *Poetics* 27, no. 2–3 (March 2000): 69–90. doi:10.1016/S0304-422X(99)00022-4.

Becker, Jochen. "Review of Iconclass: An Iconographic Classification System by H. van de Waal; L. D. Couprie; R. H. Fuchs; E. Tholen." *Simiolus: Netherlands Quarterly for the History of Art* 9, no. 1 (January 1977): 45–47. doi:10.2307/3780424.

Bekemeier, Anemone. *Reisen nach Jerusalem: Das Heilige Land in Karten und Ansichten aus fünf Jahrhunderten*. Wiesbaden: L. Reichert, 1993.

Bentley, R. Alexander, and Herbert D. G. Maschner, eds. *Complex systems and archaeology*. Foundations of Archaeological Inquiry. Salt Lake City: University of Utah Press, 2003.

Berkvens-Stevelinck, Christiane, ed. Le magasin de l'univers*: The Dutch Republic as the Centre of the European Book Trade*. Leiden: Brill, 1992.

Bialler, Nancy. *Chiaroscuro Woodcuts: Hendrick Goltzius and his Time*. Amsterdam: Rijksmuseum, 1992.

Bianconi, Ginestra. "Interdisciplinary and Physics Challenges of Network Theory," September 1, 2015. http://arxiv.org/abs/1509.00345.

De Bièvre, Elisabeth. *Dutch Art and Urban Cultures, 1200-1700*. New Haven: Yale University Press, 2015.

Blake, Emma. *Social Networks and Regional Identity in Bronze Age Italy*. New York: Cambridge University Press, 2014.

Blaut, James M. *The Colonizer's Model of the World: Geographical Diffusionism and Eurocentric History*. New York: Guilford Press, 1993.

Blondé, Bruno, and Harald Deceulaer. "The Port of Antwerp and Its Hinterland: Port Traffic, Urban Economies and Government Policies in the 17th and 18th Centuries." In *Maritime Industries and Public Intervention: The Fourth North Sea History Conference, 10-20 August 1995*, edited by Randi Ertesvåg, David J. Starkey, and Anne Tove Austbø, 21–44. Stavanger: Stavanger Maritime Museum, 2002.

Blondel, Vincent D., Jean-Loup Guillaume, Renaud Lambiotte, and Etienne Lefebvre. "Fast Unfolding of Communities in Large Networks." *Journal of Statistical Mechanics: Theory and Experiment* 2008, no. 10 (October 1, 2008): P10008. doi:10.1088/1742-5468/2008/10/P10008.

Bok, Marten Jan, and Harm Nijboer. "ECARTICO: Linking Cultural Industries in the Early Modern Low Countries, ca. 1475-ca. 1725." 2014. http://www.vondel.humanities.uva.nl/ecartico/.

Bol, Laurens J. *Die holländische Marinemalerei des 17. Jahrhunderts*. Braunschweig: Klinkhardt & Biermann, 1973.

Borges, Jorge Luis. *A Universal History of Iniquity*. Translated by Andrew Hurley. New York: Penguin, 2004.

Bowen, Karen L. *Christopher Plantin and Engraved Book Illustrations in Sixteenth-Century Europe*. In collaboration with Dirk Imhof. Cambridge: Cambridge University Press, 2008.

Bowen, Karen L., and Dirk Imhof. "18,257 Impressions from a Plate." *Print Quarterly* 22, no. 3 (September 2005): 265–279.

———. "Reputation and Wage: The Case of Engravers Who Worked for the Plantin-Moretus Press." *Simiolus: Netherlands Quarterly for the History of Art* 30, nos. 3/4 (2003): 161–195. doi:10.2307/3780915.

Braudel, Fernand. "Histoire et Sciences sociales: La longue durée." *Annales. Histoire, Sciences sociales* 13, no. 4 (Fall 1958): 725–753.

Braudel, Fernand. "History and the Social Sciences: The *Longue Durée*." In *The* Longue Durée *and World Systems Analysis*, edited by Richard E. Lee, translated by Immanuel Wallerstein, 241–276. Albany: State University of New York Press, 2012.

Brennan, Sheila. "DH Centered in Museums?" Lot 49. March 16, 2015. http://www.lotfortynine.org/2015/03/dh-centered-in-museums/.

Broos, B. P. J. "'Anthoni Waterlo f(ecit)' in Maarsseveen." *Jaarboekje Oudheidkundig Genootschap Niftarlake*, 1984, 18–48.

Brosens, Koenraad. "Can Tapesty Research Benefit from Economic Sociology and Socal Network Analysis?" In *Family Ties: Art Production and Kinship Patterns in the Early Modern Low Countries*, edited by Koenraad Brosens, Leen Kelchtermans, and Katlijne van der Stighelen, 43–51. Turnhout: Brepols, 2012.

Bubenik, Andrea. *Reframing Albrecht Dürer: The Appropriation of Art, 1528-1700*. Burlington: Ashgate, 2013.

Burke, Peter. *The French Historical Revolution: The Annales School, 1929-89*. Stanford: Stanford University Press, 1990.

Burkhardt, Astrit Schmidt. "Shaping Modernism: Alfred Barr's Genealogy of Art." *Word & Image* 16, no. 4 (October 2000): 387–400. doi:10.1080/02666286.2000.10435694.

Bury, Michael. "Giulio Mancini and the organization of a print collection in early seventeenth-century Italy." In *Collecting Prints and Drawings in Europe, c. 1500–1750*, edited by Christopher Baker, Caroline Elam, and Genevieve Warwick, 79–84. Aldershot: Ashgate, 2003.

———. *The Print in Italy, 1550-1620*. London: British Museum, 2001.

Bussels, Stijn. "Making the Most of Theatre and Painting: The Power of Tableaux Vivants in Joyous Entries from the Southern Netherlands (1458–1635)." *Art History* 33, no. 2 (April 2010): 236–247.

Byrnes, Mark. "What We Can and Can't Learn From 2,000 Years of Migration Data for 'Western Intellectuals'." The Atlantic: CityLab. August 4, 2014. http://www.citylab.com/tech/2014/08/what-we-can-and-cant-learn-from-2000-years-of-migration-data-for-western-intellectuals/375485/.

Chan, Sebastian. "Strategies Against Architecture: Interactive Media and Transformative Technology at Cooper Hewitt." In *MW2015: Museums and the Web 2015*. Chicago: Museums and the Web, April 8–11, 2015. http://mw2015.museumsandtheweb.com/paper/strategies-against-architecture-interactive-media-and-transformative-technology-at-cooper-hewitt/.

Chong, Alan, and Wouter Kloek. *Still-Life Paintings from the Netherlands, 1550-1720*. Zwolle: Waanders Publishers, 1999.

Chrościcki, Juliusz A., and Vladimir P. Odinec. "On Directed Graph Models on Influences in Art Theory." *Artibus et Historiae* 2, no. 3 (January 1981): 113–130. doi:10.2307/1483105.

Van der Coelen, Peter. *Patriarchs, Angels & Prophets: The Old Testament in Netherlandish Printmaking from Lucas Van Leyden to Rembrandt*. Studies in Dutch Graphic Art 2. Amsterdam: Museum Het Rembrandthuis, Rembrandt Information Centre, 1996.

———. *Everyday Life in Holland's Golden Age: The Complete Etchings of Adriaen Van Ostade*. Amsterdam: Museum Het Rembrandthuis, 1998.

Cohen, Deborah, and Peter Mandler. "*The History Manifesto*: A Critique." *The American Historical Review* 120, no. 2 (April 2015): 530–542. doi:10.1093/ahr/120.2.530.

Cohen, Kathleen, James Elkins, Marilyn Aronberg Lavin, Nancy Macko, Gary Schwartz, Susan L. Siegfried, and Barbara Maria Stafford. "Digital Culture and the Practices of Art and Art History." *The Art Bulletin* 79, no. 2 (June 1, 1997): 187–216. doi:10.2307/3046243.

Collar, Anna, Fiona Coward, Tom Brughmans, and Barbara J. Mills. "Networks in Archaeology: Phenomena, Abstraction, Representation." *Journal of Archaeological Method and Theory* 22, no. 1 (March 2015): 1–32. doi:10.1007/s10816-014-9235-6.

Cordell, Ryan. "Reprinting, Circulation, and the Network Author in Antebellum Newspapers." *American Literary History*, June 11, 2015. doi:10.1093/alh/ajv028.

Coward, Fiona. "Grounding the Net: Social Networks, Material Culture and Geography in the Epipalaeolithic and Early Neolithic of the Near East (21,00-6,00 cal BCE)." In *Network Analysis in Archaeology: New Approaches to Regional Interaction*, edited by Carl Knappett, 247–280. Oxford: Oxford University Press, April 25, 2013.

Csardi, G., and T. Nepusz. "The igraph Software Package for Complex Network Research." *InterJournal* Complex Systems (2006): 1695. http://igraph.org.

Curd, Mary Bryan H. *Flemish and Dutch Artists in Early Modern England: Collaboration and Competition, 1460-1680*. Visual culture in early modernity. Burlington: Ashgate, 2010.

Dackerman, Susan. "Dürer's Etchings: Printed Drawings?" In *The Early Modern Painter-Etcher*, edited by Michael Wayne Cole. University Park: Pennsylvania State University Press, 2006.

Dackerman, Susan, ed. *Prints and the Pursuit of Knowledge in Early Modern Europe*. Cambridge: Harvard Art Museums, 2011.

Davenport, M., and G. Studdert-Kennedy. "The Statistical Analysis of Aesthetic Judgment: An Exploration." *Journal of the Royal Statistical Society. Series C (Applied Statistics)* 21, no. 3 (January 1, 1972): 324–333. doi:10.2307/2346281.

Davies, Alice I., and Frederik J. Duparc. *Allart Van Everdingen 1621-1675: First Painter of Scandinavian Landscape: Catalogue Raisonne of Paintings*. Doornspijk: Davaco, 2001.

De Marchi, Neil, and Hans J. van Miegroet. "Art, Value, and Market Practices in the Netherlands in the Seventeenth Century." *The Art Bulletin* 76, no. 3 (September 1, 1994): 451–464. doi:10.2307/3046038.

———. *Mapping Markets for Paintings in Europe 1450-1750*. Turnhout: Brepols, 2006.

De Vries, Jan. "Art History." In *Art in History, History in Art: Studies in Seventeenth-Century Dutch Culture*, edited by David Freedberg and Jan De Vries, 249–271. Santa Monica: Getty Center for the History of Art & The Humanities, 1991.

———. *European Urbanization: 1500-1800*. Cambridge: Harvard University Press, 1984.

Depauw, Carl, and Ger Luijten. *Anthony Van Dyck as a Printmaker*. Antwerp: Antwerpen Open, 1999.

Dickerman, Leah, and Matthew Affron. *Inventing Abstraction, 1910-1925: How a Radical Idea Changed Modern Art*. New York: Museum of Modern Art, 2012.

Diels, Ann. *The Shadow of Rubens: Print Publishing in 17th-Century Antwerp: Prints by the History Painters Abraham Van Diepenbeeck, Cornelis Schut and Erasmus Quellinus II*. Translated by Michael Hoyle and Irene Schaudies. Turnhout: Royal Library of Belgium, 2009.

Van Dillen, J. G. *Bronnen tot de geschiedenis van het bedrijfsleven en het gildewezen van Amsterdam*. 3 vols. The Hauge: M. Nijhoff, 74 1927.

Drucker, Johanna. "Is There a 'Digital' Art History?" *Visual Resources* 29, nos. 1-2 (2013): 5–13. doi:10.1080/01973762.2013.761106.

Drucker, Johanna, Anne Helmreich, Matthew D. Lincoln, and Francesca Rose. "Digital Art History: The American Scene." *Perspective: actualité en histoire de l'art*, no. 2 (December 5, 2015). http://perspective.revues.org/6021.

Van Eeghen, P., and Johan Philip van der Kellen. *Het werk van Jan en Casper Luyken*. Amsterdam: F. Muller & Co., 1905.

Van Egmond, Marco. "The Secrets of a Long Life: The Dutch Firm of Covens & Mortier (1685-1866) and Their Copper Plates." *Imago Mundi* 54 (2002): 67–86.

Eichberger, Dagmar. "Dürer and the Netherlands: Patterns of Exchange and Mutual Admiration." In *The Essential Dürer*, edited by Larry Silver and Jeffrey Chipps Smith, 149–165. Philadelphia: University of Pennsylvania Press, 2010.

———. "*Naturalia* and *artefacta*: Dürer's Nature Drawings and Early Collecting." In *Dürer and his Culture*, edited by Dagmar Eichberger and Charles Zika, 13–37. Cambridge: Cambridge University Press, 1998.

Emirbayer, Mustafa, and Jeff Goodwin. "Network Analysis, Culture, and the Problem of Agency." *American Journal of Sociology* 99, no. 6 (May 1, 1994): 1411–1454.

Epstein, Joshua M. "Why Model?" *Journal of Artificial Societies and Social Simulation* 11, no. 4 (2008): 12. http://jasss.soc.surrey.ac.uk/11/4/12.html.

Evans, Robert John Weston. *Rudolf II and his World: A Study in Intellectual History 1576-1612*. Oxford: Clarendon Press, 1973.

Evans, Robert John Weston, and Eliška Fučiková. *The Stylish Image: Printmakers to the Court of Rudolf II*. Edinburgh: National Gallery of Scotland, 1991.

Van Everdingen, Allart. *Recueil de cent paysages inventées et gravées à l'eau forte par A. van Everdingen*. Amsterdam: P. van den Boom, 1696.

Findlen, Paula. *Possessing Nature: Museums, Collecting, and Scientific Culture in Early Modern Italy*. Berkeley: University of California Press, 1994.

Fletcher, Pamela M., and Anne Helmreich. "Local/Global: Mapping Nineteenth-Century London's Art Market." In collaboration with David Israel and Seth Erickson. *Nineteenth-Century Art Worldwide* 11, no. 3 (Autumn 2012). http://www.19thc-artworldwide.org/index.php/autumn12/fletcher-helmreich-mapping-the-london-art-market.

Fraistat, Neil. "The Function of Digital Humanities Centers at the Present Time." In *Debates in the Digital Humanities*, edited by Matthew K. Gold. New York: City University of New York, 2012. http://dhdebates.gc.cuny.edu/debates/text/23.

Freedberg, David. *Dutch Landscape Prints of the Seventeenth Century*. London: British Museum Publications, 1980.

Freeman, Linton C. "Centrality in Social Networks: Conceptual Clarification." *Social Networks* 1, no. 3 (1978): 215–239. doi:10.1016/0378-8733(78)90021-7.

Fucci, Robert. "Arcadia Unbound: Early Dutch Landscape Prints and the *Amenissimae aliquot regiunculae* by Jan van de Velde II." *Art in Print: The Global Journal of Prints and Ideas* 4, no. 5 (2015). http://artinprint.org/article/arcadia-unbound/.

Fuhring, Peter. "The Market for Prints under Louis XIV: Charles Le Brun." *Print Quarterly* 19, no. 1 (March 2002): 3–11.

———. "The Print Privilege in Eighteenth-Century France – I." *Print Quarterly* 2, no. 3 (1985): 175–193.

———. "The Print Privilege in Eighteenth-Century France – II." *Print Quarterly* 3, no. 1 (1986): 19–33.

Garrard, Mary D. "Feminist Politics: Networks and Organizations." In *The Power of Feminist Art: The American Movement of the 1970s, History and Impact*, edited by Norma Broude and Mary D. Garrard. New York: H. N. Abrams, 1994.

Garvan, Anthony N. B., Ariene Kringold, Philip Stone, and Robert Jones. "American Church Silver: A Statistical Study." In *Winterthur Conference Report: Spanish, French, and English Tradition in the Colonial Silver of North America*, 73–104. Winterthur, 1968.

Van Gelder, J. G. "Rubens in Holland in de zeventeinde eeuw." *Nederlands Kunsthistorisch Jaarboek* 3, no. 1 (1950–1951): 103–150.

Gibbs, Jack P., and Walter T. Martin. "Urbanization, Technology, and the Division of Labor: International Patterns." *American Sociological Review* 27, no. 5 (October 1962): 667–677. doi:10.2307/2089624.

Goedde, Lawrence O. "Naturalism as Convention: Subject, Style, and Artistic Self-Consciousness in Dutch Landscape." In *Looking at Seventeenth-Century Dutch Art: Realism Reconsidered*, edited by Wayne E. Franits, 129–143. Cambridge: Cambridge University Press, 1997.

Goeree, Willem. *Inleydingh tot de practijck der al-gemeene schilder-konst*. Middelburg, 1670. http://archive.org/details/inleydinghtotdep00goer.

Goldstone, Andrew. "Doing Without Texts: Sapiro on Translation." Andrew Goldstone. August 23, 2015. http://andrewgoldstone.com/blog/2015/08/23/sapiro/.

Gorgels, Peter. "Rijksstudio: Make Your Own Masterpiece!" In *MW2013: Museums and the Web 2013*. Portland: Museums and the Web, April 2013. http://mw2013.museumsandtheweb.com/paper/rijksstudio-make-your-own-masterpiece/.

Graddy, Kathryn. "Taste Endures! The Rankings of Roger de Piles (†1709) and Three Centuries of Art Prices." *The Journal of Economic History* 73, no. 3 (September 2013): 766–791. doi:10.1017/S0022050713000600.

Graham, Shawn, and Scott B. Weingart. "The Equifinality of Archaeological Networks: An Agent-Based Exploratory Lab Approach." *Journal of Archaeological Method and Theory*, December 28, 2014, 1–27. doi:10.1007/s10816-014-9230-y.

Gregory, Henry Duval. "Tabletop Still Lifes in Haarlem, c. 1610-1660: A Study of the Relationships Between Form and Meaning." PHD diss., University of Maryland, 2003.

Gregory, Sharon. *Vasari and the Renaissance print*. Burlington: Ashgate, 2012.

Van Grieken, Joris, Ger Luijten, and Jan van der Stock. *Hieronymus Cock: The Renaissance in Print*. New Haven: Yale University Press, 2013.

Grim, Patrick. "Computational Modeling as a Philosophical Methodology." In *The Blackwell Guide to the Philosophy of Computing and Information*, edited by Luciano Floridi, 337–349. Malden: Blackwell, 2004.

Guldi, Jo, and David Armitage. *The History Manifesto*. Cambridge, United Kingdom: Cambridge University Press, 2014.

Hanneman, Robert A., and Mark Riddle. *Introduction to Social Network Methods*. Riverside: Univeristy of California, Riverside, 2005. http://faculty.ucr.edu/-hanneman/nettext/.

Hartley, Craig, and Catharine MacLeod. "Supposititious Prints." *Print Quarterly* 6, no. 1 (1989): 49–54.

Harwood, Laurie B., Christopher Brown, and Anne Charlotte Steland. *Inspired by Italy: Dutch Landscape Painting, 1600-1700*. London: Dulwich Picture Gallery, 2002.

Haxthausen, Charles W., ed. *The Two Art Histories: The Museum and the University*. Clark Studies in the Visual Arts. Williamstown: Clark Art Institute, 2002.

Healy, Kieran. "Fuck Nuance." Chicago, August 2015. http://kieranhealy.org/files/papers/fuck-nuance.pdf.

Van den Heuvel, Charles, and Leonor Álvarez Francés. *Report Knaw Project: Mapping Notes and Nodes in Networks*. November 1, 2014. https://www.huygens.knaw.nl/wp-content/uploads/2015/05/EndReportMNN.pdf.

Hirakawa, Kayo. *The Pictorialization of Dürer's Drawings in Northern Europe in the Sixteenth and Seventeenth Centuries*. Bern: Peter Lang, 2009.

Hoftijzer, P. G. "Nederlandse boekverkopersprivileges in de zeventiende en achttiende eeuw." *Jaarboek van het Nederlands Genootschap van Bibliofielen*, 1993, 49–62.

Hoftijzer, Paul. "Antwerp: Books, Publishing and Cultural Production Before 1585." In *Urban Achievement in Early Modern Europe: Golden Ages in Antwerp, Amsterdam, and London*, edited by Patrick Karl O'Brien, 249–263. Cambridge: Cambridge University Press, 2001.

Van Hogendorp Prosperetti, Leopoldine. "'*Conchas Legere*': Shells As Trophies Of Repose In Northern European Humanism." *Art History* 29, no. 3 (June 2006): 387–413. doi:10.1111/j.1467-8365.2006.00507.x.

Hollstein, F. W. H. *Dutch and Flemish Etchings, Engravings, and Woodcuts, ca. 1450-1700*. Amsterdam: M. Hertzberger, 1949.

Hoogewerff, G. J. *De Bentvueghels*. 's Gravenhage: M. Nijhoff, 1952.

Hoogstraten, Samuel van. *Inleyding tot de hooge schoole der schilderkonst*. Rotterdam, 1678. http://hdl.handle.net/2027/gri.ark:/13960/t51g2037s.

Houbraken, Arnold. *De groote schouburgh der Nederlantsche konstschilders en schilderessen*. Amsterdam, 1718.

Hout, Nico van, and Paul Huvenne. *Copyright Rubens: Rubens en de grafiek*. Ghent: Ludion, 2004.

Huemer, Christian. "Provenance on Steroids: Or, the Promise of Big Data." 'New Projects in Digital Art History' symposium, Washington, D.C., November 21, 2014.

Imhof, Dirk. "An Author's Wishes Versus a Publisher's Possibilities: The Illustration of Thomas Sailly's Prayer Books Printed by the Plantin Press in Antwerp c. 1600." In *Illustrated Religious Texts in the North of Europe, 1500-1800*, edited by Feike Dietz, Adam Morton, Lien Roggen, Els Stronks, and Marc van Vaeck, 205–220. Burlington: Ashgate, 2014.

Israel, Jonathan Irvine. "Adjusting to Hard Times: Dutch Art During Its Period of Crisis and Restructuring (c. 1621 - c. 1645)." *Art History* 20, no. 3 (September 1997): 449–476.

Ivins, William Mills. *Prints and Visual Communication*. New York: Da Capo Press, 1969.

Jager, Angela. "'Everywhere illustrious histories that are a dime a dozen': The Mass Market for History Painting in Seventeenth-Century Amsterdam." *Journal of Historians of Netherlandish Art* 7, no. 1 (February 2015). doi:10.5092/jhna.2015.7.1.2.

De Jongh, Eddy, and Ger Luijten. *Mirror of Everyday Life: Genreprints in the Netherlands, 1550-1700*. Amsterdam; Ghent: Rijksmuseum; Snoeck-Ducaju & Zoon, 1997.

Joyeux-Prunel, Béatrice. "Provincializing Paris. The Center-Periphery Narrative of Modern Art in Light of Quantitative and Transnational Approaches." *Artl@s Bulletin* 4, no. 1 (June 11, 2015). http://docs.lib.purdue.edu/artlas/vol4/iss1/4.

Kaufmann, Thomas DaCosta. "'*Gar lecherlich*': Low-life Painting in Rudolfine Prague." In *The Eloquent Artist*, 106–118. London: Pindar, 2004.

———. "Perspective on Prague: Rudolfine Stylistics Reviewed." In *The Eloquent Artist*. London: Pindar, 2004.

———. "The Eloquent Artist: Towards an Understanding of the Stylistics of Painting at the Court of Rudolf II." *Leids kunsthistorisch jaarboek* 1 (1982): 119–148.

———. *Toward a Geography of Art*. Chicago: University of Chicago Press, 2004.

Keller, Alex. "A Renaissance Humanist Looks at 'New' Inventions: The Article 'Horologium' in Giovanni Tortelli's *De Orthographia*." *Technology and Culture* 11, no. 3 (July 1970): 345–365.

Kent, F. W. "Individuals and Families as Patrons of Culture in Quattrocento Florence." In *Language and Images of Renaissance Italy*, edited by Alison Brown. Oxford: Clarendon, 1995.

Kettering, Alison McNeil. *The Dutch Arcadia: Pastoral Art and Its Audience in the Golden Age*. Totowa: Allanheld and Schram, 1983.

Keyes, George S. *Mirror of Empire: Dutch Marine Art of Seventeenth Century*. Minneapolis: Minneapolis Institute of Arts, 1990.

Klaversma, Nel, and Kiki Hannema. *Jan en Casper Luyken te boek gesteld: catalogus van de boekencollectie van Eeghen in het Amsterdams Historisch Museum*. Hilversum: Verloren, 1999.

Knappett, Carl. *An Archaeology of Interaction: Network Perspectives on Material Culture and Society*. Oxford: Oxford University Press, 2011.

Kok, Jan Piet Filedt. "Early Netherlandish Prints in Dresden. Review: Tobias Pfeiffer-Helke, Mit den Gezeiten: Brühe Druckgraphik der Niderlande: Katalog der niederländischen Druckgraphik von den Anfängen bis um 1540/50 in der Sammlung des Dresender Kupferstick-Kambinetts." *Print Quarterly* 32, no. 3 (September 2015): 348–352.

———. "Hendrick Goltzius: Engraver, Designer, and Publisher 1582-1600." *Nederlands Kunsthistorisch Jaarboek* 42-43 (1991): 159–218.

Kok, Jan Piet Filedt. "Jan Harmensz. Muller as Printmaker — I." *Print Quarterly* 11, no. 3 (September 1994): 223–264.

Korbel, Günther. "Eine Typologie von Portweinflaschen mit Hilfe eines Dreieckdiagramms: der methodologische Aspekt." *Zeitschrift für Archäologie des Mittelalters*, no. 11 (1983): 109–114.

Korthals Altes, Everhard. "French Prints in Dutch Collections and their Influence on Dutch Paintings (1675-1750)." In *Les échanges artistiques entre les anciens Pays-Bas et la France, 1482-1814*, edited by Gaëtane Maës and Jan Blanc, 181–194. Turnhout, Belgium: Brepols, 2010.

Krackhardt, David, and Robert N. Stern. "Informal Networks and Organizational Crises: An Experimental Simulation." *Social Psychology Quarterly* 51, no. 2 (June 1, 1988): 123–140. doi:10.2307/2786835.

Kraemer, Ruth. "Pietro da Cortona and Cornelis Bloemaert: An Unpublished Document." *The Burlington Magazine* 131, no. 1035 (1989): 414–416.

Kubler, George. *The Shape of Time: Remarks on the History of Things*. New Haven: Yale University Press, 1962.

Lairesse, Gérard de. *Groot schilderboek: waar in de schilderkonst in al haar deelen...* 2nd ed. Amsterdam, 1712. http://hdl.handle.net/2027/gri.ark:/13960/t5j97bv64.

Landau, David. "Vasari, Prints and Prejudice." *Oxford Art Journal* 6, no. 1 (January 1983): 3–10.

Landau, David, and Peter Parshall. *The Renaissance Print, 1470-1550*. New Haven: Yale University Press, 1994.

Layard, George Somes, and H. M. Latham. *Catalogue Raisonné of Engraved British Portraits from Altered Plates,* London: P. Allan & Co., 1927.

Leeflang, Huigen. *Hendrick Goltzius 1558-1617: Drawings, Prints, and Paintings*. Amsterdam: Rijksmuseum, 2003.

———. "The Sign of Claes Jansz Visscher and his Progeny: The History and Significance of a Brand Name." *The Rijksmuseum Bulletin*, no. 62 (2014): 240–269.

Lemercier, Claire. "Formal Network Methods in History: Why and How?" In *Social Networks, Political Institutions, and Rural Societies*, edited by Georg Fertig. Turnhout: Brepols, 2011. https://halshs.archives-ouvertes.fr/halshs-00521527.

Levesque, Catherine. *Journey through Landscape in Seventeenth-Century Holland: The Haarlem Print Series and Dutch Identity*. University Park: The Pennsylvania State University Press, 1994.

Limouze, Dorothy. "Aegidius Sadeler (c. 1570-1629): Drawings, Prints and Art Theory." PHD diss., Princeton University, 1990.

———. "Aegidius Sadeler, Imperial Printmaker." *Philadelphia Museum of Art Bulletin* 85, no. 362 (April 1989): 1–24. doi:10.2307/3795429.

———. "Aegidius Sadeler's Post-Rudolfine Career: New Beginnings in an Artist's Late Oeuvre." In *Rudolf II, Prague and the World: Papers from the International Conference, Prague, 2-4 September, 1997*, edited by Lubomír Konečný and Beket Bukovinská, 211–215. Prague: Artefactum, 1998.

———. "Engraving at the Court of Prague." In *Rudolf II and Prague: The Court and the City*, edited by Eliska Fucíková, 172–178. Prague: Prague Castle Administration, 1997.

———. "From Bavaria to the Veneto, and Return: The Sadelers, Jacopo Bassano, and Italian Art in Munich." In *München - Prag um 1600*, edited by Beket Bukovinská and Lubomír Konečný, 117–124. Prague: Artefactum, 2009.

———. "Protestant Madonnas Revisited: Iconographic Duality in Works by Jan Sadeler and Joos van Winghe." In *A Tribute to Robert A. Koch: Studies in the Northern Renaissance*, edited by Barbara T. Ross, 115–129. Princeton: Princeton University Press, 1994.

Lincoln, Matthew D. "europop: Historical Populations of European Cities, 1500-1800." R Package [version 0.2], December 14, 2015. doi:10.5281/zenodo.35425.

———. "Sources for Gerrit van Honthorst's Italian Nickname." *Source: Notes in the History of Art*, Spring 2016.

Long, Hoyt. "Fog and Steel: Mapping Communities of Literary Translation in an Information Age." *The Journal of Japanese Studies* 41, no. 2 (2015): 281–316. https://muse.jhu.edu/journals/journal_of_japanese_studies/v041/41.2.long.html.

Long, Matthew P., and Roger C. Schonfeld. *Supporting the Changing Research Practices of Art Historians*, Ithaka S+R. ITHAKA, April 30, 2014. http://sr.ithaka.org/research-publications/supporting-changing-research-practices-art-historians.

Loughman, John, and John Michael Montias. *Public and Private Spaces: Works of Art in Seventeenth-Century Dutch Houses*. Zwolle: Waanders, 2000.

Luijten, Ger. "Où en sommes-nous? L'évolution des questions d'étude sur l'estampe néerlandaise." Translated by Raoul Mendegarque. *Perspective: actualité en histoire de l'art*, no. 2 (December 31, 2011): 792–798. https://perspective.revues.org/785.

MacGregor, William B. "The Authority of Prints: An Early Modern Perspective." *Art History* 22, no. 3 (September 1999): 389–420. doi:10.1111/1467-8365.00163.

Mai, Ekkehard, and Kurt J. Müllenmeister, eds. *Roelant Savery in seiner Zeit*. Köln; Utrecht: Wallraf-Richartz-Museum; Centraal Museum, 1985.

Van Mander, Karel. *The Lives of the Illustrious Netherlandish and German Painters (1604)*. Edited by Hessel Miedema. Translated by Jacqueline Pennial-Boer and Charles Ford. Doornspijk: Davaco Publishers, 1994.

———. *Het schilder-boeck*. Haarlem, 1604.

Manovich, Lev. "Style Space: How to Compare Image Sets and Follow Their Evolution." Software Studies Initiative. August 4, 2011. http://lab.softwarestudies.com/2011/08/style-space-how-to-compare-image-sets.html.

Mansfield, Elizabeth. "Allart van Everdingen's Mezzotint Incunabula." *Print Quarterly* 12, no. 2 (June 1995): 169–178.

———, ed. *Art History and Its Institutions: The Nineteenth Century*. Routledge, 2002.

Mariolis, Peter. "Concepts, Models, and Measures: Towards an Analytical Framework for Social Network Analysis." In *Sun Belt Social Network Conference*. Palm Beach, 1985.

Marlier, Georges, and Marnix Gijsen, eds. *Albrecht Dürer: Diary of His Journey to the Netherlands, 1520-1521*. Greenwich: New York Graphic Society, 1971.

Marnef, Guido. "Repressie en censuur in het Antwerps boekbedrijf." *De zeventiende eeuw* 8 (1992): 221–231.

Matos, Godinho de, Miguel, Pedro Ferreira, and David Krackhardt. "Peer Influence in the Diffusion of the iPhone 3G over a Large Social Network." *Management Information Systems Quarterly* 38, no. 4 (May 28, 2014): 1103–1133. doi:10.2139/ssrn.2053420.

Mauquoy-Hendrickx, Marie. *Les estampes des Wierix: conservées au Cabinet des estampes de la Bibliothèque royale Albert Ier: catalogue raisonné, enrichi de notes prises dans diverses autres collections*. Brussels: Bibliothèque royale Albert Ier, 1978.

McCarty, Willard. "Becoming Interdisciplinary." In *Proceedings of Digital Humanities 2013*. Lincoln: University of Nebraska, July 17, 2013. http://dh2013.unl.edu/abstracts/ab-107.html.

———. "Being Reborn: The Humanities, Computing and Styles of Scientific Reasoning." In *New Technologies and Renaissance Studies*, edited by William Roy Bowen and Raymond George Siemens. Tempe: Iter in collaboration with ACMRS (Arizona Center for Medieval & Renaissance Studies), 2007.

———. *Humanities Computing*. Basingstoke: Palgrave Macmillan, 2005.

Melion, Walter S. "Karel van Mander's 'Life of Goltzius': Defining the Paradigm of Protean Virtuosity in Haarlem around 1600." *Studies in Art History* 27 (1989): 113–133.

———. "Love and Artisanship in Hendrick Goltzius's *Venus, Bacchus and Ceres* of 1606." *Art History* 16, no. 1 (March 1993): 60–94.

Metropolitan Museum of Art. "The MediaLab." 2015. http://www.metmuseum.org/about-the-museum/museum-departments/office-of-the-director/digital-media-department/medialab.

Moes, Ernst Wilhelm, and Combertus Pieter Burger. *De Amsterdamsche boekdrukkers en uitgevers in de zestiende eeuw*. Amsterdam: M. Nijhoff, 1915.

Montias, John Michael. *Artists and Artisans in Delft: A Socio-Economic Study of the Seventeenth Century*. Princeton: Princeton University Press, 1982.

———. "Cost And Value In Seventeenth-Century Dutch Art." *Art History* 10, no. 4 (December 1987): 455.

———. "Socio-Economic Aspects of Netherlandish Art from the Fifteenth to the Seventeenth Century: A Survey." *The Art Bulletin* 72, no. 3 (September 1990): 358–373. doi:10.2307/3045746.

———. "The Guild of St. Luke in 17th-Century Delft and the Economic Status of Artists and Artisans." *Simiolus: Netherlands Quarterly for the History of Art* 9, no. 2 (January 1977): 93–105. doi:10.2307/3780327.

———. *Vermeer and His Milieu: A Web of Social History*. Princeton: Princeton University Press, 1989.

———. "Works of Art in Seventeenth-Century Amsterdam: An Analysis of Subjects and Attributions." In *Art in History, History in Art: Studies in Seventeenth-Century Dutch Culture*, edited by David Freedberg and Jan De Vries, 331–376. Santa Monica: Getty Center for the History of Art & The Humanities, 1991.

Montias, John Michael, and the Frick Art Reference Library. "The Montias Database of 17th Century Dutch Art Inventories." The Frick Collection. 2015. http://research.frick.org/montias/home.php.

Moravec, Michelle. "Toward a History of Feminism, Art, and Social Movements in the United States." *Frontiers: A Journal of Women Studies* 33, no. 2 (2012): 22–54. https://muse.jhu.edu/journals/frontiers/v033/33.2.moravec.html.

Moretti, Franco. "Network Theory, Plot Analysis." *Pamphlets of the Stanford Literary Lab*, no. 2 (May 1, 2011). http://litlab.stanford.edu/?page_id=255.

———. "'Operationalizing': Or, the Function of Measurement in Modern Literary Theory." *Pamphlets of the Stanford Literary Lab*, no. 6 (December 2013): 1–15. http://litlab.stanford.edu/?page_id=255.

Müllenmeister, Kurt J. *Roelant Savery: Kortrijk 1576-1639 Utrecht: Hofmaler Kaiser Rudolf II. in Prag: die Gemälde mit kritischem Œuvrekatalog*. Freren: Luca Verlag, 1988.

Nesselrath, Arnold. "Raphael's Gift to Dürer." *Master Drawings* 31, no. 4 (December 1993): 376–389.

Nichols, Lawrence W. "The 'Pen Works' of Hendrick Goltzius." *Philadelphia Museum of Art Bulletin* 88, no. 373 (1992): 4–56.

Oksanen, Jari, F. Guillaume Blanchet, Roeland Kindt, Pierre Legendre, Peter R. Minchin, R. B. O'Hara, Gavin L. Sipson, Peter Solymos, M. Henry H. Stevens, and Helene Wagner. "vegan: Community Ecology Package." R Pakcage [version 2.2-1], 2015. http://CRAN.R-project.org/package=vegan.

Oldman, Dominic, Martin Doerr, Gerald de Jong, Barry Norton, and Thomas Wikman. "Realizing Lessons of the Last 20 Years: A Manifesto for Data Provisioning and Aggregation Services for the Digital Humanities (A Position Paper)." *D-Lib Magazine* 20, nos. 7/8 (July 2014). doi:10.1045/july2014-oldman.

Oldman, Dominic, Martin Doerr, and Stefan Gradmann. "Zen and the Art of Linked Data: New Strategies for a Semantic Web of Humanist Knowledge." In *A New Companion to Digital Humanities*, edited by Susan Schreibman, Raymond George Siemens, and John Unsworth, 251–273. New York: Wiley-Blackwell, forthcoming 2016.

Omodeo, Anna. *Mostra di stampe popolari venete del '500: catalogo*. Florence: Gabinetto disegni e stampe degli Uffizi, 1965.

Online Scholarly Catalogue Initiative. *Moving Museum Catalogues Online: An Interim Report from the Getty Foundation*. Los Angeles: The Getty Foundation, 2012. http://www.getty.edu/foundation/initiatives/current/osci/osci_report.html.

Onuf, Alexandra. "Envisioning Netherlandish Unity: Claes Visscher's 1612 Copies of the Small Landscape Prints." *Journal of Historians of Netherlandish Art* 3, no. 1 (2011): 1–13. doi:10.5092/jhna.2011.3.1.4.

———. "Old Plates, New Impressions: Local Landscape Prints in Seventeenth-Century Antwerp." *The Art Bulletin* 96, no. 4 (December 2014): 424–440.

Orchard, Karin. *Albrecht Dürer und Lucas van Leyden: ein Vergleich; 14 September - 28 Oktober 1990*. Hamburg: Hamburger Kunsthalle, 1990.

Orenstein, Nadine M. *Hendrick Hondius and the Business of Prints in Seventeenth-Century Holland*. Rotterdam: Sound & Vision Interactive, 1996.

———. "Marketing Prints to the Dutch Republic: Novelty and the Print Publisher." *Journal of Medieval & Early Modern Studies* 28, no. 1 (1998): 141.

———. "Sleeping Caps, City Views, and State Funerals: Privileges for Prints in the Dutch Republic, 1593–1650." In *In His Milieu: Essays on Netherlandish Art in Memory of John Michael Montias*, edited by Amy Golahny, Mia M. Mochizuki, and Lisa Vergara, 313–346. Amsterdam: Amsterdam University Press, 2006.

———. "The Shift from Antwerp: The Diversification of Print Publishers in the United Provinces around 1600." *Block Points: The Annual Journal and Report of the Mary and Leigh Block Gallery* 5 (1995): 43–63.

Orenstein, Nadine M., Huigen Leeflang, Ger Luijten, and Christiaan Schuckman. "Print Publishers in the Netherlands: 1580-1620." In *Dawn of the Golden Age: Northern Netherlandish Art 1580-1620*, edited by Ger Luijten and Ariane van Suchtelen, 167–200. Amsterdam: Rijksmuseum, 1993.

Ottaviano, Gianmarco I. P., Dino Pinelli, Carole Juliette Maignan, and Francesco Rullani. *Bio-Ecological Diversity vs. Socio-Economic Diversity: A Comparison of Existing Measures*. SSRN SCHOLARLY PAPER ID 389043. Rochester, NY: Social Science Research Network, January 1, 2003. http://papers.ssrn.com/abstract=389043.

Ottenheym, Koen A. "De correspondentie tussen Rubens en Huygens over architectuur." *Bulletin KNOB* 96, no. 1 (1997): 1–11. doi:10.7480/knob.96.1997.1.390.

Padgett, John F., and Christopher K. Ansell. "Robust Action and the Rise of the Medici, 1400-1434." *American Journal of Sociology* 98, no. 6 (May 1993): 1259–1319.

Paisey, David. "Prints at the Frankfurt Book Fairs, 1568-1600." *Print Quarterly* 23, no. 1 (2006): 54–61.

Papenbrock, Martin, and Joachim Scharloth. "Datengeleitete Analyse kunsthistorischer Daten am Beispiel von Ausstellungskatalogen aus der NS-Zeit: Musteridentifizierung und Visualisierung." *Kunstgeschichte*, May 10, 2011. http://www.kunstgeschichte-ejournal.net/248/.

Parshall, Peter. "Prints as Objects of Consumption in Early Modern Europe." *Journal of Medieval & Early Modern Studies* 28, no. 1 (Winter 1998): 19.

De Pauw-de Veen, Lydia. *De begrippen 'schilder,' 'schilderij' en 'schilderen' in de zeventiende eeuw*. Brussels: Paleis der Academiën, 1969.

Pelletier, S. William. "Van Ostade's Etchings Published by 'La Veuve Jean'." *Print Quarterly* 11, no. 4 (December 1994): 395–401.

Piles, Roger de. *Abrégé de la vie des peintres, avec des reflexions sur leurs ouvrages, et un Traité du peintre parfait; De la connoissance des desseins; De l'utilité des estampes*. Paris: Jacques Estienne, 1699. http://gallica.bnf.fr/ark:/12148/bpt6k111893d.

———. *Cours de peinture par principes*. Jacques Estienne: Paris, 1708. http://hdl.handle.net/2027/gri.ark:/13960/t5w67fg51.

Piles, Roger de, and Bainbrigg Buckeridge. *The art of painting, with the lives and characters of above 300 of the most eminent painters...* London: T. Payne, 1754. http://archive.org/details/artofpaintingwit00pile.

Pollock, Griselda. *Vision and Difference: Femininity, Feminism, and Histories of Art*. New York: Routledge, 1988.

Porras, Stephanie. "Repeat Viewing: Hendrick Hondius's 'Effigies'." In *Picturing the Netherlandish Canon*, edited by Joanna Woodall. London: Courauld Institute of Art, 2013. http://www.courtauld.org.uk/netherlandishcanon/groups/essay01.html.

Prell, Christina. *Social Network Analysis: History, Theory and Methodology*. Los Angeles: Sage, October 26, 2011.

Prown, Jules David. *John Singleton Copley*. 2 vols. Cambridge: Harvard University Press, 1966.

Rabb, Theodore K. "The Thirty Years' War and the German Economy." *The Journal of Modern History* 34, no. 1 (March 1962): 40–151.

Rasterhoff, Claartje, and Filip Vermeylen. "The Zeeland Connection: The Art Trade Between the Northern and Southern Netherlands During the Seventeenth Century." In *Moving Pictures: Intra-European Trade in Images, 16th-18th Centuries*, edited by Neil De Marchi and Sophie Raux, 123–150. Turnhout: Brepols, 2014.

Raux, Sophie. "Visualizing Spaces, Flows, Agents, and Networks of the Art Markets in the 18th Century: Some Methodological Challenges." *Artl@s Bulletin* 2, no. 2 (December 12, 2013). http://docs.lib.purdue.edu/artlas/vol2/iss2/4.

Reed, Sue Welsh, and Alvin L. Clark, eds. *French Prints from the Age of the Musketeers*. Boston: Museum of Fine Arts, Boston, 1998.

Resig, John. "Using Computer Vision to Increase the Research Potential of Photo Archives." *Journal of Digital Humanities* 3, no. 2 (October 14, 2014). http://journalofdigitalhumanities.org/3-2/using-computer-vision-to-increase-the-research-potential-of-photo-archives-by-john-resig/.

Reznicek, E. K. J. "Realism as a 'Side Road or Byway' in Dutch Art." In *The Reniassance and Mannerism*, 2:247–253. Princeton: Princeton University Press, 1963.

Riggs, Timothy, and Larry Silver. *Graven Images: The Rise of Professional Printmakers in Antwerp and Haarlem, 1540-1640*. Chicago: Mary and Leigh Block Gallery, Northwestern University, 1993.

Rinehart, Richard, and Layna White. "Challenges to Museum Colalboration: The MOAC Case Study." In *Museum Informatics: People, Information, and Technology in Museums*, edited by Paul F. Marty and Katherine Burton Jones, 239–266. New York: Routledge, 2008.

Roethlisberger, Marcel, and Marten Jan Bok. *Abraham Bloemaert and His Sons: Paintings and Prints*. Doornspijk: Davaco, 1993.

Rogers, Everett M. *Diffusion of Innovations*. New York: Free Press, 1983.

Rosa, Javier de la, and Juan-Luis Suárez. "A Quantitative Approach to Beauty. Perceived Attractiveness of Human Faces in World Painting." *International Journal for Digital Art History*, no. 1 (June 26, 2015). doi:10.11588/dah.2015.1.21640.

Roy, Alain, ed. *Theodoor van Thulden: een zuidnederlandse barokschilder: 's-Hertogenbosch, 1606-1669*. Zwolle: Waanders, 1991.

Royalton-Kisch, Martin. "Review: The Brothers Wierix." *Print Quarterly* 3, no. 2 (June 1986): 141–143.

Rüger, Axel, and Rachel Billinge. "The Design Practices of the Dutch Architectural Painter Bartholomeus van Bassen." *National Gallery Technical Bulletin* 26 (2005): 23–42.

Sapiro, Gisèle. "Translation and Symbolic Capital in the Era of Globalization: French Literature in the United States." *Cultural Sociology* 9, no. 3 (September 1, 2015): 320–346. doi:10.1177/1749975515584080.

Schapiro, Meyer. "The Nature of Abstract Art (1937)." In *Modern Art: 19th & 20th Century: Selected Papers*, vol. 2. 1978: George Braziller, 1978.

Schatborn, Peter. *Drawn to Warmth: 17th-Century Dutch Artists in Italy*. In collaboration with Judith Verberne. Amsterdam: Rijksmuseum, 2001.

Schich, Maximilian. "Netzwerke von komplexen Netzwerken in der (Kunst) Wissenschaft." In *Die Dynamik sozialer und sprachlicher Netzwerke Konzepte, Methoden und empirische Untersuchungen an Beispielen des WWW*, edited by Barbara Frank-Job, Alexander Mehler, and Tilmann Sutter, 161–178. Wiesbaden: Springer, August 4, 2013.

Schich, Maximilian, Chaoming Song, Yong-Yeol Ahn, Alexander Mirsky, Mauro Martino, Albert-László Barabási, and Dirk Helbing. "A Network Framework of Cultural History." *Science* 345, no. 6196 (January 8, 2014): 558–562. doi:10.1126/science.1240064.

Schreibman, Susan, Ray Siemens, and John Unsworth, eds. *Companion to Digital Humanities*. Blackwell Companions to Literature and Culture. Oxford: Blackwell Publishing Professional, 2004. http://www.digitalhumanities.org/companion/.

Schuckman, Christiaan. "Gebruiksgrafiek bewaard: handelsmerken door Izaak Vincentsz. van der Vinne (1665-1745)." *Doopsgezinde bijdragen* 14 (1990): 155–176.

Schuckman, Christiaan, Martin Royalton-Kisch, and Erik Hinterding. *Rembrandt & Van Vliet: A Collaboration on Copper*. Amsterdam: Museum het Rembrandthuis, 1996.

Sellink, Manfred. *Cornelis Cort: Accomplished Plate-Cutter from Hoorn in Holland*. Rotterdam: Museum Boymans-Van Beuningen, 1994.

———. "Philips Galle (1537-1612): Engraver and Print Publisher in Haarlem and Antwerp." PHD diss., Vrije Universiteit, 1997.

Sénéchal, Philippe. "Justus Sadeler: Print Publisher and Art Dealer in Early Seicento Venice." *Print Quarterly* 7, no. 1 (March 1990): 22–35.

Shannon, Claude Elwood, and Warren Weaver. *The Mathematical Theory of Communication*. Urbana: University of Illinois Press, 1949.

Sholette, Gregory. *Dark Matter: Art and Politics in the Age of Enterprise Culture*. London: Pluto Press, 2011.

Silver, Larry. *Peasant Scenes and Landscapes: The Rise of Pictorial Genres in the Antwerp Art Market*. Philadelphia: University of Pennsylvania Press, 2006.

Sluijter, Eric Jan. "'Herscheppingen' in prenten van Hendrick Goltzius en zijn kring (I)." *Delineavit et Sculpsit*, no. 4 (December 1990): 1–23.

———. "'Herscheppingen' in prenten van Hendrick Goltzius en zijn kring (II)." *Delineavit et Sculpsit*, no. 5 (May 1991): 1–19.

———. "On Brabant Rubbish, Economic Competition, Artistic Rivalry, and the Growth of the Market for Paintings in the First Decades of the Seventeenth Century." *Journal of Historians of Netherlandish Art* 1, no. 2 (December 31, 2009). doi:10.5092/jhna.2009.1.2.4.

———. "The English Venture: Dutch and Flemish Artists in Britain 1550-1800." Edited by Juliette Roding, Eric Jan Sluijter, Bart Westerweel, Marijke van der Meij-Tolsma, and Eric Domela Nieuwenhuis. *Leids kunsthistorisch jaarboek* 13 (2003): 11–27.

Sman, Gert Jan van der. "Dutch and Flemish Printmakers in Rome 1565-1600." *Print Quarterly* 22, no. 3 (September 1, 2005): 251–264.

Smith, David A., Ryan Cordell, and Abby Mullen. "Computational Methods for Uncovering Reprinted Texts in Antebellum Newspapers." *American Literary History*, June 12, 2015, ajv029. doi:10.1093/alh/ajv029.

So, Richard Jean, and Hoyt Long. "Network Analysis and the Sociology of Modernism." *boundary 2* 40, no. 2 (June 20, 2013): 147–182. doi:10.1215/01903659-2151839.

Spicer, Joaneath A. "Anthony van Dyck's *Iconography*: An Overview of Its Preparation." *Studies in the History of Art* 46 (January 1994): 325–364.

Van der Starre, Jan H. E. "Automation at the RKD: A Short Overview." *Art Libraries Journal* 23, no. 2 (1998): 15–17.

Stijnman, Ad. "Stradanus' Print Shop." *Print Quarterly* 27, no. 1 (2010): 11–28.

Stiller, James, Daniel Nettle, and Robin I. M. Dunbar. "The Small World of Shakespeare's Plays." *Human Nature* 14, no. 4 (December 2003): 397–408. doi:10.1007/s12110-003-1013-1.

Van der Stock, Jan. *Printing Images in Antwerp: The Introduction of Printmaking in a City: Fifteenth Century to 1585*. Studies in Prints and Printmaking 2. Rotterdam: Sound & Vision Interactive, 1998.

Stone-Ferrier, Linda A. *Dutch Prints of Daily Life: Mirrors of Life or Masks of Morals?* Lawrence, Kansas: Spencer Museum of Art, University of Kansas, 1983.

Strauss, Walter L., ed. *Netherlandish Artists: Matham, Saenredam, Muller*. 2 vols. The Illustrated Bartsch 4. New York: Abaris Books, 1980.

Strech, Annette. "*Spranger inventor*: Überlegungen zu Entstehung und Funktion von Stichen nach Sprangers Werken." In *Rudolf II, Prague and the World: Papers from the International Conference, Prague, 2-4 September, 1997*, edited by Lubomír Konečný, Beket Bukovinská, and Ivan Muchka, 201–210. Prague: Artefactum, 1998.

Sun, Yanan. "From Diagram to Network: A Multi-mode Network Approach to Analyze Diagrams of Art History." In *Social Informatics*, edited by Akiyo Nadamoto, Adam Jatowt, Adam Wierzbicki, and Jochen L. Leidner, 100–109. Lecture Notes in Computer Science 8359. Springer Berlin Heidelberg, 2014.

Sutton, Peter C., and Albert Blankert, eds. *Masters of 17th-Century Dutch Landscape Painting*. Boston: Museum of Fine Arts, 1987.

Terras, Melissa. "Opening Access to Collections: The Making and Using of Open Digitised Cultural Content." *Online Information Review* 39, no. 5 (September 14, 2015): 733–752. doi:10.1108/OIR-06-2015-0193.

Trant, Jennifer. "Curating Collections Knowledge: Museums on the Cyberinfrastructure." In *Museum Informatics: People, Information, and Technology in Museums*, edited by Paul F. Marty and Katherine Burton Jones, 275–291. New York: Routledge, 2008.

Vaughan, William. "History of Art in the Digital Age: Problems and Possiblilites." In *Digital Art History: A Subject in Transition*, edited by Anna Bentkowska-Kafel, Trish Cashen, and Hazel Gardiner, 3–13. Portland: Intellect, 2005.

Van der Veen, Jaap. "Danckerts en Zonen: Prentuitgevers, plaatsnijders en kunstverkopers te Amsterdam, ca. 1625-1700." In *Gedrukt tot Amsterdam: Amsterdamse prentmakers en -uitgevers in de Gouden Eeuw*, edited by Elmer Kolfin and Jaap van der Veen, 58–119. Amsterdam: Museum het Rembrandthuis, 2011.

Veldman, Ilja M. *Crispijn de Passe and His Progeny (1564-1670): A Century of Print Production*. Rotterdam: Sound & Vision Publishers, 2001.

———. "Maurice as the Nimrod of his Age: Political Propaganda Prints by Jan Saenredam." *The Rijksmuseum Bulletin* 58, no. 2 (January 2010): 128–137.

———. *Profit and Pleasure: Print Books by Crispijn de Passe*. Rotterdam: Sound & Vision Publishers, 2001.

Veldman, Ilja M. "The Consequence of Professionalism: Prints as Visual Communication." *Block Points: The Annual Journal and Report of the Mary and Leigh Block Gallery* 5 (1995): 10–27.

Vermeylen, Filip, and Karolien De Clippel. "Rubens and Goltzius in Dialogue: Artistic Exchanges Between Antwerp and Haarlem During the Revolt." *De zeventiende eeuw* 28, no. 2 (December 19, 2012): 138–160. doi:10.18352/dze.8236.

Viljoen, Madeline. "To Print or not to Print? Hendrick Goltzius's 1595 *Sine Baccho et Cerere Friget Venus* and Engraving with Precious Metals." *Zeitschrift für Kunstgeschichte* 74 (2011): 45–76.

Vlieghe, Hans. "The Fine and Decorative Arts in Antwerp's Golden Age." In *Urban Achievement in Early Modern Europe: Golden Ages in Antwerp, Amsterdam, and London*, edited by Patrick Karl O'Brien, 173–185. Cambridge: Cambridge University Press, 2001.

De Vries, A. D. "Biografische aanteekeningen betreffende voornamelijk Amsterdamsche schilders, plaatsnijders, enz. en hunne verwanten." *Oud Holland* 3 (January 1885): 135–160.

Van de Waal, H. *Iconclass: An Iconographic Classification System*. In collaboration with L. D. Couprie, Rudi Fuchs, and E. Tholen. Amsterdam: North-Holland Pub. Co, 1973.

Van der Waals, Jan. *Prenten in de gouden eeuw: van kunst tot kastpapier*. Rotterdam: Museum Boijmans Van Beuningen, 2006.

Waller, François Gerard. *Biographisch woordenboek van noord Nederlandsche graveurs*. In collaboration with Willem Rudolf Juynboll. Amsterdam: B.M. Israël, 1974.

Warren, Christopher, Daniel Shore, Jessica Otis, Cosma Shalizi, Ruth Ahnert, and Sebastian Anhert. "Six Degrees of Francis Bacon." September 13, 2015. http://sixdegreesoffrancisbacon.com/.

Watts, Duncan J. *Small Worlds: The Dynamics of Networks Between Order and Randomness*. Princeton: Princeton University Press, 1999.

Weigert, R.-A. "Le Commerce de la gravure au XVIIe siècle en France: Les deux premiers Mariette et François Langlois, dit Ciartres." *Gazette des Beaux-Arts* 41, no. 6 (March 1953): 167–188.

Weingart, Scott B., and Jeana Jorgensen. "Computational Analysis of the Body in European Fairy Tales." *Literary and Linguistic Computing* 28, no. 3 (January 9, 2013): 404–416. doi:10.1093/llc/fqs015.

Welch, Evelyn S. "Women as Patrons and Clients in the Courts of Quattrocento Italy." In *Women in Italian Renaissance Culture and Society*, edited by Letizia Panizza. Oxford: European Humanities Research Centre, 2000.

Wessely, J. E. *Abraham Blooteling, Verzeichniss seiner Kupferstiche und Schabkunstblätter*. Leipzig: R. Weigel, 1867.

Wetherell, Charles. "Historical Social Network Analysis." *International Review of Social History* 43, Supplement S6 (December 1998): 125–144. doi:10.1017/S0020859000115123.

Widerkehr, Léna. "*Jacob Matham Goltzij Privignus*: Jacob Matham graveur et ses rapports avec Hendrick Goltzius." *Nederlands Kunsthistorisch Jaarboek* 42-43 (1991–1992): 219–60.

Wilkens, Matthew. "Digital Humanities and Its Application in the Study of Literature and Culture." *Comparative Literature* 67, no. 1 (January 3, 2015): 11–20. doi:10.1215/00104124-2861911.

Wilson, David M. *The British Museum: A History*. London: British Museum Press, 2002.

Wölfflin, Heinrich. *The Art of Albrecht Dürer (1905)*. Translated by Alastair Grieve and Heide Grieve. New York: Phaidon, 1971.

Woollett, Anne T., and Ariane van Suchtelen. *Rubens & Brueghel: A Working Friendship*. Los Angeles: J. Paul Getty Museum, 2006.

Van der Woude, Ad. "The Volume and Value of Paintings in Holland at the Time of the Dutch Republic." In *Art in History, History in Art: Studies in Seventeenth-Century Dutch Culture*, edited by David Freedberg and Jan De Vries, 285–329. Santa Monica: Getty Center for the History of Art & The Humanities, 1991.

Wuestman, Gerdien. "The Mezzotint in Holland: 'Easily Learned, Neat and Convenient'." *Simiolus: Netherlands Quarterly for the History of Art* 23, no. 1 (1995): 63. doi:10.2307/3780782.

Wussin, Johann. *Jonas Suyderhoef, son œuvre gravé, classé et décrit*. Translated by Henri Hymans. Brussels: Labroue et Mertens, 1862.

Wyckoff, Elizabeth Ann. "Innovation and Popularization: Printmaking and Print Publishing in Haarlem During the 1620s." PHD diss., Columbia University, 1998.

Zandvliet, Kees. *Mapping for Money: Maps, Plans, and Topographic Paintings and Their Role in Dutch Overseas Expansion During the 16th and 17th Centuries*. Amsterdam: Batavian Lion International, 1998.

Zell, Michael. "Rembrandt's Gifts: A Case Study of Actor-Network-Theory." *Journal of Historians of Netherlandish Art* 3, no. 2 (2011).

———. "The Gift Among Friends: Rembrandt's Art in the Network of His Patronal and Social Relations." In *Rethinking Rembrandt*, edited by Alan Chong and Michael Zell. Boston: Isabella Gardner Stewart Museum, 2002.

Zimmermann, Heinrich. "Urkunden, Acten und Regesten aus dem Archiv des K. K. Ministeriums des innern." *Jahrbuch der Kunsthistorischen Sammlungen des Allerhöchsten Kaiserhauses* 7 (1888).

Zorich, Diane M. *A Survey of Digital Humanities Centers in the United States*. Washington: Council on Library and Information Resources, 2008.

———. "Library and Museum Information: Beauty and the Beast." *Spectra* 18, no. 4 (Fall 1991): 2–8.

———. *Transitioning to a Digital World: Art History, Its Research Centers, and Digital Scholarship*. New York: The Samuel H. Kress Foundation and The Roy Rosenzweig Center for History and New Media, May 2012. http://www.kressfoundation.org/research/transitioning_to_a_digital_world/.

Zwollo, An. "Pieter Stevens, ein vergessener Maler des Rudolfinischen Kreises." *Jahrbuch der Kunsthistorischen Sammlungen in Wien* 64 (1968): 119–180.