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# Between Nodes and Edges: Possibilities and Limits of Network Analysis in Art History

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# **Visualizing Networks: Approaches to Network Analysis in Art History**

**Miriam Kienle, Guest Editor**

**ARTL@S BULLETIN**

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**Cover:** Detail of a Network diagram by Yael Rice showing betweenness centrality of collaborators (designers and colorists) on the Jaipur *Razmnama* (1582/3–6) manuscript illustrations.

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The *Artl@s Bulletin* 's ambition is twofold: 1. a focus on the "transnational" as constituted by exchange between the local and the global or between the national and the international; 2. an openness to innovation in research methods, particularly the quantitative possibilities offered by digital mapping and data visualization.

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# Between Nodes and Edges: Possibilities and Limits of Network Analysis in Art History

In the 2016 issue of the *International Journal for Digital Art History* on “Visualizing Big Image Data,” the featured article by the multidisciplinary art historian Maximilian Schich opens with a still image from an animated map that visualizes the movement of notable historical figures from places of birth to death (blue to red) [Fig. 1].<sup>1</sup> Hovering above the earth, connections become illuminated. This macroscopic perspective, as Schich states, rewards viewers with “breathtaking beauty and radically new insights that cannot be achieved by local inquiry.”<sup>2</sup> Originally produced as part of a study that Schich’s research team published in the high-impact journal *Science*, the visualization was utilized to locate and understand the quantitative patterns of history.<sup>3</sup> Applying a “network framework of cultural history,” they analyzed the migration of more than 150,000 notable individuals (drawn from three major US and European databases)<sup>4</sup> to find a number of significant patterns, including clear evidence that modern Europe has been characterized by two different cultural systems: a “winner-takes-all regime,” in which historical actors clustered around centers such as Paris, and a “fit-gets-richer regime,” where sub-centers in regions such as Central Europe formed



**Figure 1.** A still from an animation that was part “A Network Framework of Cultural History” published in *Science Magazine* by Maximilian Schich, et al. Copyright © 2014 Maximilian Schich, University Texas, Dallas.

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Author’s Note: I would like to thank the peer-reviewers and editors of *Artl@s Bulletin* for their incredibly helpful comments and suggestions.

<sup>1</sup> Maximilian Schich, “Figuring Out Art History,” *International Journal for Digital Art History* vol. 2 (2016): 40.

<sup>2</sup> *Ibid.*, 45.

<sup>3</sup> Maximilian Schich, 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 (August 1, 2014): 558–62.

<sup>4</sup> The names were collected from Google’s Freebase; Getty’s Union List of Artists Names; and DeGruyter’s General Artist Lexicon. *Ibid.*, 558.

dispersed patterns as they competed for dominance.<sup>5</sup> Although these findings generally reproduce common knowledge about the social structure that governed these regions during the modern period, Schich argues that pinpointing specific dates when major cultural hubs in Europe shift or develop new organizational patterns can help researchers to locate “historical trends of cultural centers beyond the scope of specific events or narrow time intervals.”<sup>6</sup>

Schich’s aim with these two articles is to demonstrate the need for a “systematic science of art and culture” that “integrates qualitative inquiry and observation, with methods of computation, natural science, and information design.”<sup>7</sup> For Schich, this new data-driven approach to art history is necessary because on the one hand, the computational ability of digital technology constitute an under-utilized resources that can help to reveal unforeseen cultural patterns through the processing of vast amounts of data; and on the other, because it could make art history newly relevant in an economic and political climate in which the discipline is under threat.<sup>8</sup> Certainly Schich’s video [Charting Culture](#) made with information designer Mauro Martino and produced by the scientific journal *Nature*—which currently has over 1,250,000 views on YouTube—has far surpassed the reach of the vast major of art historical publications.<sup>9</sup> In our image-saturated digital environment, projects such as this one that seek a broader understanding of art history and visual culture are undoubtedly an important endeavor. However, one must ask: do the epistemological premises of this data-driven approach to culture themselves constitute a threat to the very humanistic line of inquiry that Schich argues they’re saving?

## Theorizing a Network Framework for Art History

The philosopher Michael P. Lynch utilizes *Charting Culture* as an example to explore how the proliferation and positivistic view of data in the digital age can suppress important theoretical questions despite the appearance of giving us greater access to knowledge.<sup>10</sup> In regard to Schich’s video, which draws on the findings of his *Science* article, Lynch asserts that the under-examined questions include: How is culture being defined in advance of the data analysis? What are the underlying assumptions that shape the metadata? How do the sources of the data shape the findings? What gets left out as a result? And finally, what role do the actual works of art by these important figures play in this formulation of culture?<sup>11</sup> Investigating these questions leads to a troubling set of assumptions that art historians—employing feminist, Marxist, post-colonial, psychoanalytic, and semiotic methods—have fought hard over the past 50 years to overturn. Such assumptions include: Western Europe’s unrivaled cultural dominance and history defined by “notable figures,” otherwise known as the “great man” theory of history, which suggests known and noteworthy figures alone transform history. This theory pushes to the side the power dynamics of gender, class, race, religion, and ethnicity, while obscuring social forces such as economics and politics. In other words, although network analysis has a great potential to reveal the significance of actors marginalized by canonical narratives of art history through the mining of archival data and also to track unforeseen transnational and intercommunal histories of artistic exchange, it may also paradoxically silence social hierarchies and mechanisms of marginalization, as well as historical disruptions to them, if the principles

<sup>5</sup> Ibid, 562.

<sup>6</sup> Ibid, 558.

<sup>7</sup> Schich, “Figuring Out Art History,” 41-42.

<sup>8</sup> Ibid, esp. 42, 45-47.

<sup>9</sup> In addition to the large number of views, the video—built on the research of Schich’s team from the *Science* article—also sparked an intense, if not always productive, debate about racial, ethnic, and gender bias of the study in the YouTube comments section. See: <https://www.youtube.com/watch?v=4gIhRkCcD4U> Retrieved August 1, 2017. The video was original published on *Nature*’s video channel on July 31, 2014 and was designed by Schich and Martino, along with Kerri

Smith, Charlotte Stoddart, and Alison Abbot:

<http://www.nature.com/nature/videoarchive/charting-culture/index.html>

<sup>10</sup> Michael P. Lynch, *The Internet of Us: Knowing more and Understanding Less* (New York: W. W. Norton, 2016), 161. Similarly, media theorist Alexander R. Galloway has described the positivistic empiricism of computational approaches to analyze culture (particularly network analysis) as “anti-hermeneutic” or the idea of knowledge without or against interpretation. David M. Berry and Alexander R. Galloway, “A Network is a Network is a Network: Reflections on the Computational and the Societies of Control” *Theory, Culture and Society* 33, no. 4 (2016): 159.

<sup>11</sup> Ibid, 162.

underlying the data are not interrogated from the outset.

Schich's team, however, does acknowledge the biases of their metadata in the supplementary materials of their *Science* article on which *Charting Culture* is based, if not in the video itself.<sup>12</sup> This acknowledgement distinguishes Schich's project from what visual theorist Johanna Drucker has described as the problematic "realist" approach to data analysis and visualization, or the lack of recognition that "*Data are capta*, taken not given, constructed as an interpretation of the phenomenal world, not inherent in it."<sup>13</sup> In other words, data is not a neutral or natural phenomenon, but rather an observer-dependent construction that is constituted by the epistemologies that shape it. Moreover, Schich asserts the vital importance of discussing the structural biases against underrepresented artists and believes that quantitative analysis can produce "actionable insight for future research and funding" to address these data voids.<sup>14</sup> However, even if researchers worked to create more inclusive databases by digitizing non-canonical works (which could have the adverse side-effect of endangering an artwork's material survival in more economically precarious parts of the world),<sup>15</sup> one must still ask if the fundamental premises of quantitative analysis remain in opposition to humanist thought.

In my conversation with digital humanist Miriam Poser at the end of this volume, she expresses her concern that there is "a terrible problem at the heart of the digital humanities endeavor: namely, that the operations necessary to divide sources into data are in some ways antithetical to the humanistic enterprise."<sup>16</sup> Illustrating this point with an example, she describes how she and her students attempted to create a database of silent race films.

However, enumerating specific attributes in order to delineate precisely what constituted a "race film" was such a thorny endeavor as to be nearly impossible. Left in somewhat of a quandary, she asks: "How can a community of practice have no reliably enumerable qualities, and yet, without a doubt, constitute a community?"<sup>17</sup> For Posner and her students this un-addressability was the most fascinating aspect of this project. Although it is easy to say that the digital humanities constitute an irresolvable opposition—between an emphasis on pattern, probability, and consensus in computational analysis, and ambiguity, unpredictability, and dissensus in the humanities—Posner's example demonstrates how working back and forth between qualitative and quantitative forms of analysis can help make researchers' thinking about a particular subject more systematic or precise, while at the same time complicate the very process of classification and quantification.

The heuristic value of such a discussion cannot be emphasized enough. Augmenting established art historical methods with new digital humanist techniques can help to broaden the discipline, particularly when demographics and statistical maps provide evidence of cultural exchanges that challenge canonical narratives of art history. Michele Greet's [Transatlantic Encounters](#) project on Latin Americans in Paris between the wars is exemplary in this regard.<sup>18</sup> Building and analyzing large data-sets, Greet and her team offer proof of the importance of foreign artists to the development of modern art in France—questioning the Eurocentrism of current scholarship on interwar modernism and exploring how a pan-Latin Americanism began to develop

<sup>12</sup> As stated in the article: "Potential sources of bias are addressed in the SM, including biographical, temporal, and spatial coverage; curated versus crowd-sourced data; increasing numbers of individuals who are still alive; place aggregation; location name changes and spelling variants; and effects of data set language." Schich, et al. "A Network Framework of Cultural History," 558.

<sup>13</sup> Johanna Drucker, *Graphesis: Visual Forms of Knowledge Production* (Cambridge, MA: Harvard, 2014), 128.

<sup>14</sup> Schich, *Figuring Out Art History*, 50.

<sup>15</sup> Stephanie Porras makes this point in her article: Stephanie Porras, "Keeping our eyes open: Visualizing networks and art history," *Art@s Bulletin* vol. 6, no.3 (Fall 2017): <http://docs.lib.purdue.edu/artlas/>

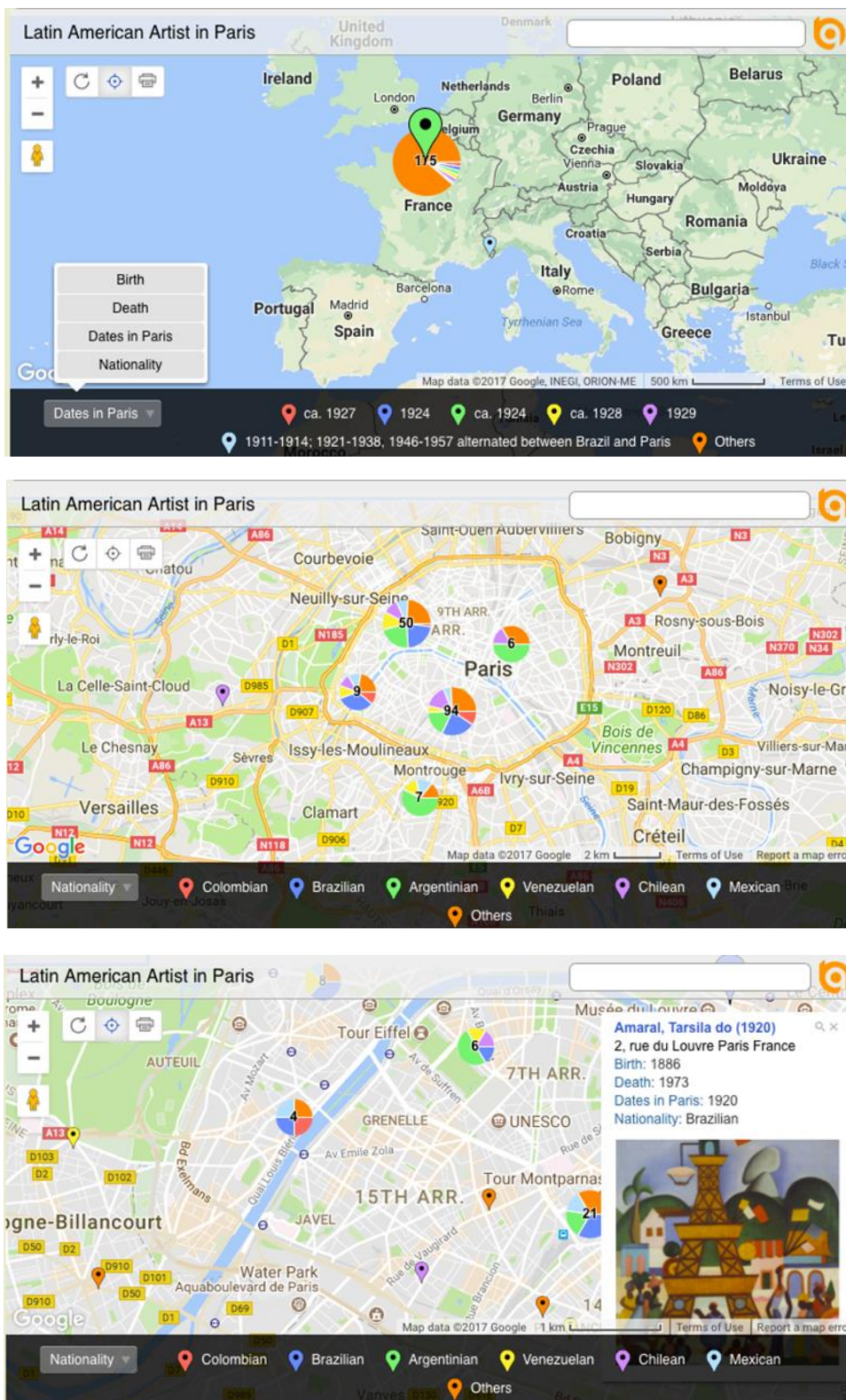
<sup>16</sup> Miriam Kienle, "Digital Art History 'Beyond the Digitized Slide Library': An Interview with Johanna Drucker and Miriam Posner," *Art@s Bulletin*, vol. 6, no.3 (Fall

2017): <http://docs.lib.purdue.edu/artlas/>

<sup>17</sup> Ibid.

<sup>18</sup> Michele Greet, "Mapping Cultural Exchange: Latin American Artists in Paris between the Wars," in *Circulations in the Global History of Art*; Studies in Art Historiography series, Thomas DaCosta Kaufmann, Catherine Dossin, and Béatrice Joyeux-Prunel eds. (London: Ashgate: 2015), 133-147. To experience Greet's interactive maps, see: Michele Greet, "Transatlantic Encounters: Latin American Artists in Interwar Paris," <http://chnm.gmu.edu/transatlanticencounters/> (Accessed October 10, 2017). The book that goes along with the online DH project is forthcoming from Yale, see: Michele Greet, *Transatlantic Encounters: Latin American Artists in Paris between the Wars* (New Haven, CT: Yale University Press, 2018), forthcoming.





**Figure 2.** A map of Latin American artists in Paris between the World Wars from Michele Greet's *Transatlantic Encounters* project, which is organized by the artists' nationality, dates in Paris, and birth and death dates. Visitors may explore the proximity of these artists to each other and to the sites and neighborhoods of Paris during the war, while also examining the works of individual artists. The website is powered by Omeka (an online exhibition platform) with maps are powered by Google. Copyright © 2015 Michele Greet, George Mason University, Washington DC.



among artists living abroad.<sup>19</sup> However, the success of this project stems from how it weaves together narrative and digital formats in a manner that integrates uncertainty, subjectivity, and historical situatedness into quantitative methods. For example, although Greet's interactive maps provide staggering evidence of the presence of Latin American artists in Paris during the period—marking each one by national identity and place of residence in Paris [Fig. 2]—she also stresses the importance of including narrative case studies of artists who resist national categorization (as dual-nationals or second-generation immigrants) and/or who simply reject the idea of “national identity” altogether.<sup>20</sup> Furthermore, rather than drawing clear links between Latin American actors in Paris, the network her project articulates is implied through the concentration of artists in particular parts of the city at specific moments in time because, in many cases, there is not documented evidence of their connection despite the probability.

Johanna Drucker, in our interview, has like Posner and Greet underscored the importance of integrating theoretical questions and methodological paradigms of the traditional humanities with new digital methods, rather than polarizing the quantitative and qualitative. As she argues:

Humanistic methods are rooted in the assumption that epistemologies *constitute* their objects of inquiry, they do not simply encounter them as self-evident and autonomous objects. This means, however, that making computational models of interpretative activity has to change approaches to data structures and their expressions. We are a long way from achieving this, but the point is to insist on such explorations within the conception of digital projects, not simply bracket them out, shrug, and accept computational efficiencies and expediencies on their own terms of disambiguation and discreteness.<sup>21</sup>

In other words, on the one hand, the digital humanities must come to see how data sets are structured by epistemologies, and therefore data analysis cannot precede interpretation;<sup>22</sup> and on the other hand, the traditional humanities cannot simply turn its back on the digital—dismissing the “disambiguation and discreteness” of computational approaches as too antithetical to its basic tenets of humanism to be addressed. If we do, society runs the risk of ceding the problems of interpreting the complexities of our digital environment to those who do not have sufficient tools to deal with them.

In Drucker's recent scholarship, she has attempted to address the lack of critical engagement with the explosion of information visualizations, including those produced by digital humanities projects. As she describes in her book *Graphesis: Visual Forms of Knowledge Production*, the graphical force of information visualization too often conceals the premises and parameters on which the data was constructed; the graphical expression, in other words, drops back appearing as a passive presentation (i.e. a “realist” model) rather than an active qualitative expression of statistical information (i.e. a “constructivist” model).<sup>23</sup> In the field of information design, this realist model is largely the industry standard. The discipline prizes graphical efficiency, transparency, elegance, clarity, and directness. As data visualization guru Edward Tufte famously stated: “Good design is clear thinking made visible.”<sup>24</sup> For Tufte, the best infographics show the data, not the design—making complexity coherent in a seamless manner.<sup>25</sup> In these designs, the verbal, visual, and statistical are all closely integrated in order to reveal the data through the simplicity of the design; in other words: “Designs so good that they are invisible.”<sup>26</sup>

Returning to Schich & Martino's infographic *Charting Culture* and evaluating it on Tufte's terms,

<sup>19</sup> Ibid.

<sup>20</sup> Greet, “Mapping Cultural Exchange,” 141.

<sup>21</sup> Ibid.

<sup>22</sup> This thought echoes what Alan Liu has described as the problematic inclination of the digital humanities toward “tabula rasa interpretation” or “the initiation of interpretation through the hypothesis-free discovery of phenomena.” Alan Liu, “The Meaning of the Digital Humanities,” *PMLA* vol. 128, no. 2 (March 2013): 414.

<sup>23</sup> Drucker, *Graphesis*, 125–35. Drucker's idea of a “realist” idea of infographics bares similarity to what Sean Cubitt has called the “new formalist mimesis” of data

visualization as meta-presentation or the notion that the world is inherently data. Sean Cubitt, “Data Visualization and the Subject of Political Aesthetics,” in *Postdigital Aesthetics: Art, Computation and Design*, eds. David M. Berry and Michael Dieter (London: Palgrave Macmillan, 2015), 179–81.

<sup>24</sup> Edward Tufte quoted in Alan Bisbort, “Escaping Flatland” (1999):

[https://www.edwardtufte.com/tufte/advocate\\_1099](https://www.edwardtufte.com/tufte/advocate_1099), accessed July 20, 2017.

<sup>25</sup> Edward Tufte, *The Visual Display of Quantitative Information*, Second Ed. (Cheshire, CT: Graphics Press, 2001), esp. 13, 177.

<sup>26</sup> Edward Tufte, *Envisioning Information* (Cheshire, CT: Graphics Press, 1990), 33.

one may observe how it succeeds as a transparent, efficient, and elegant presentation of 2600 years of cultural history. In fact, *Charting Culture* was featured on numerous lists of the “best data visualizations” of 2014 and 2015.<sup>27</sup> However, if we look more critically, applying the art historical tools of visual analysis and comparison, we may begin to see how precisely the graphical display expresses the data and investigate the broader theoretical implications of visualizing cultural history in this manner.

## Visual Analysis and Network Visualization

In the beginning of the video, we see a blue dot appear, signifying the birth of Leonardo da Vinci in the Tuscan village of Anchiano near Florence in 1452 [Fig. 3]. Floating on a white ground, a grey dot representing Leonardo moves from a blue dot toward a red one that signifies his death in the French city of Amboise in 1519. As a fine grey line arcs across the frame connecting the blue and red dots, the narrator describes how the “Great Renaissance Artist” was so well-known across Europe that late in his life he was invited by the King of France to come work for him. For those familiar with Leonardo, the efficient graphic may appear to omit other key nodes and links (such as Leonardo’s works for the Duke of Milan or the Pope in Rome). Perhaps the choice to analyze only one link (e.g. an artist) between two nodes (e.g. cities of birth & death) was for the sake of clarity and purity of the graphic. However, the lack of complexity in the network diagram may also have to do with the thorny issue of characterizing other important sites of production in an artist’s biography. Unlike cities of birth and death, plotting the city in which an artist’s “notable works” were made or reside is a qualitative question that depends on point of view. Establishing nodes (also termed vertices, actors, agents, and data points) and links (or arcs, edges, ties, and relations) is much more difficult when

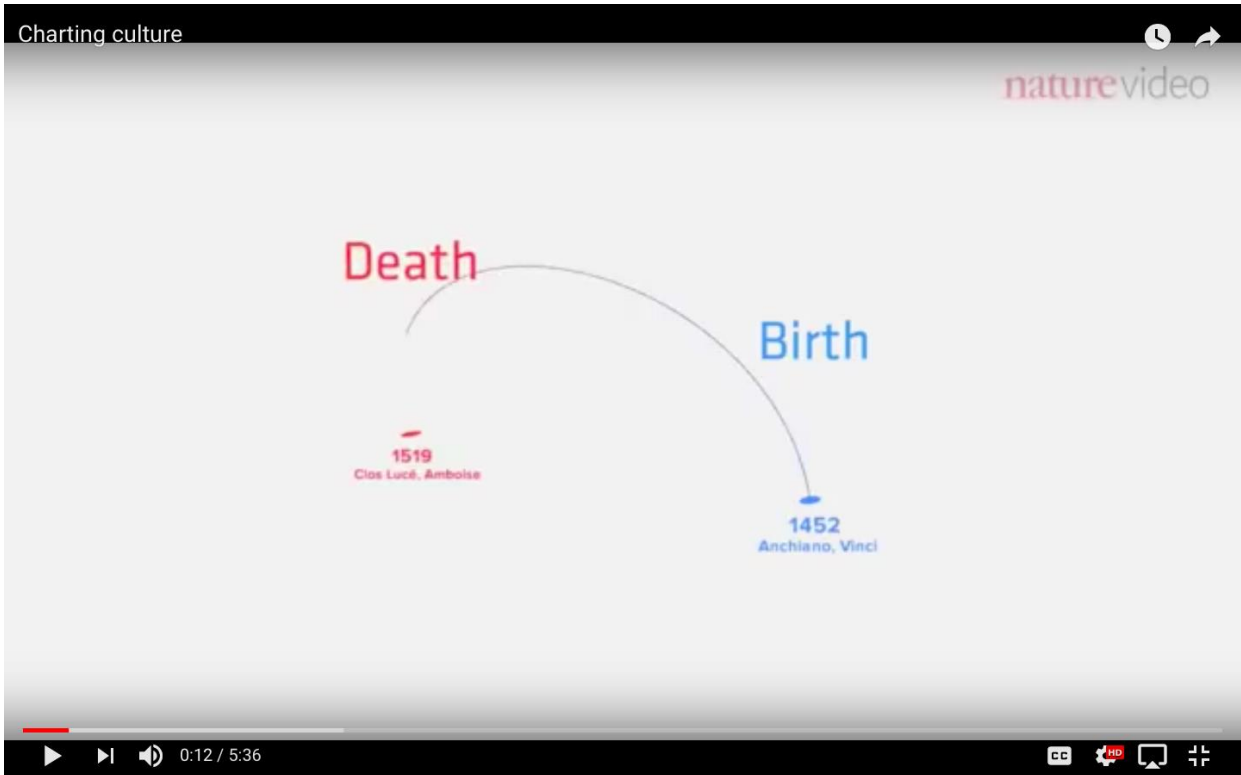
determining “cities of significance,” as these data points are debatable and cannot as easily appear as a given. For this reason, experts in macroscopic data analysis may find it useful to partner with art historians specializing in particular time periods and cultures, so that when they zoom in to specific examples, the microscopic maybe examined in a manner that provides more nuance, perhaps even complicating the macroscopic view.

Correspondingly, the processing of large datasets, as Matthew Lincoln points out in his article, may help specialists focused on the microscopic to locate unforeseen continuities, despite the priority given to disruption-centered narratives within the discipline of art history. However, in contrast to Schich’s study, Lincoln’s project only examines continuities over a few hundred years and it focuses on his areas of specialization in Renaissance and Baroque Europe.

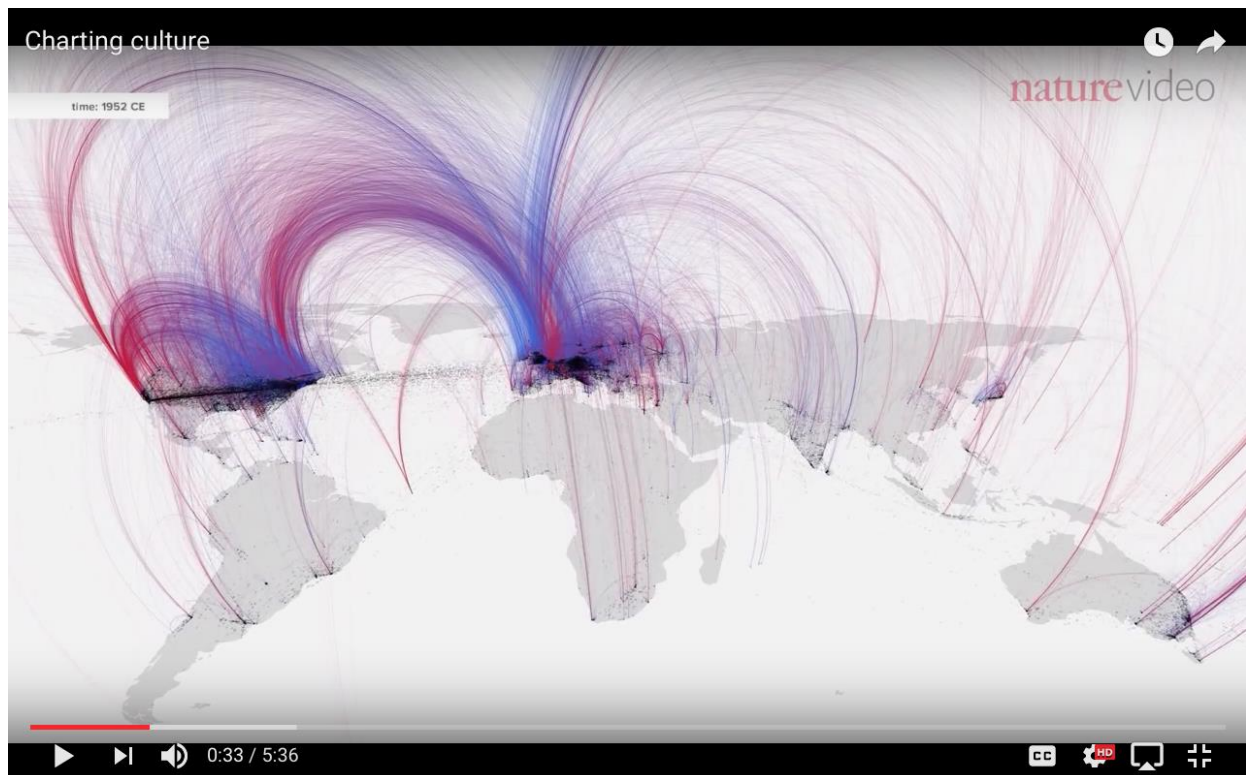
In *Charting Culture*, which spans thousands of years all over the globe, a figure like Leonardo helps to ground a vast analysis, serving as the paradigmatic example for all the other actors and relations. With the thousands of agents and their ties culled from Google’s Freebase.com, a world map of global culture unfolds [Fig. 4]. While the narrator describes Schich’s research project, arcs of a gradient blue/red hue spread across the flat grey world map—first in Europe and then elsewhere—as hundreds of years accumulate like seconds on a small stopwatch in the upper left-hand corner. Covered in nodes and links, this animated map closely resembles graphics that visualize global flight patterns and internet connectivity—diagrams to which we have all become accustomed in the 21<sup>st</sup> century. Unlike the timelines that have traditionally anchored historical texts, this new “network framework” of cultural history prioritizes space over time.

<sup>27</sup> For three of these lists, see: Nathan Yau, “Best Data Visualizations in 2014” *FlowingData*: <http://flowingdata.com/2014/12/19/the-best-data-visualization-projects-of-2014-2/> Retrieved August 1, 2017; Gareth Cook, ed. *Best American*

*Infographics 2015* (New York: Houghton Mifflin Harcourt, 2015), 150-51; National Science Foundation & Popular Science, 2015 Vizies Visualization Challenge - *Finalist* - Video: [http://www.mamartino.com/img/nsf\\_award.jpg](http://www.mamartino.com/img/nsf_award.jpg) Retrieved August 1, 2017



**Figure 3.** A still that centers on the life of Leonardo da Vinci from the video *Charting Culture* made by professor Maximillian Schich (University Texas, Dallas) and designer Mauro Martino (IBM Watson Group) with Kerry Smith, Charlotte Stoddart, and Alison Abbott at *Nature*. Copyright © 2014 by Nature/Macmillan Publishers Ltd.



**Figure 4.** A still that visualizes global cultural migration from the video *Charting Culture* (2014) made by professor Maximillian Schich (University Texas, Dallas) and designer Mauro Martino (IBM Watson Group) with Kerry Smith, Charlotte Stoddart, and Alison Abbott at *Nature*. Copyright © 2014 by Nature/Macmillan Publishers Ltd.

This shift from a temporal to spatial emphasis, however, is not unique to the *Charting Culture* project. Many network visualizations and statistical maps minimize the complexity of temporality and the importance of periodization in profit of a stable geography. Although there are practical and technical reasons as to why this might be the case,<sup>28</sup> the prioritizing of geography over chronology may also be seen as a structuring principle of what the sociologist Manuel Castells calls the “network society,” or a society in which “space organizes time” and space is presented as fluid rather than bounded.<sup>29</sup> Castells argues that under the conditions of globalization, connectivity controlled by a global elite has created a society in which the “space of flows dominates the space of places” and “timeless time supersedes clock time.”<sup>30</sup> Although historical work has always entailed looking at the past with present-day frameworks of understanding, the network frameworks of our digital age may imperil the concrete time of specific localities by collapsing it into a “timeless time” of global connectivity that works against historical thinking.<sup>31</sup>

All network visualizations, however, do not function in the same manner and thus demand critical analysis. There are “counter-cartographies,” such as the one Greet constructed, which was researched and designed from the perspective of a scholar trained in post-colonial studies.<sup>32</sup> As the field of critical cartography has taught us, we must examine the assumptions that structure the network diagram, as neither the map nor the data that shapes it are neutral, and often they serve and reflect the interests of dominant

groups.<sup>33</sup> As Stephanie Porras argues in her article, we must understand network visualizations of historical phenomenon as “artifacts of contemporary visual culture, laden with the biases and limits of both past and present knowledge systems.”<sup>34</sup> In the instance of *Charting Culture*, the bias of Eurocentric databases—a legacy of the enforced inequities of European colonial domination—are clearly visualized in the far larger concentration of data points in the global north. However, against this implicit colonialist discourse, Schich and Martino have chosen not to use the standard world map or the “Mercator Projection”—used by Google Maps, among others—which has been long criticized for how it grossly minimizes the actual size of Africa and Latin America. In *Charting Culture*, the viewer gazes from South to North which offsets the distortion. And yet, due to the admitted bias of the data, when the camera pans and zooms in on Japan or Australia, the names that inhabit these spaces are predominately European rather than Japanese or Aboriginal.<sup>35</sup> The discrepancy visualized here, as Schich later suggested, can be seen as a strong argument for larger and more comprehensive digitizing projects that are aimed at addressing such imbalances.<sup>36</sup> Against the pejorative manner in which “big data” is discussed by many art historians, Schich argues that we in fact need “bigger data,” in order more holistically and critically examine cultural exchange.<sup>37</sup> Furthermore, as Léa Saint-Raymond & Antoine Courtin assert in their contribution to this issue, linked open data may also be utilized to

<sup>28</sup> For example, Michelle Greet observed that her team faced challenges when attempting to integrate time into maps in their *Transatlantic Encounters* project. This was in part due to the lack of, or discrepancies between, the dates of the artists’ residential data. Without chronology that shows changes in artists’ residences over time, as Greet admits, their map “creates a false sense of contiguity.” The challenge of adequately time also had to do with the choice of platform (i.e. a geo-coded GoogleMap). Greet, “Mapping Cultural Exchange,” 142.

<sup>29</sup> Manuel Castells, *The Rise of the Network Society*, second edition (Oxford: Blackwell, 2000), 407. I have also shown how this move out of time and into space works in other art historical network analyses: Miriam Kienle, “Artist as Network,” *Media-N*, vol. 11, no. 2 (Fall 2014): <http://median.newmediacaucus.org/art-infrastructures-information/artist-as-network-out-of-time-and-into-space-with-the-warholtimeweb>

<sup>30</sup> As Castells observes of the network society: “Space and Time, the material foundations of human experience, have been transformed, as the space of flows dominates the space of places, and timeless time supersedes clock time of the industrial era.” Manuel Castells, *End of Millennium: The Information Age: Economy, Society, and Culture, Volume 3*. Second Edition (Malden, MA: Wiley-Blackwell, 2010), 1.

<sup>31</sup> Castells, *Network Society*, 1-25, esp. 5-12.

<sup>32</sup> Greet, “Mapping Cultural Exchange,” 133-37.

<sup>33</sup> For an excellent overview of the field of critical cartography, including examples of “counter-cartography” that express the worldview of non-dominant groups, see: Jeremy W. Crampton and John Krygier, “An Introduction to Critical Cartography,” *ACME: An International Journal for Critical Geographies* vol. 4, no. 1 (2006): 11-33. On current issues in the field, see the special issue of this journal on the subject “Do maps lie?”: Béatrice Joyeux-Prunel, ed. “Introduction: Do maps lie?,” *Art@s Bulletin* vol. 2, no. 2 (2013): <http://docs.lib.purdue.edu/artlas/vol2/iss2/>

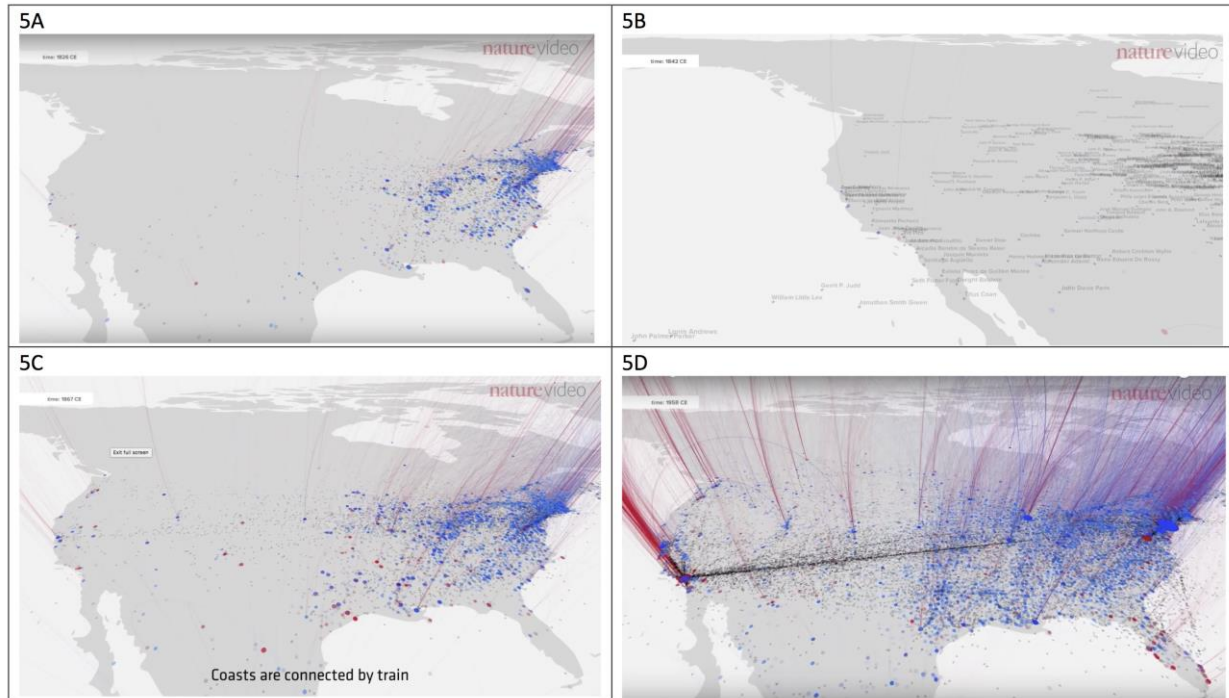
<sup>34</sup> Porras, “Keeping Our Eyes Open,” <http://docs.lib.purdue.edu/artlas/>

<sup>35</sup> The notable figures highlighted by the narrator are 17<sup>th</sup> century Christian missionaries to Japan who were “persecuted for their faith” by the Japanese, and the infamous “bushranger” Ned Kelly, the son of an Irishman (i.e. a British colonial subject) banished to Australia by the British because he stole pigs. The narrative therefore is not only Euro-centric in the selection of individual figures, but also in the dichotomous savage/civilized narrative of colonialism that it reinforces.

<sup>36</sup> Schich, “Figuring Out Art History,” 50.

<sup>37</sup> Ibid, 47-51.





**Figure 5.** Four stills that together show the “pull of the west coast cultural centers” in US during the 19<sup>th</sup> and 20<sup>th</sup> centuries from the video *Charting Culture* (2014) made by professor Maximillian Schich (University Texas, Dallas) and designer Mauro Martino (IBM Watson Group) with Kerry Smith, Charlotte Stoddart, and Alison Abbott at Nature.. Copyright © 2014 by Nature/Macmillan Publishers Ltd.

address the publication bias of any one digital archive alone.<sup>38</sup> With these promising new developments on the horizon, one might wonder: How could bigger data that is open and linked transform a visualization like *Charting Culture*? With the emergence of new data points, what kind of new narrative might surface?

Turning to US cultural history (after an analysis of the development of major European cultural centers from Roman times to present), the video quickly pans to actors flocking from Europe to the northeast coast of the United States, and then out to the west coast from the 18<sup>th</sup> century onward. As these cultural migrants flow across the country, the narrator describes how at first notable people settled in the river valleys, but then with the advent of new “transportation links” larger numbers flocked to the west coast to “live out their days

there,” particularly migrating toward cultural and technological meccas like San Francisco and Los Angeles [Fig. 5A-5D].

Ultimately, we are told: “This depiction makes clearer the pull of the west coast cultural centers where people move during their lifetimes.” Similar to the rhetoric that underpinned the US’s westward expansion (i.e. manifest destiny), the “pull of the west” appears as a natural phenomenon, and thus *mythical* rather than *historical*.<sup>39</sup> However, perhaps by accumulating more data related to the cultural contributions of indigenous populations, the push and pull of creative actors might look quite different.

Watching this massive migration from the perspective of a scholar of American Art, it is hard not to wonder about the people who were already there; how their culture intersected with that of the

<sup>38</sup> Lea Saint-Raymond & Antoine Courtin, “Enriching and Cutting: How to Visualize Networks Thanks to Linked Open Data Platforms,” *Artl@s Bulletin* vol. 6, no.3 (Fall 2017): <http://docs.lib.purdue.edu/artlas/>

<sup>39</sup> Describing the force of technological progress and westward expansion—while suppressing the violent colonization of Native American lands, and the attempted erasure of their people and culture—*Charting Culture* like manifest destiny makes the Euro-American domination of the West appear to be a natural, divine, or

inevitable phenomenon, rather than the product of ideology and the policies and archives constituted by it. In this way, the video is “mythical” rather than “historical” in Roland Barthes’ sense of the term because it transforms “history into nature” rather than investigating its relation to dominant period ideologies. Roland Barthes, “Myth Today,” in Jessica Evans & Stuart Hall, ed. *Visual Culture: The Reader* (London: Sage, 1999), 58.



settlers; and where and how they “lived out their days.” During a brief pause in the narrative, we zoom in on the west coast around 1850 to see a flood of European male names attached to nodes that float freely across the landscape [Fig. 5B]. Looking hard among these names, one may find a few indigenous names, such as Cochise (a leader of the Chiricahua Apache) and Sem-Yeto (also known as Chief Solano, a famous leader of the Suisunes). However, in contrast to the colonizers, these actors appear more static, resting in a single spot for the duration of the clip, despite the historical reality of being forced to leave their native lands during periods of US national expansion.<sup>40</sup> Perhaps collaborating with art historians trained in Native American studies and postcolonial methods, the migrations of indigenous artists could become more accurately documented and narrative accounts of the contributions of these figures would emerge (such as the one about Leonardo Da Vinci) that could help to begin to address the video’s bias.

Finally, as we zoom out again to view the entire country, the narrator describes how the invention of trains, and then cars, facilitated the westward migration of notable figures [Fig. 5C]. Evocative of airplane networks, brilliantly colored arcs connect cities and towns across the land—grafting the image of present-day transportation technologies onto those from the past. The presentism and techno-positivism of the video are furthered by the fantasy of being able to see the whole world at once, or what feminist philosopher and new media theorist Donna Haraway famously called the “god trick” of “seeing everything from nowhere.”<sup>41</sup> The totalizing vision offered by visualization technologies, according to Haraway, have “a

perverse capacity—honed to perfection in the history of science tied to militarism, capitalism, colonialism, and male supremacy—to distance the knowing subject from everybody and everything in the interests of unfettered power.”<sup>42</sup> The myth of this neutral, distanced, and all-encompassing form of vision becomes a powerful tool that suppresses that fact that all vision is embodied and knowledge socially situated. In order to humanize and socially situate cultural production and reception, we must therefore—as the next section argues—move back and forth from big to small, quick to slow, global to local, always acknowledging the assumptions that frame those movements.

## Investigating Abstraction: Intimacy, Distance, and Para-Empiricism

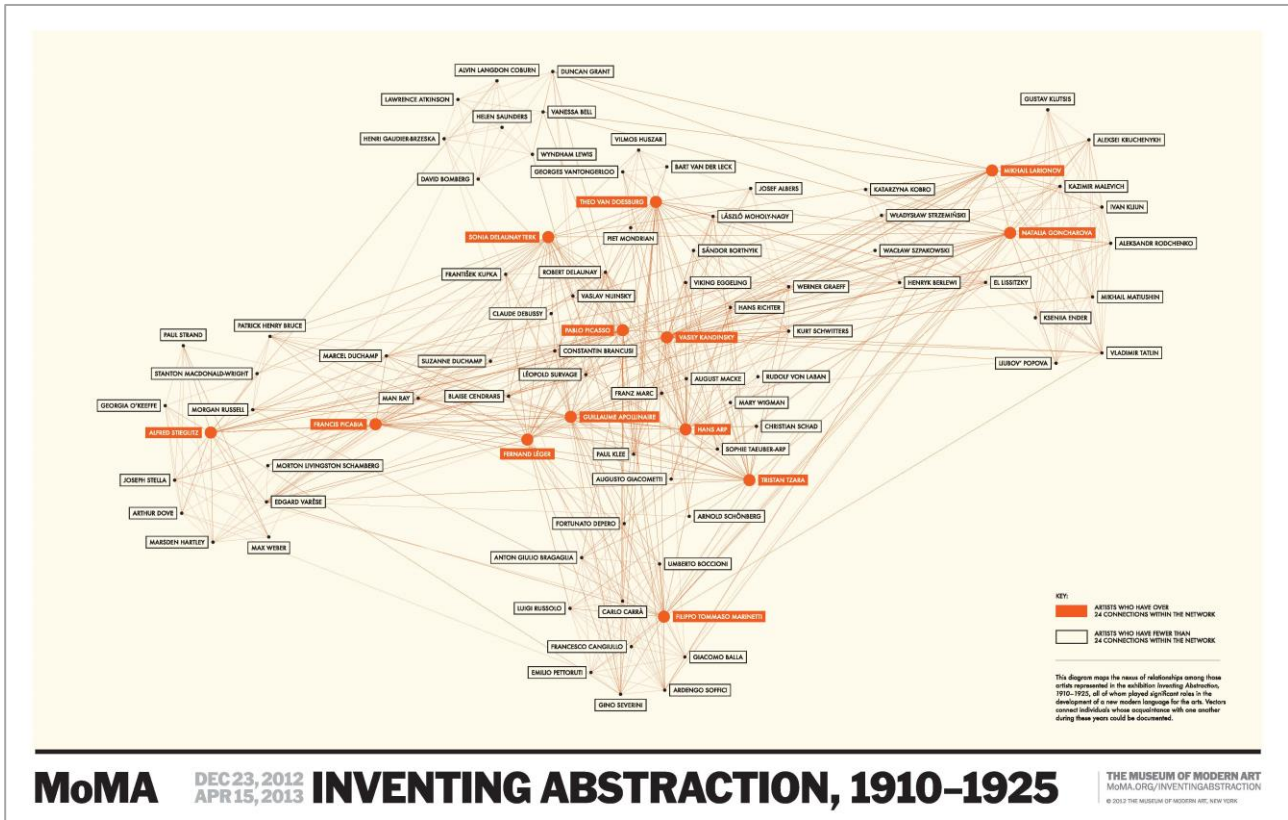
As many network visualizations employ this distanced macroscopic perspective, it is important to investigate how it operates. One particularly notable example in the field of art history is the “Artist Network Diagram” from the Museum of Modern Art’s [Inventing Abstraction](#) exhibition (December 23, 2012–April 15, 2013) [Fig. 6]. Lauded initially by critics as presenting a new, more inclusive and interdisciplinary approach to the history of artistic abstraction,<sup>43</sup> recent scholarship on the interactive network diagram has addressed the implications of viewing this history at a remove—as an abstraction of the

<sup>40</sup> As the second half of the 19<sup>th</sup> century has been characterized by Michael Friendly as the “golden age of statistical graphics,” it would be interesting to contemplate the role that infographics played in the US’s Native American reservation system. In his book *Representing the Nation*, John Rennie Short has argued that the great American statistical cartographer Francis A. Walker famously combined census data into thematic maps in his widely-read *Statistical Atlas* (1874), which was aimed at national unification after the civil war as well as social reform and control. As a proponent of the reservation system, Walker’s emphasis on westward expansion worked hand-in-hand with his focus on locating spaces of social disorder or deviation from the colonizer’s norm. Connecting race to spaces of moral and physical degeneracy through data, Walker aimed to enumerate the “other.” The visualization of census data was thus used to justify discriminatory policies, as well as the continued accumulation and visualization of census data through visually striking designs. Michael Friendly, “A Brief History of Data Visualization,” *Handbook of Data Visualization* (Berlin: Springer-Verlag, 2008), 28. Charles Rennie Short, *Representing the Republic: Mapping the United States, 1600–1900* (London: Reaktion, 2001), 217–20.

<sup>41</sup> Donna Haraway, “Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective,” *Feminist Studies* vol. 14, no. 3 (1988): 575–599, quote 581.

<sup>42</sup> *Ibid.*

<sup>43</sup> For positive reviews, see: Roberta Smith, “When the Future Became Now,” *The New York Times*, December 20, 2012, <http://www.nytimes.com/2012/12/21/arts/design/inventing-abstraction-1910-1925-at-moma.html> (accessed September 15, 2017); Thomas Micchelli, “MoMA’s Show of Shows: Inventing Abstraction, 1910–1925,” *Hyperallergic*, December 22, 2012, <https://hyperallergic.com/62402/momas-show-of-shows-inventing-abstraction-1910-1925/> (accessed September 15, 2017); Peter Schjeldahl, “Shape of Things: The Birth of Abstraction,” *The New Yorker*, January 7, 2013, [http://www.newyorker.com/arts/critics/artworld/2013/01/07/130107craw\\_artworld\\_schjeldahl](http://www.newyorker.com/arts/critics/artworld/2013/01/07/130107craw_artworld_schjeldahl) (accessed September 15, 2017); Hal Foster, “At MoMA,” *London Review of Books*, February 7, 2013, <https://www.lrb.co.uk/v35/n03/hal-foster/at-moma> (accessed September 15, 2017).



**Figure 6.** The Artist Network Diagram in *Inventing Abstraction: 1910-1925*, an exhibition at The Museum of Modern Art, 2012-13, organized by Leah Dickerman with Masha Chlenova. Courtesy of the Museum of Modern Art. Copyright © 2012 The Museum of Modern Art, New York.

mechanisms of social connectivity.<sup>44</sup> In this interactive network visualization, the user is prompted to explore the connections between important pioneers of abstraction—from Georgia O’Keeffe and Alfred Stieglitz in the US, to Pablo Picasso and Sonya Delaunay in France, to Natalia Goncharova and Mikhail Larinov in Russia—who are all linked by red lines that spread across a plain cream background (despite the configuration implying the geography of the US and Europe). Artists with the greatest connectivity, such as Delaunay, Goncharova, and Picasso are highlighted. With this densely connected web of artists, the

visualization productively shows that abstraction was not an innovation of “solitary genius,” but a product of “network thinking.” It also demonstrates that female artists (traditionally marginalized in the history of abstraction) were in fact central hubs in the development of this revolutionary art form.<sup>45</sup> In fact, revealing the significance of important yet under-recognized female artists—through analysis of archived correspondence, institutional records, and auction results—is one manner in which network analysis in the field of art history can be particularly useful from a feminist perspective.<sup>46</sup>

<sup>44</sup> For more recent critiques, see: Miriam Posner, “MoMA’s Inventing Abstraction” Network Diagram” *DH101 Blog*, November 9, 2014, <http://miriamposner.com/dh101f14/?p=938>; Claire Bishop, “Against Digital Art History,” *Humanities Futures*, October 20, 2015, <https://humanitiesfutures.org/papers/digital-art-history/>; Maximilian Schich, “Figuring Out Art History,” 52-3, 60; Nicole E. Reiner and Jonathan Patkowski, “Inventing Abstraction, Reinventing Our Selves: The Museum of Modern Art’s Artist Network Diagram and the Culture of Capitalism,” *Rutgers Art Review* vol. 32 (2017), <http://rar.rutgers.edu/current-volume/volume-32/reiner-patkowski-inventing-abstraction-reinventing-our-selves/#go%20to%20notes>

<sup>45</sup> Leah Dickerman, ed. *Inventing Abstraction* (New York: Museum of Modern Art, 2013):

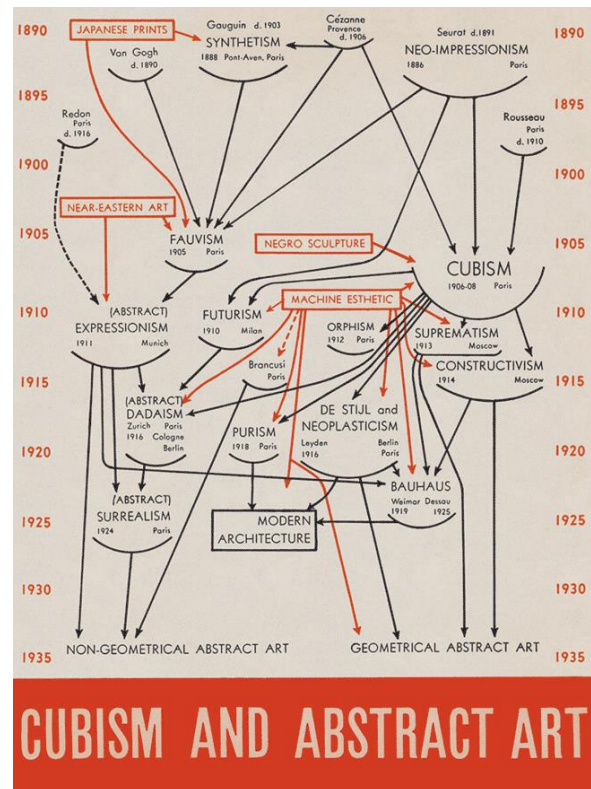
<https://www.moma.org/interactives/exhibitions/2012/inventingabstraction/> (accessed September 15, 2017).

<sup>46</sup> On the benefits of using network analysis to recover important women artists and their networks, see: Christina Weyl, “Networks of Abstraction: Postwar Printmaking and Women Artists of Atelier 17,” *Archives of American Art* website (Graduate Student essay prize, 2014): <http://www.aaa.si.edu/essay/christina-weyl>; On the problems and promises of network analysis from a feminist perspective, see: Michelle Morevec’s contribution to this volume: “Network Analysis and Feminist Artists,” Miriam Kienle, ed. “Visualizing Networks” Special Issue, *Artl@s Bulletin* 6, no. 3 (Fall 2017): <http://docs.lib.purdue.edu/artlas/>

However, as feminist digital humanists Catherine D'Ignazio and Laura Klein have pointed out, feminist data visualization entails examining power, situating knowledge, and making one's process visible.<sup>47</sup> Therefore, visualizations that reinforce masculinist ideals of distance, mastery, and totality, as well as hierarchical and binaristic configurations like center/periphery, cannot be called "feminist" per se.<sup>48</sup> Therefore, although MoMA's network diagram appears to disrupt hierarchies through the horizontal placement of nodes and demonstration of documented patterns of acquaintance that reveal women as key players, one is still left wondering what exists beyond this Euro-and-US-centric web of names floating on a blank background. As a result of the design, it is hard to situate these agents in space and time and to understand the power that the highlighted actors are meant to hold. As Miriam Poser points out in her analysis of this network visualization, despite being told that "24 connections" serves as a threshold for an artist to be highlighted, it is uncertain what that criteria signifies (influence, inclusion, or extroversion) or from where these connections are derived (letters, magazines, or exhibition catalogues).<sup>49</sup> Similarly, Maximilian Schich has critiqued the diagram for its lack of complexity and precision. For Schich, the famous 1936 flow chart from *Cubism and Abstract Art* by MoMA curator Alfred Barr—which the *Inventing Abstraction* diagram is meant to update [Fig. 7]—has far more nuance and art historical value.<sup>50</sup>

In Nicole Reiner and Jonathan Patkowski's recent analysis of the *Inventing Abstraction* network visualization, they too found several troubling implications: 1) the omission of non-western cultures, which the original Barr flow chart (while problematic in other ways) includes and even highlights; 2) the elision of powerful economic and social forces that shape the movement of art and

artists; 3) the reduction of artistic labor and innovation to an entrepreneurial model of social connectivity that resonates with a contemporary neo-liberal world-view.<sup>51</sup>



**Figure 7.** Chart prepared by Alfred H. Barr, Jr., for the dust jacket of the exhibition catalogue, *Cubism and Abstract Art*, by Alfred H. Barr, Jr. Copyright © 1936 The Museum of Modern Art; Licensed by SCALA / Art Resource, NY.

Building on Reiner and Patkowski's argument, the art historian Claire Bishop states: "Carefully reasoned historical narrative is replaced by social network (the avant-garde equivalent of LinkedIn) and has no room for non-human agents that elude quantification—such as African artifacts, which were crucial to the development of abstraction, or the imperial powers that mobilized their circulation in Europe."<sup>52</sup> Developments in art and culture thus appear to emerge from free and even flow of ideas among singularly significant actors, rather through a process of exchange among known

<sup>47</sup> Catherine D'Ignazio and Laura Klein, "Feminist Data Visualization," IEEE VIS 2016 Workshop on Visualization (unpublished conference paper), <http://vis4dh.dbvis.de/papers/Feminist%20Data%20Visualization.pdf> (accessed September 15, 2017). Catherine D'Ignazio, "What would feminist data visualization look like?," MIT Center for Civic Media Blog, December 20, 2015, <https://civic.mit.edu/feminist-data-visualization> (accessed September 15, 2017)

<sup>48</sup> Ibid.

<sup>49</sup> Posner, "MoMA's Inventing Abstraction" <http://miriamposner.com/dh101f14/?p=938>

<sup>50</sup> Schich, "Figuring Out," 52-3, 60.

<sup>51</sup> Reiner and Jonathan Patkowski, "Inventing Abstraction, Reinventing Our Selves" <http://rar.rutgers.edu/current-volume/volume-32/reiner-patkowski-inventing-abstraction-reinventing-our-selves/#go%20to%20notes>

<sup>52</sup> Claire Bishop, "Against Digital Art History," <https://humanitiesfutures.org/papers/digital-art-history/>

and unknown agents that entails uprooting, loss, intersection, acquisition, and repurposing of cultural forms or what is known in the field of visual studies as “transculture.”<sup>53</sup>

Bishop’s critique of the *Inventing Abstraction* diagram, however, is not simply skeptical of network frameworks of art and culture, but of digital art history more broadly. Bishop—whose current research analyzes the impact of digital technology on global contemporary art—has emerged as a particularly vocal critic of digital art history. In a recent paper, she suggests that digital or quantitative approaches to art history are also the product of the neo-liberalism, which has transformed all activity into metric evaluation, even if not directly monetized. As she states:

Digital art history, as the belated tail end of the digital humanities, signals a change in the character of knowledge and learning. Ideals like public service, citizenship, knowledge as an end in itself, and questions of what is just, right, and true have decreasing validity because they resist quantitative measurement, and moreover do not easily translate into information that optimizes the performance of society (i.e. generate profit).<sup>54</sup>

In Bishop’s view, the neo-liberalization of higher education in the US academy has worked hand-in-hand with the digital humanities to displace (rather than expand) the public humanities and its qualitative questions of truth, justice, and liberty. Furthermore, as art history belatedly adopts the “distant viewing” of the digital humanities (wherein vast numbers of catalogued artifacts are examined through quantitative computational analysis),<sup>55</sup> Bishop suggests appropriating this mode of viewing against itself. Therefore, in presentations of her current research project, “Déjà Vu: Reformatting Modernist Architecture,” she engages distant viewing by setting her PowerPoint to quickly scroll through various combinations of hundreds of examples of contemporary art from all over the world that quote modernist architecture.

By replacing single paradigmatic examples (i.e. the case study approach of traditional art history) with a dizzying array of loosely related images that recalls the results of a Google search, Bishop aims to critically address the pervasiveness of distance viewing in contemporary digital culture. As Bishop notes in her article, this distanced and decontextualized mode of image viewing has infuriated audience members, which is perhaps precisely the reaction she aims to achieve. A believer in the necessity of antagonism to democracy, Bishop sees this mode of critique as a catalyst for change.<sup>56</sup> However, one must wonder, if no alternative is proposed—no suggestion as to where to go from here—doesn’t this presentation of our digital image landscape simply reinforce the numbing effects it’s meant to critique?

Against such polarizing, the architect and visual studies scholar, Laura Kurgan, has taken a different tack. In her book *Up Close At A Distance*, she not only attempts to critique, but also to expand and improve how digital technologies of representation are utilized. These projects, as Kurgan explains, “explicitly reject the ideology, the stance, and the security of ‘critical distance’ and reflect a basic operational commitment to a practice that explores spatial data and processing from within.”<sup>57</sup> As founder of Columbia University’s Spatial Information Design Lab (SIDL) and director of the Center for Spatial Research (CSR), she and her team examine the political and ethical stakes of digital technologies—working *with* and *through* them to gain intimate knowledge of how these tools may be utilized to create greater civic engagement and a more just and democratic world. For example, in recent visualizations of the global migrations that stem from political, economic, and environmental crises such as [EXIT](#) (2015) and [Conflict Urbanism: Columbia](#) (2016) [Figs. 8 & 9], Kurgan acknowledges the military and governmental origins of the technologies and modes of visualization she employs to examine these spaces

<sup>53</sup> On transculture, see: Nicholas Mirzoeff, “Transculture: From Kongo to Congo,” *An Introduction to Visual Culture* (London: Routledge, 1999): 125-156.

<sup>54</sup> Ibid.

<sup>55</sup> Bishop’s idea of “distant viewing” builds on Franco Moretti’s term “distant reading” or the quantitative approach to comparative literature. Ibid.

<sup>56</sup> Claire Bishop, “Antagonism and Relational Aesthetics,” *October* no.110 (Fall 2004): 51-80, esp. 65-70; *Artificial Hells: Participatory Art and the Politics of Spectatorship* (London: Verso, 2012).

<sup>57</sup> Laura Kurgan, *Up Close At A Distance: Mapping, Technology, and Politics* (Brooklyn, NY: Zone Books; MIT Press, 2013), 14.



and events—traces of which remain even as her team aims to redirect their utilization towards humanistic and public goals.



**Figure 8.** This digital environment visualizes the 19.5 million refugees worldwide and more than 38 million IDPs. The team describes of the project's aims: "Exit, immerses the viewer in a dynamic presentation of data documenting contemporary human movement. Statistics documenting population shifts are not always neutral and the multiple efforts to collect them are decentralized and incomplete. Here the data are repurposed to build a narrative about global migration and its causes. The viewer enters a circular room and is surrounded by a panoramic video projection of a globe which rolls around the room printing maps as it spins. The maps are made from data which has been collected from a variety of sources, geocoded, statistically analyzed, re-processed through multiple programming languages and translated visually. The presentation is divided into narratives concerning population shifts, remittances, political refugees, natural disaster and sea-level rise and endangered languages." Originally completed in 2008, EXIT has been fully updated to coincide with Cop21, the United Nations Conference on Climate Change and reflects data from 2015. On view at the Palais Tokyo in Paris from November 25, 2015 – January 10, 2016. Project team © Diller Scofidio + Renfro, Mark Hansen, Laura Kurgan, and Ben Rubin, in collaboration with Robert Gerard Pietrusko and Stewart Smith. Photos © 2015 Luc Boegly.

However, the team attempts to de-stabilize the techno-positivism of statistical cartography and social network analysis. Rather than offer viewers a secure and solid orientation, the team's visualizations favor complexity and disorientation. Zooming in and out of specific localities, these projects embody both a top-down & bottom-up account of global conflict and suggest that through a combination of case studies and macroscopic analysis we might begin to see how new networks could emerge from this crippled infrastructure. As Kurgan states, they did not aim to visualize "hard data," but rather to create a "soft map that is infinitely scalable, absolutely contingent, and open to vision thus revision."<sup>58</sup>

In order to achieve this aim, Kurgan has adopted a "para-empirical" approach, in which data is treated not as purely empirical, concrete, and irreducible facts about the world, but rather a representation or emissary of reality.<sup>59</sup> From this view, data works alongside reality—remediating and reshaping it—and it does so incompletely and imperfectly, as every representation is an interpretation, negotiation, and translation. Para-empiricism is thus not meant to dismiss objectivity—plunging us into an abyss of doubt—but rather open up political and ethical debates that enlarge our conception of the world. Although Kurgan works predominantly in the disciplines of architecture and urban planning, we might ask ourselves how this "para-empiricism" could inform digital approaches to art history such as network analysis. If data is not understood as objective truth—but rather a representation that implies remediation, incompleteness, and construction—perhaps trans-cultural exchange may be mapped and charted in new ways. By critically examining the abstraction of lived experience that constitutes network analysis and visualization, we can investigate what lies between all of those nodes and edges, structuring it in absence.

<sup>58</sup> Ibid, 204.

<sup>59</sup> Ibid, 34-36.





**Figure 9.** Visualization of Colombia's internally-displaced people. Data from Registro Único de Víctimas—Red Nacional de Información, Colombia 1985-2015. The [Conflict Urbanism: Colombia](#) (2016) project by Laura Kurgan, Juan Saldarriaga, and Angelika Rettberg at Center for Spatial Research at Columbia University, along with M.A. Program in Peacebuilding at Universidad de los Andes in Bogotá. Copyright © 2016 Center for Spatial Research, Columbia University, New York.

## Analyzing Networks in Art History

“Visualizing Networks: Approaches to Network Analysis in Art History” features case studies that utilize network theory and analysis to investigate patterns of art historical circulation and exchange. It aims to address the lack of dialogue and understanding between quantitative and qualitative approaches to art history, which are too often polarized. By bringing together articles that conceptualize art historical networks in different ways, this issue attempts to ask questions about the promises and problems of network analysis in the field of art history. Contributors, therefore, investigate how theoretical methods of humanists—such as feminist and postcolonial art history—may be productively used in conjunction with quantitative approaches to art historical

analysis, particularly if truly integrated with computational methods rather than treated as an afterthought. Frequently designers and computer scientists are brought into digital humanities projects late in the game, seen as providing “tools,” and thus the capacities for digital methods to investigate and visualize a particular corpus are ill- or under-utilized. Additionally, theorizing must be positioned not as something to be overcome by quantifiable data, but rather as a fundamental means of understanding how and why the data is structured in one way rather than another. Therefore, the contributors to this volume attempt to locate more holistic approaches to network analysis in art history, investigating the epistemologies that structure a given network and the knowledge produced in their visualization.

In this issue, Matthew Lincoln’s contribution demonstrates how computational analysis of professional networks among European printmaking communities from the mid-16<sup>th</sup> to the mid-18<sup>th</sup> centuries can expose patterns of exchange beyond the individualist and nationalist narratives of artistic development that have traditionally characterized the histories of this work. Using data culled from the databases of prints in the British Museum and Rijksmuseum, Lincoln aims to test post-hoc national classifications of prints in their collections rather than assuming them as a foundational truth. Using network analysis to trace associations among European communities of print designers, plate cutters, and publishers, Lincoln demonstrates how printmaking internationalized during this period and examines this trend in relation to powerful demographic forces more than discrete historical ruptures. Lincoln’s method recuperates the historical continuities lost in the disruption-focused narratives that center on the contributions of exceptional individuals and anomalous events, showing gradual and continuous changes can provoke new questions about the production and circulation of prints across Europe during the long 17<sup>th</sup> century, including the examination of important period

figures obscured by canonical narratives of art history.

Stephanie Porras, who like Lincoln works on Renaissance and Baroque art and print culture, examines how networks visualizations have on the one hand the ability to turn messy archival material into powerful webs of connection that may reveal hidden historical actors, and yet on the other hand, also have the propensity to obscure the biases and assumptions that structure the archives from which the network visualization's data derives. Although Porras utilizes theories of networks in her research on the global circulation, reception, and remediation of a sixteenth-century Flemish print of St. Michael the Archangel—specifically sociological theories of “virality” that stress the agency of all actors in the network and the power structures that propel movement—she is skeptical about network science's ability to analyze art historical patterns given the structural imbalances that constitute the available data.<sup>60</sup> As she describes, networks require data; however, data related to art by historically marginalized populations is often scant, particularly if the producer was anonymous. Therefore, network visualizations have the dangerous potential to “simply re-inscribe historic and contemporary power differentials—between colonizer and colonized, places and people that benefitted from political, economic and social stability that enabled the accumulation of records and archives and those that did not.” Porras demonstrates how this “computational inequality” plays out in a number of humanist network visualization projects. Although she recognizes the formidable task of analyzing vast stores of data and the potential of computational analysis to help us better understand the transitivity and centrality of certain art historical agents and spheres, she also asserts the need to “keep our eyes open” to the under-examined assumptions that structure networks and the biases that their visualization may unwittingly reinforce.

Yael Rice's contribution shows how social network analysis (SNA) of artists in the royal atelier of the Mughal court during the late 16<sup>th</sup> century can help us better understand both the social structure of the manuscript workshop (which is little documented in the period texts) and the stylistic innovations found in the manuscripts it produced. Although the unique illustrative style of these Mughal manuscripts has been framed from a Eurocentric perspective as the result of the influence of European prints, or from a pan-Asianist perspective as the product of a synthesis between Persianate and Indic cultural systems, Rice shifts our focus to show how the internal structure of the manuscript workshop itself played a role in generating the exceptional commixture of styles found in these works. Because research on these manuscripts often focuses on “master” artists, scholars have not adequately analyzed the significance of the collaborations and large number of connections that the workshop actually fostered. Employing Granovetter's theory about the “strength of weak ties,” Rice demonstrates how Mughal workshops in South Asia fostered numerous acquaintanceships between artists (rather than a few intimate or familial relationships), which resulted in wide stylistic fusion and highly productive workshops. In order to arrive at this conclusion, Rice examined the collaboration between designers and colorists documented in contemporaneous marginal inscriptions that appear in three heavily illustrated royal manuscripts. With SNA software Gephi, Rice was able to track patterns of collaboration. However, as Rice admits, the task of gathering, editing, and cleaning her data in advance of its analysis in Gephi presented many challenges, such as spelling inconsistencies of artist names and shifting roles in the workshop. Rather than elide these issues, Rice is transparent about the constructedness and imperfection of her data and the reasoning behind how and why she edited it in a particular manner.

<sup>60</sup> For Porras's use of theories of “virality” to understand early modern print networks, see: Stephanie Porras, “Going Viral? Maerten de Vos' *St. Michael the*

*Archangel*,” *Nederlands Kunsthistorisch Jaarboek* 66 (2016): 54–78.

Similarly, Michelle Moravec addresses some of the structural and systemic barriers she faced when employing social network analysis to examine feminist artists' networks. She looks at two different projects in which she used computational modes of analysis to study the shape and function of social networks in the field of feminist art. The first is a study of the artist Carolee Schneemann's social network. Although several recent digital art history projects—such as the *Warhol TimeWeb*, *Six Degrees of Peggy Bacon*, and *Whistler and Roussel: Linked Visions*<sup>61</sup>—have similarly aimed to expand the monographic approach to artists by demonstrating the significance of creative collaborations, Moravec utilizes network visualization not simply to *display* the importance of networks, but to *investigate* the power that its form exerts upon the actors and edges that comprise it. Although every visualization is an interpretation on some level, graphical displays often conceal the epistemologies that structure them. Moravec's study, however, is generative and clearly from a feminist perspective. As a result, in her analysis of Schneemann's network, she actively limits her dataset to female correspondents in order to see and analyze connections between key women who are otherwise obscured by the preponderance of male colleagues, indicative of the patriarchal structure of the art world. In her second project, she examines a corpus of American feminist periodicals to trace the circulation of feminist art manifestos. With both projects, Moravec realizes her research was limited: 1) by the lack of feminist artists' archives and limited data pertaining to them 2) by the use of only one form of computational analysis. She therefore strived to expand and edit her corpus in ways that addressed gender bias, and combined computational linguistics and network analysis to create a more nuanced picture of the cultural community under analysis.

As digital humanist Elijah Meeks has described, the forms of computational analysis most used by scholars in the humanities or the “three pillars to DH research” are “Text Analysis, Spatial Analysis and Network Analysis,” adding that he also has “a sneaking suspicion that Image Analysis is something else that sits with the aforementioned three.”<sup>62</sup> While some digital humanists use one mode of analysis, many use multiple. Just as Moravec uses textual analysis alongside social network analysis, and Maximillian Schich couples network analysis with spatial analysis, the contribution by Stefanie Schneider and Hubertus Kohle makes use of both image and network analysis. Although in the field of art history the exploration of sociocultural networks is often done in conjunction with cartographic analysis, Schneider and Kohle point out that networks need not refer to spatial relationships. Library or image catalogues are networks—forming edges between the nodes of author and work—yet this is not a spatial relation. In Schneider & Kohle's analysis of the “social image tagging” site *Artigo* (of which they are both key contributors), they show how an online catalogue of thousands of digital images may be analyzed to reveal unforeseen clusters among crowd-sourced tags. Using a clustering algorithm to segment the tagged images into groups, they can trace new categories of image proximity that may expand traditional artistic genres (such as history, portrait, still life, etc.). More than displaying visual proximities, filtering images through crowd-sourced annotations can generate new research questions about classification itself and result in new ways of framing images beyond their current categorization. In the end, these subtler categories may be used to train a Convolutional Neural Network that could be made to automatically classify digital images of artworks that are not annotated or lack any metadata.

<sup>61</sup>The Warhol, *Warhol TimeWeb*, <https://vimeo.com/162073894> (Accessed September 25, 2017); Smithsonian Archives of American Art, *Six Degrees of Peggy Bacon*, <http://www.smithsonianmag.com/smithsonian-institution/its-a-small-world-after-all-six-degrees-of-peggy-bacon-806322/> (Accessed September 25,

2017); Art Institute of Chicago, *Whistler and Roussel: Linked Visions*, <http://linkedvisions.artic.edu/network.php> (Accessed September 25, 2017).  
<sup>62</sup> Elijah Meeks, “More Networks in the Humanities or Did Books have DNA?” *Digital Humanities Specialist* (blog), Stanford University, December 6, 2011: <https://dhs.stanford.edu/visualization/more-networks/>.

Léa Saint-Raymond and Antoine Courtin similarly engage questions about how digital art historians can develop better methods for structuring their data. Their research builds on studies of the art market, which frequently apply quantitative methods such as network analysis to better understand the production, reception, and exchange of art among interconnected communities of producers and consumers.<sup>63</sup> Looking at the networks of artists that emerge from archives of Parisian auction sales from the 19<sup>th</sup> and early 20<sup>th</sup> centuries, Saint-Raymond & Courtin seek to advance a better methodology for enriching their data (to avoid flatness, imprecision, and overly reductive data-sets), and also for cutting their data (so that the network under analysis does not become obscured by a proliferation of nodes and edges). In order to enrich their data, they turned to new and highly useful “linked open data platforms,” in which networks become networked through the semantic web. By enriching their data, their initial corpus of auction records was expanded to create a fuller picture of the social realities they trace. However, after enriching, they also cut the data (by removing “singletons” or artists that only appear once in the record) in order to enhance their articulation of the core network, which they visualized using Gephi. Furthermore, as Saint-Raymond & Courtin describe, at times they chose to visualize the network not as a “network graph,” but rather as a chart or table—both to better illustrate the result of the analysis, and allow for a greater level of interpretation.

The final two contributions are interviews. In the first of these two conversations, Anne Collins Goodyear talks with the interdisciplinary and intermedia artist, R. Luke DuBois, discussing how data gains meaning with and through the graphical

structures that he employs to represent it. In particular, their conversation explores how his creative data visualizations disrupt the positivism implied by contemporary infographics—exposing how their claim to truth can obscure the interpretive process embedded within them and that gives them form. From statistical cartographies of political affiliation and social sentiment, to network diagrams of interpersonal communication, DuBois explains how his works attempt to interject indeterminacy, irony, and lyricism into data analysis and visualization in order to interrogate their assumed neutrality and truthfulness. For example, *Self-Portrait, 1993-2014* (2014)—a work DuBois made by running his email through an algorithm and then cleaning, cutting, and visualizing his data—was designed to render an objective visualization of the artist’s social network, and yet through the process, he found that some of his more personal relationships were not apparent due to the in-person or analogue nature of much of their communications. Problems such as data voids and reductive aggregates, as well as the manner in which data visualization becomes fetishized and gratuitously utilized, are explored in the playful and provocative projects that DuBois describes.

The second interview is a conversation that the author conducted with Johanna Drucker and Miriam Posner following the Getty/UCLA Summer Institute that they co-organized, *Beyond the Digitized Slide Library*.<sup>64</sup> With the belated arrival of the digital humanities to the discipline of art history, the Summer Institute aimed to foster a wider engagement with digital methods beyond the digitizing of art works—teaching participants about key debates, while offering hands-on training with tools and techniques. Several of the

<sup>63</sup> Foundational studies in this field, include: Harrison and Cynthia White, *Canvases and Careers: Institutional Change in the French Painting World* (New York: Wiley, 1965), and Robert Jensen, *Marketing Modernism in Fin-de-Siècle Europe* (Princeton, NJ: Princeton University Press, 1997). Important recent articles include: Béatrice Joyeux-Prunel, “Circulation and the Art Market,” *Journal for Art Market Studies* Vol. 1, no. 2 (2017): <https://www.fokum-jams.org/index.php/jams/article/view/13/45> (Accessed September 25, 2017); Maximilian Schich, Christian Huemer, Piotr Adamczyk, Lev Manovich, and Yang-Yu Liu, “Network Dimensions in the Getty Provenance Index,” <http://arxiv.org/abs/1706.02804> [physics.soc-ph] (Accessed September 25, 2017).

<sup>64</sup> This issue is indebted to the institute instructors Miriam Posner, Johanna Drucker, Todd Presner, Steven Nelson, and Francesca Albrezzi, as well as all of the

participants and the fascinating projects that they brought to the workshop. The content of the Summer Institute has been transformed into an online textbook and collection of resources for those interested in gaining practical and theoretical knowledge of Digital Art History. Posner, et al., *Digital Art History 101* (Los Angeles, CA: UCLA; Getty Foundation, 2016): <https://ucla-beyond-slide-library.github.io/DAH101/About.html>

contributors to this volume, the author included, were participants in the institute, which undoubtedly transformed each of our projects and expanded our thinking about digital methods. Referenced several times earlier in this introduction, this interview serves as a kind of state of the field of “digital art history.” Similar to the discussions held during the Summer Institute, the interview addresses key debates and points of contestation, as well as exemplary projects within the field. In the spirit of *Beyond the Digitized Slide Library*, the aim of this issue is to further critical dialogues about the visual tactics and theoretical frameworks that structure quantitative and computational approaches to art and its networks.