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Is There a "Digital" Art History?

Johanna Drucker

The field of art history faces unique challenges with regard to digital practice. While access and availability of the art historical corpus have been facilitated by the development of online repositories, tools for analysis or computational processing have been slow to emerge. This paper surveys some of the current directions in "digital" art history and addresses the difficulties that arise with regard to the remediation of images and their availability (and resistance) to techniques of data mining and other computational techniques.

Keywords: Digital Art History; Digital Humanities; Data Mining; Cultural Analytics; Remediation; Repository; Virtual Models

Art history poses specific challenges for digital humanities on account of the visual nature of its core objects of study and their resistance to computational processing and analysis.[1] To date no research breakthrough has made the field of art history feel its fundamental approaches, tenets of belief, or methods are altered by digital work.

Will that change? If so, how and in what ways can digital techniques offer fundamentally innovative or useful insights to the discipline of art history? What work in digital formats or using digital tools would produce an intellectual insight sufficiently striking that anyone working in the field would be prompted to cite it because it has changed the field through its methods or theoretical implications? If digital tools are just new ways of doing old work a little faster, easier, and with greater access to more materials of all varieties, then why rush to put scarce resources in this direction or press for training in digital techniques?

A useful contrast might be drawn between the impact of critical theory and that of digital methodologies. In the 1980s, traditional art history was upended. Semiotics, structuralism, post-structuralism, psychoanalysis, Marxism, cultural and critical studies, and feminist thinking sharply divided art historians. At conferences, scholars would stand and bear witness to their love of "objects," generating applause for their defense of traditional approaches.[2] Many deplored such retrograde thinking, nixing the false binarism between theory and objects it introduced. The effect of theory was profound. Every aspect of art historical knowledge was shaken at its foundations. Whether you were an adherent, convert, or detractor, you had to take a position on the place of theory in art history because it seemed that the future of the field was at stake. The idea of what constituted an object was radically challenged. The ideological values of artworks were unmasked, their participation in the hegemonic order exposed, their existence as discursive formations, social agents, and desiring machines became as

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much the topic of discussion as their iconography, style, formal elements, compositional features, or technique had been for an earlier generation.

For the same thing to happen with the encounter between digital technology and art history, we have to see a convincing demonstration that digital methods change the way we understand the objects of our inquiry. If epistemology constitutes its objects, does not just describe them, then what are the ways of thinking about works of art that arise from digital methods and reconfigure our fundamental understanding of what constitutes a work of art? What new research questions can be asked?

Imagine, for example, that we start with an iconic work of art like Jan van Eyck's (ca. 1390–1441) *The Arnolfini Portrait* (1434; National Gallery, London), and track each of its material, physical, iconographic, compositional, stylistic, economic, ritual, and other features into their respective field of associations using an integrated array of computational techniques, image analysis, and close readings produced by combining digital technologies with network analysis and connoisseurship.[3] Begin with pigment analysis and consider what would happen if a database existed that contained the provenance history of all different sources for pigments used in Western medieval illumination and Renaissance painting. Understanding van Eyck's work in relation to global systems of trade, commerce, and economic value at the material level would change dramatically and unpredictably using such a tool. Querying such a database would require using information visualizations of networked relations, statistical information, and other analytic techniques. We might situate van Eyck in a very different set of associated art works, each brought into view from one of many online repositories. Such a display would demonstrate what enhanced curation looks like in a digital age. Pursuing this further, we can continue by mining metadata, crafting links to every known purported wedding portrait, or image of a married couple and the symbols and objects surrounding them, every painting with a mirrored reflection, other symbolic images of *memento mori*, other portraits of pets, scenes of domesticity and ritual, possibly of pregnancy foretold, of costume and interior decoration, of perspectival construction, point-of-view systems—the list could go on.

The point is that we could situate a work within the many networks from which it gains meaning and value, and then present the results within complex visual arguments—the kind that were elaborately constructed on slide tables before being reduced to side-by-side comparisons for lectures or standard print publications. Though this example is only a sketch, it contains a hint of the ways art history might change if scholars took full advantage of computational capacities and techniques to ask questions of larger corpora. Just as some late twentieth-century scholarship shifted approaches to the study of objects away from the connoisseurship of autonomous objects toward the analysis of social conditions, so too the computational assessment will demonstrate the identity of objects as nodes in many various networks of cultural relations. The computational, statistical, and informational components of a work will provide new bases on which the judgment of the trained historian can build.

We are still some distance from having the computational instruments that will support the scenario outlined above, but the tools to develop them are in play: repository development, database creation, metadata enhancement, provenance studies, visual or cultural analytics, and new approaches to curating and publishing.

The first phase of digital activity in art history has been characterized by repository building. We now take for granted having access to images in digital form. Almost overnight, it seems, the inventories of museums, libraries, galleries, and collections have been digitized. We are suddenly able to avail ourselves of the great corpus of art historical, architectural, archaeological, and other cultural artifacts through a Google image search, snapping our PowerPoints into place in a fraction of the time it took to make our slide-table lectures in the visual resources rooms of an earlier era. Ease, convenience, and availability are signs that an economy of plenty has replaced that of scarcity. This is *digitized* art history, one built on the use of online resources.

But no particular changes of thought or critical stance come with this convenience, even if the days of slide-hoarding possessiveness are mercifully past, and the range of images and resources available are also more varied as well as more numerous. Challenges remain before the full corpus (however defined) of art historical images will be online—if ever.[4] But even if this conversion into digital access and delivery has wrought substantive changes in the world of visual resources management, it has not had a ripple effect on the intellectual foundations of art history.

If I go back to the earlier comparison with the impact of theory, other contrasts arise. Theory arrived above ground—its forces occupied the classrooms, lecture halls, conference proceedings, and publications in full view. Digitization arrived through the reworked infrastructure of our entire practice. This infrastructure has become naturalized so quickly that we take it for granted, like indoor plumbing or electric light. All of the humanities are being reformulated at the intersection of technical and cultural formations. The co-dependence between technical and cultural life has never been so rapidly deployed in reshaping objects, practices, and their conception. Digitized materials are basic to "how we do art history" in our time—but the arrival of digital practices has been both a stealth attack on the systems of production and a rapidly naturalized condition of reception. Changes in academic publishing are still ahead, and when they arrive, they will bring home some of the liabilities and benefits of working in digital environments.

But a clear distinction has to be made between the use of online repositories and images, which is *digitized* art history, and the use of analytic techniques enabled by computational technology that is the proper domain of *digital* art history. We have to take into account the ways digital humanities more broadly have taken up computational techniques and then consider the specificity of visual art objects and their particular requirements and points of resistance.

New methods have emerged to form the core of what is now commonly, if imprecisely, referred to as digital humanities. Text "mark up," topic modeling, structured metadata, visualization of information, network analysis, discourse analysis, and virtual modeling, simulation, and aggregation of materials distributed across geographical locations are all touchstones of new practice and thought. These approaches are not merely tools for accessing materials online, but ways of thinking with digital processes. But most of the first generation digital projects were text-based, data-driven, or metadata-focused. Why? The input devices for creating digital files were alphanumeric keyboards. Words, texts, numbers, and statistical information comprised the sources that were migrated from analog to digital.[5] All digital files are remediations of

analog materials, but the translation of a typewritten or printed text into a digital transcription has a one-to-one relation of source to code.

By contrast, images do not have a "natural" equivalent in digital form. In digital formats, all images are radical remediations, usually several times over—scans of pictures of original works, at best, and oftentimes, scans made from slides, reproductions, and printed versions that are a step or more removed from the original.[6] Even "born digital" images are mediated by the choice of file formats, lossless or lossy compression, and other material properties of digital code. Techniques for image analysis—such as image parsing (feature recognition) referred to above—require complex computational processes that are still far from being able to imitate human abilities of perception and analysis. Applications such as *Google Goggles* or devices such as headgear display take advantage of the computer's ability to augment human vision, but machine vision has not yet succeeded in imitating our own.

Nonetheless, various techniques of computational analysis can be used to reveal features of art historical artifacts in novel ways. These allow us to rethink the identity, purpose, use, and substance of objects; to ask questions about, for example, production history, or cultural diffusion of style or technique, at micro and macro scales that extend traditional methods of observation and analysis through the use of technological means. An object subject to analysis through a variety of these imaging techniques yields different points of inquiry than when observed only by the human eye. The multifaceted digitization performed by the Western Semitic Epigraphy Project, for instance, yields results through aggregation of the *information* in digital files—processing the data with mathematical rather than optical methods.[7] The result is not merely a visual combination or layering, but an analysis of the statistical patterns generated by the imaging technologies. So if one technique is able to decipher the chemical properties of ink, another able to read dimensional effects of impressions on a surface, and yet another able to pick up on traces of age or wear, these readings can be processed as data points using algorithms that understand visual information mathematically. The results can be queried through faceted searches and used to reveal properties of an artifact that would not have come into view otherwise.

What is the object? It becomes the *effect* of these processes, constituted by the integration of information, and not a static object merely perceived as such. Dynamic queries reconfigure an object through inquiry and along lines of analyses that are multifaceted, not literal, or reductive. Tools for engaging with stylometrics that abstract visual information into data will augment the ability of the human eye to make judgments about attribution and authorship. Chemical traces, microscopic texture analysis, techniques for dating, x-ray and infrared imaging of occluded layers can produce a distinctive "fingerprint" data profile used for identifying an artist's work.

As previously noted, digital objects are fully remediated. They exist in the fungible condition of code. The way artifacts are encoded depends on the parameters set for scanning and photography. These already embody interpretation, since the resolution of an image, the conditions of lighting under which it is produced, and other factors, will alter the outcome. For instance, raking light emphasizes the textures of surface, while direct light puts emphasis on the legibility of the depiction and hence aids in iconography. Other forms of image production concentrate on the chemical or physical properties

of an artifact, and this kind of imaging produces statistical information that can be processed for multiple forms of analysis. Not only is the composition of an artifact able to be studied according to precise parameters of physical description, but such information also links to patterns of trade in pigments and materials as well as transmission of specialized knowledge and skill. Any piece of art historical information that can be parameterized—given a specific metric value—can be processed computationally. The scale of analysis, as well as the range, is unparalleled in prior art historical research. The very notion invoked in the Arnolfini painting example—that pigment analysis might be performed on all known and extant medieval manuscripts and Renaissance paintings as a realistic possibility—opens the horizon of inquiry in the field.

This has implications for the basic ontological assumptions on which we proceed, as well as for the critical study of the social production of art and the transactions through which works circulate as real and symbolic objects in the social imaginary. While the rhetoric of social production has asserted the systemic and constitutive character of works of art within their networks of production and reception, the sheer scale of material evidence that has to be processed to support a substantive systems theory approach is currently beyond the scope of an individual researcher. While judgment cannot be automated, the analysis of specific features or properties in large corpora of digital files of texts or images on which art historical research proceeds can be significantly enhanced and augmented by the use of computational techniques. The approach known as cultural analytics, chiefly developed through the work of media theorist and digital humanities pioneer Lev Manovich, is designed to create tools and methods for analyzing large-scale corpora through the use of computer screens with the capacity to display hundreds of thousands of images at the same time in combination with the use of parameters used to sort visual information. Features such as shape, color, structure, orientation, scale, and texture can be processed and sorted in the service of inquiry, classification, or examination in ways unsupportable in analog scale.

Large-scale patterns become evident in data mining, and the value of leaps of scale is particularly striking in looking at trends in social behaviors or activities across a geographical or temporal span. For the most part, data mining in art history depends on the processing of textual material, so it is particularly suited to analyzing the discourses of art history, rather than its objects. The *Getty Provenance Index* (http://www.getty.edu/research/tools/provenance/), a massive database aggregating centuries of transcribed catalog records of ownership histories of works of art, is an excellent example of the benefits reaped by computational processes, since with very simple queries to the database remarkable results can be produced.[8] A painting's history can be tracked across the aggregated catalog and inventory information in an instant, a task that formerly would have taken, literally, years of travel, study, diligent research into obscure corners and archives.

The more that the secondary materials of art history are migrated into digital form, the more benefit will accrue to research in the field. A small selection of provenance materials would hardly work to support scholarship. The statistical sample would be too small for data mining, and the odds of tracking any particular work would also be too limited. But the value of these resources increases exponentially with increases

in the quantity of records that are aggregated. As primary and secondary textual sources for art historical research become available in full-text format, our engagement with discourse analysis will escalate dramatically. Simply tracing terminology for style, technique, attribution, and other basic concepts will expose aspects of the field that could only be partially glimpsed through traditional reading and study. Anne Helmreich's study of markets and sales in the branches of the Goupil & Cie/Boussod, Valadon, & Cie firm in the nineteenth century is a vivid demonstration of the counterintuitive evidence that arises when long-lost or ignored artists turn out to have been popular, or a market for a particular genre or circle of artists appears to have been active in ways formerly unrecognized.[9] These results and others generated through analytic techniques are not endpoints, but rather starting points for thinking about art history and its objects.

A project like the longstanding *Perseus Digital Library* (http://www.perseus.tufts.edu/hopper/), with its interlinked corpus of classical texts that are translated, transcribed, marked up, and searchable through faceted and authoritative means, is so remarkable as a resource that its benefits will only expand. As a model for a scholarly work in the service of historical and humanistic inquiry, Perseus is exemplary, and shows how an integrated resource can serve a discipline-specific field. Creating federated resources, ways of searching across authoritative materials that were not created in a single, homogeneous, and controlled environment, will be increasingly important, particularly if art history is to expand beyond its traditional canons into dialogue with material arts, popular culture, graphic design, decorative arts, fashion, and other fields.

As image analysis becomes more computationally sophisticated, techniques such as those inaugurated by Antonio Criminisi, Martin Kemp, and Andrew Zisserman to analyze the construction of perspectival space in paintings will become the basis of visual data mining.[10] In 2005, they presented a paper based on attempts "to analyze the consistency and perspectival accuracy of the geometry of a painting" using computational methods. The results were linked to other work on computer vision and analysis, and were useful in showing deviation from mathematically perfect models of perspective. Again, the results were a starting point for inquiry, not an endpoint, and meant to provoke analysis of those deviations. Why, for instance, did Raphael (1483–1520) use a particular set of distortions in his construction of space in *The School of Athens* (1510–1511, Apostolic Palace, Vatican) if he knew the techniques of perspective full well? At a small scale, on a minimal corpus of works, this kind of approach seems to replicate the work art historians can do better without the aid of computers, but when we extrapolate such analytic techniques to a larger scale, then the effect is radically different, since we can map standards and deviations across a massive number of specific examples. Visual pattern recognition will alter art history. Return to Arnolfini and ask how many wives, women, or brides are shown possibly pregnant or anticipating pregnancy and what are the graphic indicators of the gravid condition? Such evidence might simply inflame old debates, or might put them to rest.

Virtual conservation and restoration offer opportunities for speculative and comparative approaches to objects as well as the built environment. These techniques will

shape and qualify our historical understanding as will new methods of enhanced curation and display possible in the digital age. The speculative repainting of classical statues, based on extrapolation from existing evidence that may seem mawkish to the modern eye, has been successful in at least provoking art historians to debate the premises on which these visual recreations are done. But no matter how disturbing the virtual images are, they demonstrate that re-creation can be speculative without harm to existing evidence or remains. The thought that no artifact of art history would ever need to be intervened again, except to stabilize its condition, and that reconstruction and repair might be done virtually, as augmented reality images and studies in possibility, rather than physical changes wrought on an existing relic, has its own promise for art historical pedagogy and research.

Architectural historians have made use of virtual reconstructions to pose problems of use, ritual, performance, engineering technology, and style in ways that, again, though possible on paper and in drawn or constructed models, do not have the analytic flexibility that they have in digital form. Stephen Murray's *Mapping Gothic France* (http://mappinggothic.org/) makes excellent use of visualization techniques to compare cathedral architecture in ways that cannot be done using slides or drawings.[11] Using wireframe models from photography, he is able to abstract information for contrast and comparison in forms of display that are flexible and repurposable. Aligning arches, comparing heights and spans, and tracking distribution of knowledge about construction and style, Murray's work links the cathedrals to their cultural conditions of production as well. The Roman Forum and Virtual Karnak projects conducted at University of California, Los Angeles, allow researchers to pose questions about circulation, sight lines, occupation, temporary and permanent structures, ritual processions and a host of other research areas.[12] The ability to inhabit such models virtually, experience times of day and events, to reconstruct experience, has led to reconsideration of assumptions in archaeological and architectural sites. Stuart Dunn's study of patterns of occupation and domestic activity in Bronze Age huts, or Steve Plog's copiously documented and data rich study of the Chaco Canyon site in New Mexico, are two outstanding examples of the integration of modeling reconstruction, artifact remains, and computational and traditional intellectual knowledge.[13]

Finally, we should reflect on the fact that the cultural understanding of a field is embodied in its nomenclature and classifications systems. Cross-cultural differences in naming, organizing, and ordering objects are fraught with political struggles and power relations. Attention to these explicit articulations of worldviews, as well as indigenous and alternative cosmologies that might take center stage in a reworking of our common cultural heritage, also offers a computationally rich potential for analysis, display, and discussion. Exposing the differences among epistemological assumptions and approaches has great benefit in rethinking hegemonic approaches to a field. Thus the basic metadata structures of ARTstor and standards for cataloging cultural objects, when subject to review and revision, might be re-made to allow for multiplicity of viewpoints, commentary, and intellectual content. Even the idiosyncratic and individual schemes by which scholars organize their lectures, thoughts, notes, and approaches might be captured and encoded in ways useful to their areas of expertise.

In summary, we are still in a preliminary condition with regard to digital art history, and yet, already, many basic directions for future work and research have taken shape. We know that repositories will expand, and that as they do, the crucial recognition that *digitization is not representation but interpretation* will serve as a critical springboard for insight. Every choice made about transforming an analog image into a digital file or, in the case of born-digital materials, creating the original format, is part of a chain of decisions that constitutes the digital artifact as certainly as decisions about features like film stock, pigment, substrate, sizing, and/or printing techniques determine the identity of an analog object. The materiality of digital images may be radically mediated, but digital materiality embodies decisions and assumptions that constitute the object as artifact. These decisions carry interpretative inflection; they are not neutral or value-free, and each privileges one aspect of a digital artifact at the expense of others. Once made, these decisions cannot always be reversed, and the artifact embodies the interpretative assumptions by which it was formed. (A useful comparison can be made to the ways decisions about conservation and restoration carry interpretative values at every point.)

Digital techniques for image processing and computational analysis are currently modeled according to intellectual parameters that will require rethinking beyond mere empirical and statistical measures. What can we parameterize? To what values might we assign a metric? And how might computationally generated studies produce a very different object of inquiry than the longstanding techniques of observation with the eye? The huge critical corpus of primary and secondary materials in the field of art history will come online over the next decade, and as they do so, techniques of data mining, network analysis, and textual study will enhance art history in predictable but as yet unacknowledged and underutilized ways. Methods and inquiries specific to the discipline of art history can take full advantage of large-scale visualization, display, virtual and augmented presentations, and models of knowledge made possible by digital technologies that arise directly from art historical knowledge.

Art historians, and other humanists, must first acknowledge that digital models of knowledge in their area of expertise are being made daily—through digitization projects, prototypes of archival production, virtual rendering, image study, metadata production, classification schemes, and finding aids, to name only the most conspicuous elements in the digital landscape. Once they recognize the gravity of this fact, they will realize that they do not want to cede production of the digital future of art history to those outside the field. At the moment, however, complacency far outstrips urgency with regard to these innovations and their impact. Only a combination of dramatic proof-of-concept works and strategic funding and hiring initiatives will change the field—if it even wants to be changed. Plenty of art historians will be content to shrug, say "Why bother?" but as they do so, they will watch the field change out from under them.

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1 *Blackwell's Companion to Digital Humanities*, ed. Susan Schriebman, Ray Siemens, and John Unsworth (Oxford: Oxford University Press, 2004) contains almost no reference to art history, and a look through other anthologies and journals concerned with digital humanities makes clear the under-representation of art history.
2 See Mieke Bal and Norman Bryson, "Semiotics and Art History," *Art Bulletin* 73, no. 2 (June 1991): 174–208 for one summary, milestone piece.
3 The interpretation of this as a wedding portrait, even a sort of witness to the event, was put forth originally by Erwin Panofsky, "Jan van Eyck's Arnolfini Portrait," *Burlington Magazine for Connoisseurs* 64, no. 372 (March 1934): 117–19 + 122–27. Subsequent interpretations have argued otherwise, with a recent contribution by Margaret Koster suggesting it may even be a memorial to the woman pictured, a wife already dead. See "The Arnolfini Double Portrait: A Simple Solution," *Apollo* 158, no. 499 (September 2003): 3–14, and at http://www.thefreelibrary.com/The+Arnolfini+double+portrait%3A+a+simple+solution.-a0109131988. My comments on the iconography of the image may be taken as a leitmotif and suggestive reading after Panofsky, historiographic rather than authoritative in its claims and methods.
4 These challenges include migrating private slide collections into the public domain, creating adequate metadata to make materials useful, creating adequate finding aids, search and retrieval systems, and dealing with copyright and contractual issues.
5 These sources include archival materials, demographics, and statistics and textual corpora of all kinds.
6 Born-digital images are another matter, and I am referring here to the common variety of art historical images used for research, lecturing, publishing, not original works of art in digital format.
7 *Inscriptifact*, a project of the University of Southern California's West Semitic Research Group, http://www.inscriptifact.com/.
8 The *Getty Provenance Index* contains over 1.1 million records culled from inventories, catalogs, auction records, and other documents.
9 Anne Helmreich and Pamela Fletcher, "Local/Global: Mapping Nineteenth-Century London's Art Market," *Nineteenth-Century Art Worldwide* 11, no 3 (2012) at http://arthist.net/archive/4125.
10 Antonio Criminisi, Martin Kemp, and Andrew Zisserman, "Digital Art History, A Subject in Transition," *Microsoft Research* (January 2005) at http://research.microsoft.com/apps/pubs/default.aspx?id=67264.
11 See also the "Digital Crossroads: New Directions in 3D Architectural Modeling in the Humanities" special issue of *VR* (25, no. 4, December 2009) at http://www.tandfonline.com/doi/abs/10.1080/01973760903331742#preview.
12 *Digital Roman Forum*, at http://dlib.etc.ucla.edu/projects/Forum/ and *Digital Karnak: Google Earth*, http://dlib.etc.ucla.edu/projects/Karnak/google_earth/. See also Christopher Johanson, "Visualizing History: Modeling in the Eternal City," *Visual Resources* 25, no. 4 (December 2009), 403–18.
13 Stuart Dunn, *Motion in Place Platform* (MiPP), http://www.kcl.ac.uk/innovation/groups/cerch/research/projects/completed/mipp.aspx and http://www.motioninplace.org/; and Steve Plog, *Chaco Research Archive*, http://www.chacoarchive.org/cra/.