Jane M. Gaines

1 The DH Dilemma: Knowing More & Knowing for Sure vs. Never Knowing At All

Introduction

Why Digital Humanities? In 2004, two U.S. Humanities Center heads published a "Manifesto" in *The Chronicle of Higher Education*. Humanities in research universities were being left in the dust, they argued. In their analysis, humanities knowledge, in contrast with the sciences and social science, had not been historically associated with "discovery."[1] A decade later, the opposition between fields continued, as in Alan Liu's reference to "two cultures," although he saw an "artificial divide" between the sciences and the humanities and envisioned Digital Humanities as bringing the humanities and the sciences closer together.[2] I am not so sanguine about Liu's bridge to the sciences, however. Instead, I note with interest his advocacy for more dialogue between digital humanities and new media studies, as well as media archaeology.[3] For this, I have more hope, especially as the critique of what I call the "computational" develops.[4] As for film and media studies, I propose a contrast *within* the promise of datafication – knowing more, as opposed to knowing for sure, that is, knowing with scientific certainty. But in the end, I veer off into philosophical territory and conclude with the quandaries of what it means to find productivity in the void of *never knowing at all*, that is, never knowing despite having searched.

The 2004 DH "Manifesto" sets up this field dichotomy with its reference to, on the one hand, "critical reflections" on the creation of knowledge and, on the other, the "effects" of knowledge and the attendant implications.[5] It would seem that

1 Cathy Davidson and David Theo Goldberg, "A Manifesto for the Humanities in a Technological Age," *The Chronicle of Higher Education* 50, no. 3 (February 13, 2004): B7–B9, accessed February 28, 2023, https://www.chronicle.com/article/a-manifesto-for-the-humanities-in-a-technological-age/.

2 Alan Liu, "Where Is Cultural Criticism in the Digital Humanities?" in *Debates in the Digital Humanities*, ed. Matthew K. Gold (Minneapolis: University of Minnesota Press, 2012), 496.

3 Liu, "Where is Cultural Criticism in the Digital Humanities?" 501.

4 I have long preferred "computational" to "digital," but this stems from a conversation I had with Kate Hayles around 2007 in which I recall that she said computer scientists preferred "computational"; while at the time I thought that the term might emerge as more pronounced in the humanities, its functionality remains to be seen.

5 Davidson and Goldberg, "Manifesto."

https://doi.org/10.1515/9783111082486-002

"knowledge-effects" implies measurability and consequently accountability, whereas "critical reflections" suggests quite the opposite of the quantifiable and the verifiable. For a moment, however, think of the enormity of the area of inquiry that "critical reflections" can cover. Critical approaches might not only interrogate but might completely abandon the computational project of data collection, storage, and output. Or, critique can even become inquiry into the almost incomprehensible or even unfathomable, either because of the enormity of datasets or the notorious opacity of computational processes themselves.[6]

What is our job? Thinking about how sound and image-making machines were invented and what such machines can do has been basic to film and media theory and historiographic research across the twentieth century and into the twenty-first. In 2009, Tara McPherson charged the field with theorizing new computational research methodologies, arguing that a film theory legacy should translate into a special facility, a ready-made critical orientation, and asking "Who better to reimagine the relationship of scholarly form to content than those who have devoted their careers to studying narrative structure, representation and meaning, or the aesthetics of visuality?"[7] In the decade after her invitation to such reimagining, many scholars trained in the field innovated amazing projects that transformed historical research.[8] But let's add to McPherson's point about film scholars having a background in narrative and visual aesthetics, their knowledge of the history of technology as well as the broadcast of mass culture – preparation for some of the best work on the history and theory of networked communication.[9] Still, as Miriam Posner and Lauren F. Klein remark, the field as a whole has yet to "fully grapple" with data as a medium.[10]

Film and media studies may already be aligned with the broad "critical humanities," as it continues the politics of "critical theory," and remembers post-

6 Christine L. Borgman, *Big Data, Little Data, No Data: Scholarship in the Networked World* (Cambridge, MA: MIT Press, 2015); Mark B. N. Hansen, *Feed-Forward: On the Future of Twenty-First Century Media* (Chicago: University of Chicago Press, 2015), 70, refers to technical processes that are "cognitively inscrutable" to humans.

7 Tara McPherson, "In Focus: Digital Scholarship and Pedagogy," *Cinema Journal* 48, no. 2 (2009): 120.

8 For one list of links, see: https://transformationsconference.net/dh-cinema-projects, accessed February 28, 2023.

9 See, for example, Tung-Hui Hu, *A Prehistory of the Cloud* (Cambridge, MA: MIT Press, 2015).

10 Miriam Posner and Lauren F. Klein, "Editor's Introduction: Data as Media," *Feminist Media Histories* 3, no. 3 (2017): 2. See also Marsha Kinder, "Medium Specificity and Productive Precursors: An Introduction," in *Transmedia Frictions: The Digital, the Arts, and the Humanities*, ed. Marsha Kinder and Tara McPherson (Berkeley: University of California Press, 2014), 3.

structuralism and semiotics.[11] Also emerging here is "critical code studies," which considers a wider range of technologies of datafication, including self-tracking devices like the wearable Fitbit.[12] And, in the following, this critical theory legacy informs my focus on graphic form data visualization or data modeling as a point of departure to discuss the implications of using applications designed for the sciences as one way to configure humanities projects around the question of disciplinary difference. But before we go too far down this road, since we are considering disciplines, the "form of knowledge" issue will inevitably lead back to what, after all, constitutes knowledge, in addition to how we assume it is acquired and, most importantly, stored, as datasets grow to enormous proportions and Google Books scans millions of book titles that it refers to as a "body of knowledge."

And yet introducing the term "knowledge" is always risky, given the centuries-old philosophical approach to thinking about the nature of knowledge. "What is knowledge?" as a question dates from Socrates' dialogue with young Theaetetus to whom he explains that knowledge is not the same as belief but requires "justification." The elaboration of justification as irrefutable evidence then fell to Descartes, who introduced "certainty" as a concept. Descartes is followed by John Locke, who developed empiricism as the philosophy that beliefs are justified by experience. Locke's further elaboration finds knowledge stored in the mind as the collection of ideas.[13] What surprises me in this textbook account is that philosophy, also associated with the imponderable and the unfathomable, was so early associated with evidentiary certainty, historically the terrain of science. And so it is that common sense has come to see knowledge as synonymous with certainty along with its attendant empirical vantage which has its tautological form in *to know is to know*.

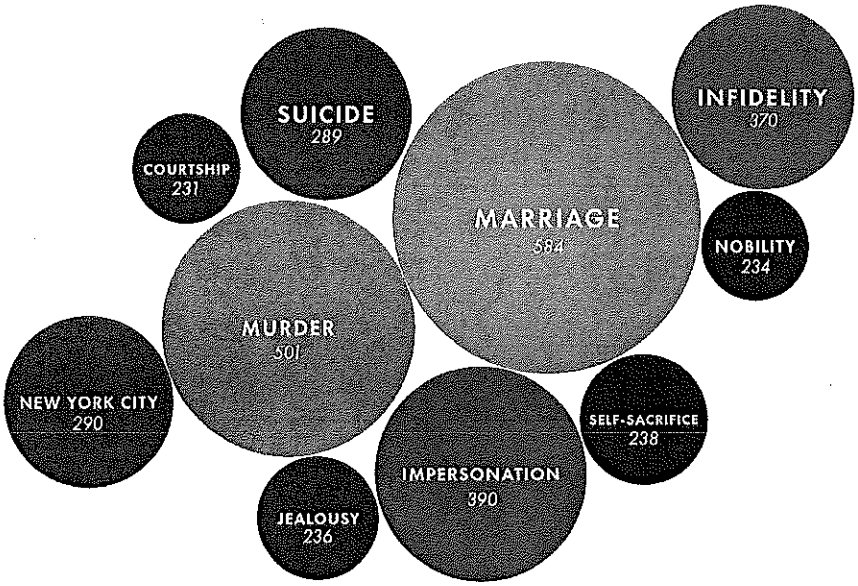
We must ask about knowledge in the light of a standard position used to defend Digital Humanities computational methods. These methods are not only defended by the research advantage of "more" knowledge, and "knowledge labor" made efficient. One also encounters the claim that datafication yields "better knowledge." This, however, is where we need to ask: does "better" mean more

11 One often finds reference to Roland Barthes, "From Work to Text," in *Image/Music/Text*, trans. Stephen Heath (New York: Hill and Wang, 1977), 155–164. In the U.S., the journal that keeps the connection vital is *Critical Inquiry*. See, most recently, Orit Halpern, Patrick Jagoda, Jeffrey West Kirkwood, and Leif Weatherby, "Surplus Data: An Introduction," *Critical Inquiry* 48, no. 2 (2021): 197–210, accessed June 30, 2023, https://www.journals.uchicago.edu/doi/full/10.1086/717320.

12 Mark Marino, *Critical Code Studies* (Cambridge, MA: MIT Press, 2020); Sun-ha Hong, *Technologies of Speculation: The Limits of Knowledge in a Data-Driven Society* (New York: NYU Press, 2020).

13 Anthony Appiah, *Thinking it Through: An Introduction to Contemporary Philosophy* (New York: Oxford University Press, 2003), 41–47, 53–54.

"correct" or "more data"? If "more data," this is where computation has made an undeniable impact in silent film history research in the kinds of breakthroughs I call historical *course correction*. One recent example of *course correction* would be the work of the American Film Institute (AFI) project "Women They Talk About: Exploring Female Filmmakers in Early American Cinema." With a National Endowment for the Humanities grant, AFI researchers undertook a statistical analysis of silent era film credits. One of their goals was to correct the widely circulated estimate that 50% of silent era screenwriters were women. The AFI study of the U.S. case shows that, on the contrary, between 1910 and 1930, 27.5% of U.S. feature films were credited to women.[14]



J: Please ention Fig- 'e 1–2, 4–5 in e text.

Figure 1: "Women They Talk About" Project Data Visualization. Top Ten Subjects of Films Written About by Women in Silent Era. Courtesy American Film Institute.

When it comes to historical *course correction*, computational methods have been a boon across humanities disciplines, regardless of the cultural status of the object of study. Does this mean that digital humanities has in any way levelled the "cultural

14 American Film Institute: "Women They Talk About" Project (January 2023), accessed June 30, 2023, https://aficatalog.afi.com/wtta/; Jane M. Gaines, "How Wrong We Were: Women in the Silent Era American Film Industry," accessed June 30, 2023, https://devaficalmjediwestussa.blob.core.windows.net/images/sites/3/2023/01/AFI-Women_Gaines.pdf.

playing field," so to speak? Maybe, maybe not. Film and media studies is oddly implicated in the question of knowledge since, as John Hartley has pointed out, our original object of study did not originally "qualify" as knowledge in the academic sense. Unlike word-based print – the "preferred medium of knowledge" – moving pictures were thought to require no specialized knowledge at all.[15] Proof of this "no knowledge needed" was that no education was required to access film and television entertainment. What was there to know or to learn to appreciate about "the popular" anyway? After all, moving images were so effortlessly "known" – that is, recognizable for what they represented (the visible world as seen), and furthermore were widely available as mass culture. Such mass culture was not as scarce and therefore not as valuable as high culture. Against this, semiotics and cultural studies taught that images needed to be "read" by academics. Still, institutions of higher learning have been keepers of the secret key that unlocks access to the print-based culture, that culture on which academic humanities knowledge has historically relied. And one more thing about our originally unacademic object of study – because motion pictures were machine-made, not man-made, or worked automatically without humans, the field compensated for this by privileging old humanities high art approaches. As we all know, the best example of this old humanities hold over is *auteur* studies, dedicated as it has been to elevating the motion picture film to the degree that it could be found to be the artistic "expression" of the director. However, as a consequence of decades of attempts to elevate moving pictures by the analogy to literature, we may have been too slow to embrace the history of technology, relative to which we are now called upon to think how machines produce "art" if "art" is considered the exclusive domain of the artist-human.[16]

In addition, film and media studies, in comparison with literary studies, has had a historically different relation to computational developments in research and teaching. The contemporary moment might appear to witness a trajectory *away* from 1970s close analysis of the single canonical film text toward distribution and exhibition, but at the same time moves *back* to the canonical text with computation aiding ever more sophisticated variations on shot counting.[17] Reach-

15 John Hartley, "Digital Scholarship and Pedagogy, the Next Step: Cultural Science," *Cinema Journal* 48, no. 2 (2009): 141–143.

16 Kashmir Hill, "With A.I. Appropriating Their Style, Some Artists Join the Resistance," *New York Times* (February 19, 2023), 6.

17 For one example, see the study of city films exemplified by BERLIN, SYMPHONY OF A GREAT CITY (1927) and MAN WITH A MOVIE CAMERA (1929) in Eva Hielscher, "The Phenomenon of Interwar City Symphonies: A Combined Methodology of Digital Tools and Traditional Film Analysis Methods to Study Visual Motifs and Structural Patterns of Experimental-Documentary City Films," *Digital Hu-*

ing back further, however, the academic foundation of film studies, dedicated as it has been to close text analysis and theories of the image, did not commit to countable research outcomes but to the exact opposite. It was instead avowedly anti-empiricist.[18] In addition, the post-structuralist rejection of objectivity charged the documentary with having too close a tie to the camera as objective instrument. In the 1970s *Screen* theory moment, historian Barry Salt became a pariah for counting average shot length (ASL) and correlating film titles based on ASL by decades; his method exemplified empirical tabulation and measurement, then an anathema to film theory, dedicated as that theory was to anti-historicism and the critique of positivism. Yet after Yuri Tsivian's *Cinemetrics* ASL collection project website launched in 2005, Barry Salt was rehabilitated along with his Starword statistical style analysis.[19] In a way, the *Cinemetrics* model anticipated the revolution in the analysis of film form, an approach which comes to fruition in Barbara Flückiger's Analysis of Film Colors, a massive project testifying to the complexity of the cinematic text, but also reminding us of the multiple numerical aspects of our particular object – edge numbers, shot length in seconds, aspect ratio, film stock gauge measured in millimeters, responsiveness to light represented by numbers, and of course the measurement of film stock color temperature.[20]

Just considering the material specificity of our moving image object of study, as well as the statistical significance of its mass circulation, it might seem that the use of computational tools yielding quantified research outcomes is inevitable and returns us to empiricism with a vengeance. We can point this out, but we cannot leave it at that. Why? Two reasons:

1. Because our assessment may be too soon. I say this, considering the especially creative analytical possibilities. For example, see ALIEN VISIONS (Pablo Nunez Palma & Bram Loogman, 2020), a work based on machine sorting of newsreel footage that takes the problem of machine indecipherability and reverses it to ask: what if humans were the machine and the human was alien?[21]

---

manities Quarterly 14, no. 4 (2020), accessed June 30, 2023, http://www.digitalhumanities.org/dhq/vol/14/4/000495/000495.html.

18 See Jane M. Gaines, "What Happened to the Philosophy of Film History?" *Film History* 25, nos. 1–2 (2013): 70–80.

19 Barry Salt, *Moving Into Pictures: More on Film History, Style, and Analysis* (London: Starword, 2006), accessed June 30, 2023, www.starword.com/index.html.

20 Barbara Flückiger and Gaudenz Halter, "Methods and Advanced Tools for the Analysis of Film Colors in Digital Humanities," *Digital Humanities Quarterly* 14, no. 4 (2020), accessed June 30, 2023, http://digitalhumanities.org/dhq/vol/14/4/000500/000500.html.

21 See https://sensorymovingimagearchive.humanities.uva.nl/index.php/2020/05/17/semia-artist-projects-and-alien-visions-pablo-n-palma-bram-loogman-2020/, accessed June 30, 2023. For those of us who have regretted the paucity of Digital Humanities approaches to sound, listen to *Rendered*

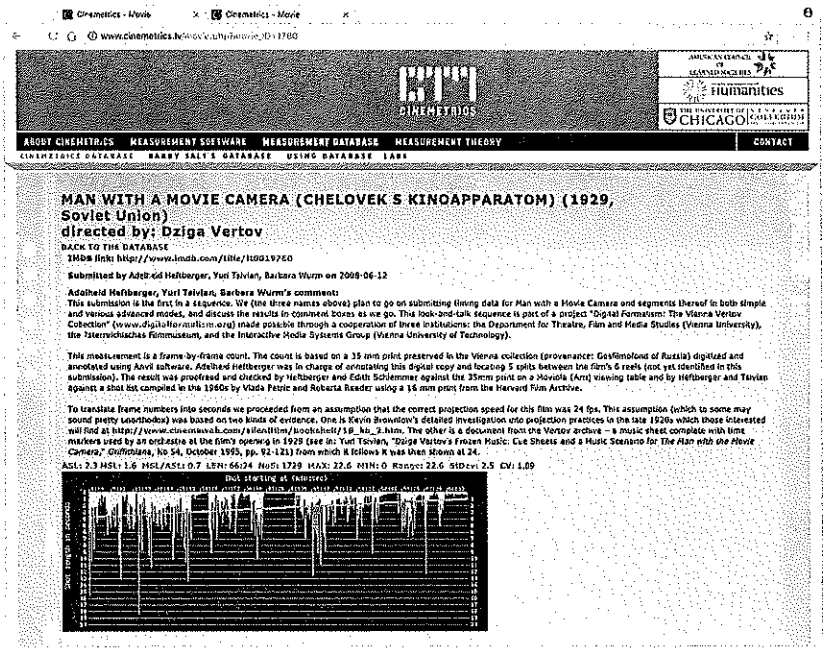


Figure 2: *Cinemetrics* frame-by-frame count and ASL graph. MAN WITH A MOVIE CAMERA (Dziga Vertov, Soviet Union, 1929). Courtesy Cinemetrics.

2. Because we know too much. By this I mean that there are familiar theoretical issues at stake and here I raise only a few. For one, with the computational, the old stand-off between word culture and image culture comes to the fore again. Mark Williams, situating the Media Ecology Project, foregrounds the historic "tension" between visual culture and word culture.[22] For "keywording," "searching," "tagging," and word "prompting" co-exist with the outcome – graphic visualization of data – at the operational level. Note the function of "prompt" in the verb form: words "prompt" images. There is a disciplinary dichotomy between

Environments (Adam Jurasezek, 2016), processed using SuperCollider software from radio broadcast snippets: https://sovnrecords.bandcamp.com/album/rendered-environment, accessed June 30, 2023. I would still argue that we need more work that goes further to blur the distinction between experimental video art and digitally enhanced research projects.

22 Mark Williams, "The Media Ecology Project: Collaborative DH Synergies to Produce New Research in Visual Culture History," *Digital Humanities Quarterly* 15, no. 1 (2021), accessed June 30, 2023, http://www.digitalhumanities.org/dhq/vol/15/1/000524/000524.html.

word culture and visual culture, as well as a hierarchy evidenced in the degree to which word culture research projects far outnumber visual culture projects. As Lev Manovich puts it, Digital Humanities as a field remains dominated by word culture.[23] He also objects to the very term "digital humanities" which he finds both too narrow and too broad.[24] His analysis of broad *and* narrow, however, lends support to my argument that film and media studies projects need to engage with the larger field *and* to carve out a space of expertise within it that might be *for* as well as *against* "digital humanities." But an important caveat: such expertise *must include the film and media studies legacy of critique.* Recall the critique of traditional empirical methodologies that responded to the so-called "historical turn" to New Film History, a critique on behalf of theory: the issue was a concern that the turn to empiricism abandoned the anti-empiricist foundations of the field, as I have just noted.[25] But now the question has been raised as to whether we need to call out a second "historical turn" relative to the "new new cinema history."[26] One might say, however, that this "new new empiricism" is not a "turn" either backward or forward but a "leap" to updated empirical research methods, and ever-more-amazing display design, as well as platforms for testing future technologies. But something is a little strange here and our challenge decidedly different from what it was at the New Film History advent. Critique requires us to historicize and to theorize the software-hardware interface of the computational apparatus *at the same time* that we are relying on that very apparatus for historical research on earlier technologies and their social moments.

23 Lev Manovich, *Cultural Analytics* (Cambridge, MA: MIT Press, 2020), 9. His example is one of the smaller percentage of visual culture projects presented in the 2019 Utrecht Conference on Digital Humanities.

24 Manovich, *Cultural Analytics*, 7. Marsha Kinder and Tara McPherson, "Preface: Origins, Agents, and Alternative Archaeologies," in *Transmedia Frictions: The Digital, the Arts, and the Humanities*, ed. Marsha Kinder and Tara McPherson (Berkeley: University of California Press, 2014).

25 Gaines, "What Happened to the Philosophy of Film History?"

26 Daniel Biltereyst, Richard Maltby, and Philippe Meers, "Introduction: The Scope of New Cinema History," in *The Routledge Companion to New Cinema History*, ed. Daniel Biltereyst, Richard Maltby, and Philippe Meers (London: Routledge, 2019), 9. Chris Yogerst, review of *Explorations in New Cinema History*, posits another "historical turn," *Journal of Cinema and Media Studies* 60, no. 3 (2021): 210.

Arclight Software, *Lantern* Search Tool, and Early Film Datasets

As we know from "critical code studies," whatever the promise of statistical certainty, data is not pristine, given the unavoidability of biases in dataset selection and software design.[27] Cautioning us, the editors of *The Arclight Guidebook to Media History and the Digital Humanities* quote Deb Verhoeven on the kinds of assumptions programmed into databases, leading her to warn that "interrogating software and databases is as important as technical mastery."[28] It might appear, however, that more often than not, interrogation is limited to a cautionary aside within the literature. Where and how do we undertake a robust interrogation, from science-based software development, to server farm energy gluttony, to biases in datasets, to deceptive data visualization? Can we do this all at once?

Although in the following I begin by testing approaches to the critique of data visualization exemplified by the Timeline and the Dendrogram, I first want to highlight a key difference between the literature on film and media studies computational projects and literary studies scholarship, which even insightful analyses of what could be called an "ideology of datafication" may gloss over or postpone.[29] For example, one literary scholar states that, just as in other disciplines, humanities scholars are increasingly dealing with "data." But then he asks whether "data" replaces "books, paintings, movies."[30] The problem here is that this observation only deals with the *word* "data" and not at all with the processes of scanning or digitizing books as opposed to still and moving images. Datafication is, of course, the product of documents having been scanned or digitized, and my impression is that the terms *digitization* and *scanning* appear more in film and media studies than in literary digital humanities project studies. One expects to see in all DH literature the standard thinking about image "resolution" based on scan rate, the difference between 600 and 1200 dpi (dots per inch). Or the pro-

27 Lisa Gitelman and Virginia Jackson, "Introduction," in *"Raw Data" is an Oxymoron*, ed. Lisa Gitelman (Cambridge, MA: MIT Press, 2013), 1–4.

28 As quoted in Eric Hoyt, Kit Hughes, and Charles R. Acland, "A Guide to the Arclight Guidebook," in *The Arclight Guidebook to Media History and the Digital Humanities*, ed. Charles R. Acland and Eric Hoyt (Falmer: REFRAME Books, 2016), 23, accessed June 30, 2023, https://projectarclight.org/book/.

29 However, see Hong, *Technologies of Speculation*, 4–5, for an analysis of how "technologies of datafication" work through a new objectivity to effectively deliver "better knowledge" in the image of data visualization itself.

30 Christof Schöch, "Big? Smart? Clean? Messy? Data in the Humanities," *Journal of Digital Humanities* 2, no. 3 (2013): 1.

cess of datafication in which unlike aesthetic objects become information, transformed into computable data to be operationalized, and requiring software/computer interface. One wonders as well why in the majority of DH literature one finds so few references to Optical Character Recognition (OCR) software and the process of translating numerical into graphic values. Given that the wider DH field remains so dominated by word culture, I wonder how much longer such seeming obliviousness to the technological can be sustained.[31]

One model of how to foreground the computational is Eric Hoyt's article on how he discovered a hierarchy of influence among early motion picture exhibitors, where he offers detail about the functioning of the Media History Digital Library (MHDL) interface that he helped to design.[32] Even with Hoyt's level of explanation, however, MHDL processes may remain impenetrable to anyone who is not as yet digitally fluent. What Hoyt explains is that the scaled entity search (SES) uses *Arclight* software and the search platform *Lantern* to "draw on" the dataset of the Media History Digital Library. How it works is that "users" input a word into the "query box" located on the MHDL home page. What Hoyt refers to as the "algorithmic backbone" uses Apache Solr, an open-source search technology. From search terms supplied by the "user," the *Archlight* software "generates a line graph." In the next step, the "user" may click on dots that appear in the graph, with each click opening pages of *Photoplay* or *Moving Picture World*, for instance, in *Lantern*.[33] That online search processes and the attendant terminology have already become second nature in the field is all the more reason to foreground steps, name software as well as hardware, and, ideally, interrogate every term. Why, for instance, have we settled so complacently on the term "search"? How did the "user" become constituted as a "user"?[34]

Yet in the same article, Hoyt acknowledges one criticism of digital humanities computational approaches with his metaphor of the way technology *may determine* the kind of research we undertake. As he puts it, if research questions are determined by computational capacity and software design, it may be that, metaphorically, this "allows the tail to wag the dog."[35] To put it another way, it may be that *we look for what we know we can find.* Or, we undertake research to fit available software tools. The keyword search via Lantern Search engine of publications, such

31 Williams, "The Media Ecology Project."

32 See https://mediahistoryproject.org/, accessed June 30, 2023.

33 Eric Hoyt, "Arclights and Zoom Lenses: Searching for Influential Exhibitors in Film History's Big Data," in *The Routledge Companion to New Cinema History*, ed. Daniel Biltereyst, Richard Maltby, and Philippe Meers (London, New York: Routledge, 2019), 84, 86.

34 Joanne McNeil, *Lurking: How a Person Became a User* (New York: Farrar, Straus and Giroux, 2020).

35 Hoyt, "Arclights and Zoom Lenses," 85.

as *Motion Picture World*, invites early cinema "media industries" projects, and *Photoplay* holdings encourage more star studies. Hoyt would counter this with the increased infinity of research possibilities, especially as the MHDL currently contains 2,845,814 pages, 1,944 of which pertain to global cinema sources from China, Iran, and India, now added to the original U.S. and European sources.[36]

Data Visualization

We should still wonder why film and media studies has been relatively peripheral to digital humanities scholarship, given that visual culture analysis is so integral to the broader field. And where more than in the standard use of data display – graphs and charts, maps and timelines? Johanna Drucker in her extensive work on visualization, however, sees a conceptual inconsistency that comes to a head in the use of graphic design in computational data display. Here she finds a paradox: the legacy of *distrusting* images and the *trust* placed in quantitative statistical approaches rendered as data visualization. Why? Charts and graphs appear explicit and unambiguous, even straightforward, in their presentation of information, she answers.[37] But think again. A graph, especially without context, may appear relatively information poor in its non-representational abstraction. Wouldn't such a design signify not explicitness but ambiguity and therefore openness to a range of interpretations? Here, I think, is a second paradox: information certainty is information poverty. Despite this apparent inconsistency (to state the obvious about the computer-generated data chart), trust is crucial, given the representational imperatives built into visualization software: to confirm the assumption of visual equivalency of the mathematical computational; to stand for what it is that we say that we know for sure – to prove beyond doubt, to prove for certain, especially in the context of business and science. To take a field specific example, however, consider Figure 3. The graph represents the use of Project Arclight and Lantern search tools to chart the industry story coverage of Chinese-American motion picture actress Anna May Wong, in contrast with that of German Marlene Dietrich between 1920 and 1945, mapping career highs and lows. What would be our critique of this visualization? After all, the timeline seems so straightforward. But such very apparent straightforwardness is what Drucker wants to call to our attention.

AU: The cross references to figures, tables and equations are highlighted for the author/editor to check and confirm its correct placement. These highlights will be removed in the next stage. Please make changes if necessary.

36 See https://mediahistoryproject.org/collections/global-cinema/, accessed June 30, 2023.

37 Johanna Drucker, *Visualization and Interpretation: Humanistic Approaches to Display* (Cambridge, MA: MIT Press, 2020), 6.

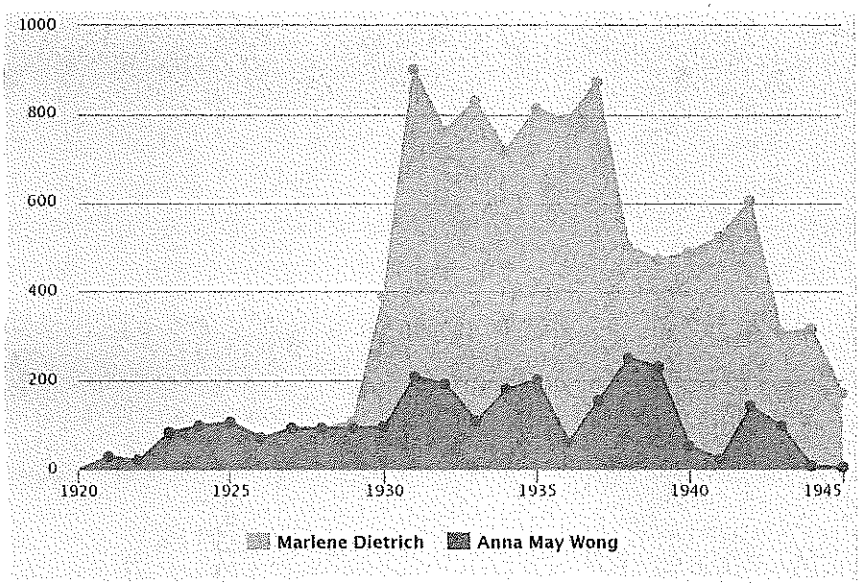


Figure 3: Arclight timeline with graph representing the industry story coverage of Marlene Dietrich and Anna May Wong. Courtesy Media History Digital Library.

Drucker's position is an eerie carryover from the ideological critique of representational images, and a recap of structuralism and semiotics. So when she takes a critical approach to the visualization of datasets and the interpretation of such graphic modeling, it is difficult for media theorists not to experience a sense of *déjà vu* on encountering the phrase "enunciative apparatus of information systems."[38] Because we are adept at the ideological critique of the visual image, as well as narrative as carrier of meaning, one assumes that we would be poised and ready to turn the same critique on forms of *data* or *information visualization.* And what would these visualizations be? Answer: pie chart, dot strip plot, doughnut, ordered bar graph, and timeline. What are these forms expected to represent? Answer: deviation, correlation, distribution, ranking order, spatial relations, magnitude, change over time, part-to-whole relations, and flow, to name a few variable relations of correspondence and non-correspondence.

To start with *data visualization* as one feature that film and media studies computational projects have in common with computational literary studies – the graphic that Drucker treats as a "knowledge form." Here, numbers are translated into graphic values in such a way that their very presentation may be read as in

38 Drucker, *Visualization and Interpretation*, 7.

some way equivalent; that is, the data and the visualization of it are considered, as she says, "one and the same."[39] Then, she asks what "knowledge claims" underly the use of *data visualization*, which as a graph or timeline appears on a screen as something like a "statement of fact" in image form, that is, an abstract non-representational image.[40] Basic to Drucker's critical project is the insistence that the humanities have inherited conventions of data presentation from mathematics, natural sciences, and social sciences, where the very software design assumes that the graph is an "expression" of underlying data. Here, she thinks, is exemplification of the perspectives of empiricism and positivism where the meaning of texts is treated as fixed.[41]

Let's stop a moment here to remind ourselves of how positivism may serve to advance an idea of history, the discipline, as scientific. Then to acknowledge the antidote to this perspective, the school of thought following Nietzsche: "History, so far as it serves life, serves an unhistorical power, and thus will never become a pure science like mathematics."[42] This is also the position of the contemporary philosophy of history, somewhat of an outlier within the discipline of history.[43]

Drucker wants us to foreground the invisibility of the acts of interpretation that disappear in the face of the visualization of statistical data, and to perform something like an ideological critique of the graph, machine/software interface, and search engine navigation. Ideology, as "cultural value," she continues, can be found "in every graphic, layout, format, bit of iconography (as well as interface & navigational features . . . even as it disappears . . . [by means of conventionalization]."[44] Yet we must ask if this doesn't seem elementary. Yes and no. Calling for an ideological critique of *data visualization* might slow the leap onto the digital humanities bandwagon in which functional application comes first, and theory second, if at all. Think back now to the excitement around the possibilities of database reconfiguration of narrative structure based on Marsha Kinder's Labyrinth Project in 1997.[45] Because the Labyrinth projects were received as alternatives to narrative linearity, the first questions they raised did not necessarily have to do with machinic functions.

39 Drucker, *Visualization and Interpretation*, 2.

40 Drucker, *Visualization and Interpretation*, 14.

41 Drucker, *Visualization and Interpretation*, 5–6.

42 Friedrich Nietzsche, *The Use and Abuse of History* [1873] (New York: Cosimo Classics, 2010), 12.

43 For background see Frank Ankersmit, "Bibliographical Essay," in *A New Philosophy of History*, ed. Frank Ankersmit and Hans Kellner (Chicago: University of Chicago Press, 1995), 278–283.

44 Drucker, *Visualization and Interpretation*, 15.

45 See Marsha Kinder, "Designing a Database Cinema," in *Future Cinema: The Cinematic Imaginary After Film*, ed. Jeffrey Shaw and Peter Weibel (Karlsruhe, Germany: ZKM, 2003), 346–353.

In Steve F. Anderson's theorization of recombinant "database histories," they are unlike traditional descriptions of the historical past in that they are instead collections of fragments "infinitely retrievable," categorizable, reconfigurable, and thus open to "continual revision and reinterpretation."[46] Today, thinking about "database history," we might recall Lev Manovich's earlier hypothesis in which the database succeeds the novel and cinema as the dominant form of "cultural expression."[47] Yet in this transition moment, as the database form is no longer compared with narrative form, a different question arises. While we might *hope* that the very invitation to reconfigure that is set up by the "interactive" database might produce critical distance on the production of historical narratives (plural), *the invitation alone is no guarantee*. Engagement is no guarantee that users (as a consequence of use), will come to think of narrative history as an ideological construction. Sarah-Mai Dang, describing the "Aesthetics of Access" project and the interactive Women Film Pioneers Explorer, refers to the tradition of historical research that the Explorer's searches and data reconfigurations are designed to challenge. As she puts it, traditional historiography still carries an "implicit promise" that if enough information is made available, the "whole" historical story (singular) will emerge.[48] We would ask whether resources like the Digital Media History Library offer a "knowing more" that encourages searches for the "whole" historical story. But the critique of "totality" that theorist Siegfried Kracauer associated with photography and film as well as history, for instance, may now be seen as belonging to another tradition, one not only too early but now relegated exclusively to the subfield of film-philosophy.[49] So how do we go about building political analysis in the tradition of film theory's critique of ideology into exercises in computational historiography? This, in a field where we expect researchers to be hyperaware of the constructedness of everything, especially digital materiality and machinic functions.

46 Steve F. Anderson, *Technologies of History: Visual Media and the Eccentricities of the Past* (Hanover, NH: Dartmouth College Press, 2011), 122.

47 Lev Manovich, "Database as Symbolic Form," *Convergence* 5, no. 2 (June 1999): 80.

48 Sarah-Mai Dang, "Unknowable Facts and Digital Databases: Reflections on the Women Film Pioneers Project and Women in Film History," *Digital Humanities Quarterly* 14, no. 4 (2020), accessed February 27, 2023, http://www.digitalhumanities.org/dhq/vol/14/4/000528/000528.html, 4. See also Henri Dickel, Matija Miskovic, Karazm Noori, Christian Schmidt, Atefeh Soltanifard, Sarah-Mai Dang, and Thorsten Thormählen, "Women Film Pioneers Explorer, 2021," accessed June 30, 2023, https://www.online.uni-marburg.de/women-film-pioneers-explorer/index.html.

49 Siegfried Kracauer, "Photography," in *The Mass Ornament: Weimar Essays*, ed. and trans. Thomas Y. Levin (Cambridge, MA: Harvard University Press, 1995), 47–66. See also Siegfried Kracauer, *History: The Last Things before the Last* (New York: Oxford University Press, 1969).

Database to Data Visualization: The Women Film Pioneers Explorer Dendrogram

We can start by taking a field historical perspective on the knowledge form and function of the Dendrogram visualization enabled by the software DISPLAYR on the Women Film Pioneers Explorer's website. First, as an exercise in historical contrast, imagine the 1990s when scholars began collecting documents for a set of Women Film Pioneers source books. That original project conceived in 1993 as a several-volume set never materialized in book form but morphed into an online database launched in New York under the auspices of Columbia University Libraries in 2013.[50] The Dendrogram as a visualized dataset confirms the limitations of the book form to dramatize scope and comparison within categories. Thus constrained, the original goal was to only prove that there were *more* women working as directors and writers in the U.S. in the first two decades of motion pictures than at any time since. Of the three categories made searchable – Name, Geography, and Occupation – the third yielded the most surprising information, indicating a wider range of jobs held by women than we originally projected. This was especially unexpected as we had been more interested in world geography flows, as exemplified by the case of American Fern Andra, a circus performer who left the small town of Watseka, Illinois, to travel to Berlin, Germany, where she founded the Fern-Andra Company in 1917.[51] In 2009, when Women Film Pioneers database design began, Dendrogram-style data display had not been developed for use outside the sciences, and it was only after the partner "Aesthetics of Access" Project used DISPLAYR software to produce data visualization that the research possibilities became evident. It is almost impossible to visualize what the computer can pattern until one has seen the data visualization version of information collected, often the work of decades.

50 See Kate Saccone's article "(Re)Visioning Women's Film History: The Women Film Pioneers Project and Digital Curatorial-Editorial Labor" in this volume for background on how the Columbia University Libraries Digital Research and Scholarship staff worked with scholars to turn Word-files and glossy images prepared for book publication into an interactive website as a pilot project on the future of publishing. Women Film Pioneers Project: https//wfpp.columbia.edu, accessed June 30, 2023.

51 For Fern Andra, see f_films: female film workers in europe, accessed March 27, 2024, https://f-films.deutsches-filminstitut.de/biographien/f_andra_b.htm. Thanks to Paulina Junginger for her continued work on early German filmmakers.

Figure 4: Fern Andra, actress/producer, founder of Fern-Andra Company. Courtesy Deutsche Kinemathek, Berlin, Germany.

In the context of a cultural studies approach to data mining, Adrian Mackenzie asks: "What does machine learning want?" The Dendrogram, as she describes it, is a diagram based on the model of a tree to represent hierarchical clusters, whose arrangement is thought to produce analyses that correspond with its clustering. If its basic use is computational biology, and it is designed for representing gene clusters and fine differentiation between those clusters, we can assume an amazing capacity to order and to differentiate. The Dendrogram graph makes it now possible to analyze classifications within occupations, given that the machine can "recognize and render patterns" that people are unable to manage.[52] In the Women Film Pioneers Explorer Project, the machine undertook the labor of sorting to reveal, for instance, variations on Script work, breaking down that category of work as: Script Assistant, Script Consultant, Script Editor, Script Girl, Script Reader, and Script Supervisor. Then, regarding our query as to whether computational machine enhancement is changing the kinds of questions we ask, consider the original question: "What happened to women in the silent film industries

52 Adrian Mackenzie, "The Production of Prediction: What Does Machine Learning Want?" *European Journal of Cultural Studies* 18, nos. 4–5 (2015): 437.

who were there in numbers around 1917 and then were phased out?"[53] In effect, "What happened to them?" was an unanswerable question from an empirical standpoint and that is exactly why I asked it. The question that *did* become answerable, however, was "In what occupations were they engaged?" As a consequence of both the European "Aesthetics of Access" with its Explorer interactive database and the U.S. American Film Institute "Women We Talk About" projects, it is now possible to shift the emphasis from the original pressure to find more women film directors worldwide and to consider instead categories of work that a new industry created around production, exhibition, and distribution, as well as censorship and the promotion of motion pictures, at the turn of the last century when young women were first entering the labor force.[54]

What can computational tools not be made to do? Most difficult to chart would be the shift in epistemological positions – from the 1970s "no women" position to projects like the American Film Institute "Women They Talk About," dedicated to enumerating and classifying, and the Women Film Pioneers Explorer interactive database, which innovates alternative research approaches featuring computational reconfigurations like the Dendrogram, the Cluster, and the Timeline. In a nutshell, here is the dilemma: historically, the feminist theory of the "male gaze" in classical film narrative functioned to disallow any attempt to count, beginning in the 1970s. How, beginning in the 1990s, could we make the case *with* numbers that women were excluded *in numbers*, that is, to *use* numbers to illustrate that, in the first decades, they were *not* excluded? Indeed, researchers were finding more (in numbers) than scholars first anticipated would be found. To put it another way, the original motivation was to challenge 1970s feminism's pessimistic "no women" film theory – *no women* behind the camera, *no women* in the audience, and women on screen *only* for the pleasure of men. There is apparent *contradiction* in the goal to advance the discovery that there were women at all levels, while maintaining that theoretically there were "no women," the feminist film analysis. The challenge was to keep alive the theory of their "absence" and at the same time prove with a preponderance of evidence that women were there in numbers, as well as in influence, despite their having had little to no influence on the classical Hollywood narrative fiction film, the form exported worldwide. In the end, while the question as to what exactly "happened" to them

53 See Jane M. Gaines, *Pink-Slipped: What Happened to Women in the Silent Film Industries?* (Urbana: University of Illinois Press, 2018), 16–32 (chapter 1).

54 See "Women They Talk About: Discovering America's Female Film Pioneers," accessed June 30, 2023, https://aficatalog.afi.com/wtta/; "Aesthetics of Access: Visualizing Research Data on Women in Film History," accessed June 30, 2023, https://wfpp.columbia.edu/the-aesthetics-of-access-visualizing-research-on-women-in-film-history/.

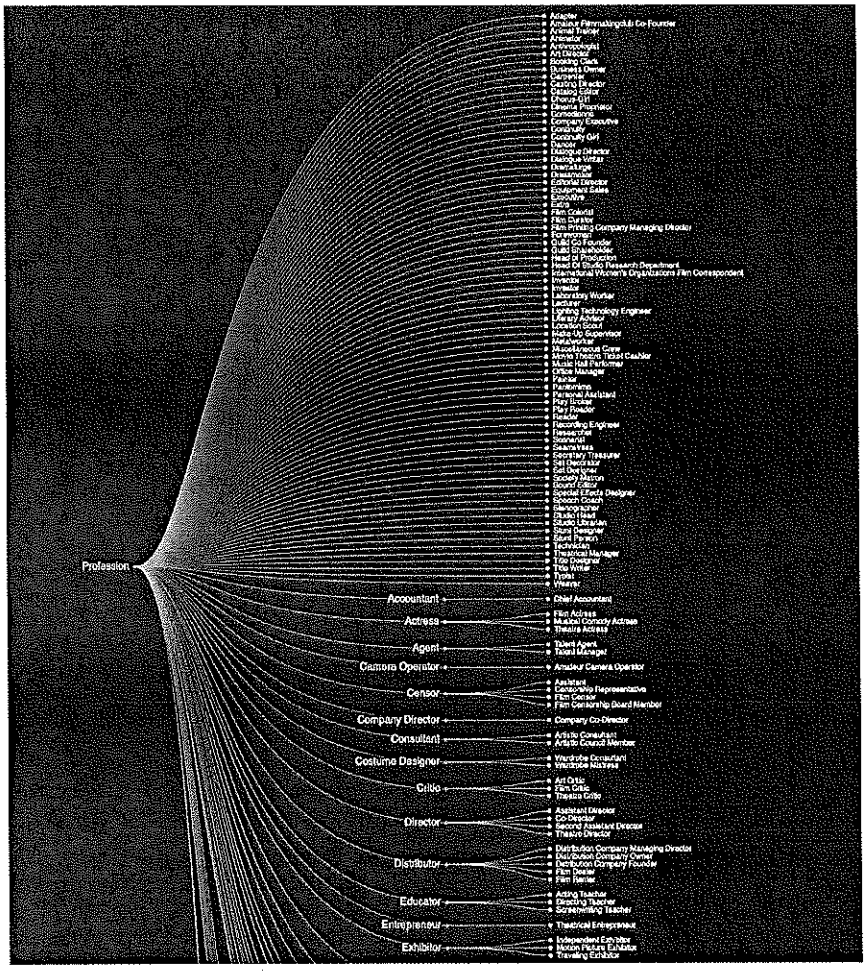


Figure 5: Women Film Pioneers Explorer Dendrogram. Courtesy Aesthetics of Access Project.

may not be empirically answerable, to say that the question is unanswerable is not to say that there is no more to be discovered about the events in the career trajectories of the figures who are still coming to the attention of scholars. Relative to this paradox of *no women but women*, Sarah-Mai Dang asks our question: how is it possible for a database to take into account the "contradictions and contingencies of history"?[55]

55 Dang, "Unknowable Facts and Digital Databases," 7.

Theories of History: The Timeline

A computer-generated timeline, amazing as it is, especially supplemented with a graph dotted with points, is still a timeline. Let's not forget that 1970s film theory challenged traditional historiography as the "linear" narrative that the historian imposed on events, or that, in the "linguistic turn," theorists of history challenged as the narrativization of historical discourse.[56] But as a graphic display of a data-set, a "translation" of numbers into lines and shapes, the timeline raises issues germane to the philosophy of history as well as film and media theory. Let's take these one at a time, first representationality. There is of course the data-set-to-visualization relation – the issue as to what it is that a timeline graph represents, especially if it is taken to be data that is unproblematically "the same as" its graphic form, to recap Drucker.[57] We might object that in media theory a timeline visualization might be treated not as a representation but as a "remediation" of underlying data. For instance, one can ask how many mediations the Project Arclight timeline (Figure 3) is away from the original historical events – first the pre-1920 early lives, followed by the careers of Anna Mae Wong and Marlene Dietrich. Film historians might supplement the graphic abstraction with what they know about the Chinese-American actress as well as the German actress before, during, and at the end of World War II.[58] Then, one can ask about processes of transformation from events to published fan magazine stories over the period 1920 to 1945, and from magazine pages scanned and converted in bulk to data and as numerical values transformed into screen display. Even with this kind of critical media engagement, however, we might take the timeline for granted and fail to ask why the chronological ordering of events in time in the first place – as though it is the only possible ordering. And let's not fail to notice here that the term "order" has come to be synonymous with "chronology," as though there could be no other kind of ordering.

Thus, second, insofar as the graphic timeline assumes chronology, a critique of graphic conventions cannot avoid the historical backstory of the measurement

56 On the more recent "postnarrativist" shift and reference to the earlier "historical turn," see Frank Ankersmit, "Forum Debate on Jouni-Matti Kuukkanen's Postnarrativist Philosophy of Historiography," *Journal of the Philosophy of History* 11 (2017): 1.

57 Drucker, *Visualization and Interpretation*, 2.

58 See Patrice Petro, "In the Wings," in *Idols of Modernity: Movie Stars of the 1920s*, ed. Patrice Petro (New Brunswick, NJ: Rutgers University Press, 2010), 270–283; Yiman Wang, "'Speaking in a Forked Tongue': Anna May Wong's Linguistic Cosmopolitanism," in *Revisiting Star Studies: Cultures, Themes, Methods*, ed. Sabrina Qiog Yu and Guy Austin (Edinburgh: Edinburgh University Press, 2017), 65–82.

of units tied to particular cultures, which, while leading back to the relativity of such measurement, also finds chronology everywhere, especially as the historian's basic tool. Theorist of history Reinhart Koselleck has weighed in on the dependence of standard historiography on chronology understood as "unalterable succession" of one event following another, establishing a necessary "before" and an "after" for past events. The problem, he explains, is that a chronology cannot possibly contain events and yet it must be "made to conform."[59] Finally, not so surprisingly, the standard chronological timeline also corresponds with common sense notions about temporality as a straight line, as in the metaphor of "time's arrow," and the idea that time moves from past to present.[60]

Here is the opportunity that we don't want to pass up – the chance to critique lines of time, such as the chronology as the too easily calculable ordering principle of historical events. For in Koselleck, historical grasp of past events requires a theory not of singular trajectory but of the relation between temporalities plural. In his theory of multiple times, moments that may be enacted and subjectively felt by humans overlap in such a way as to defy objective time measurement, which brings us to his idea of "subjective historical times," or times as registered, experienced, or felt.[61]

AI Affect and the Race between Humans and Machines

Lest we get stuck at the current stage of computer-aided historical research, fascinated with Project Arclight's interactive timeline, let's consider the current impetus to develop alternatives to the timeline. In Drucker's analysis, the network visualization standard based on a visualization timeline represents dynamic historical conditions as static. Most salient, but currently the most difficult, would be how to represent *change over time*.[62] Even more difficult would be how to represent Kosel-

59 Reinhart Koselleck, *The Practice of Conceptual History: Timing History, Spacing Concepts*, trans. Todd Samuel Presner and others (Stanford, CA: Stanford University Press, 2002), 108–109.

60 Koselleck, *The Practice of Conceptual History*, 115.

61 Koselleck, *The Practice of Conceptual History*, 110.

62 Drucker, *Visualization and Interpretation*, 123–124. For an example of a project, Drucker gives the 3D visualization interface *Grand Canyon* developed to represent all the events of the year 1969 drawn from online image libraries; see John David Miller and John Maeda, "A Stitch in Time: Visualizing History Through Unit Forms and Repetition Structures," 2015, accessed February 27, 2023, https://www.researchgate.net/publication/277250414_A_Stitch_in_Time_Visualizing_History.

leck's theorization of multiple historical times and "subjective historical times."[63] Drucker laments that, translated into the work of computer programmers, there is as yet no technical capacity to generate nonstandard metrics, given the need for "warping transformations" capable of indicating "affective forces."[64] She introduces the concept of "affective metrics" that would be "generated from subjective experience," as opposed to those designed to merely "register" that experience.[65] But, if we stand back from such a hypothetical, we must ask if its goal is still the quantification of the unquantifiable, the measurability of the immeasurable.

Let's consider the question of the future goal of computational modeling as adaptation to the kind of complexity valued in fields associated with the humanities as opposed to the sciences. If the issue is how to program computers to register conceptual and affective complexity, and to present such affect as graphic display, we inch towards the challenges of training computers to operate in those intellectual and affective realms in which human beings excel – the domain of current artificial intelligence research. What are tech companies leading us to think about their progress on that old question as to whether computers can be taught to think like humans, but also to feel "just like" human beings?[66] We may be familiar with the big tech argument that Virtual Reality can teach empathy, and even that VR will be the new "digital novel." Then consider the AI Now Institute's "AI Lexicon Project" blog, which features media theorist Hannah Zeavin, who has tracked "empathy" as a goal of robotics, hiring algorithms, and facial emotion recognition. But why empathy, she wants to know. For "empathy" is a strange programming goal, she thinks, given that "knowing" the other may incite violence as much as encourage understanding between people. And, she goes on, as recognition, empathy is still thought to be "impossible to code."[67]

63 For Koselleck's theory of history as relevant to film history, see Jane M. Gaines, "What Next? The *Historical Time* Theory of Film History," in *How Film Histories Were Made: Materials, Methods, Discourses*, ed. Malte Hagener and Yvonne Zimmermann (Amsterdam: Amsterdam University Press, 2023), 59–84. On the complexity of Koselleck's multi-layered theory of history as well as multiple temporalities, see Helge Jordheim, "Natural Histories for the Anthropocene: Koselleck's Theories and the Possibility of a History of Lifetimes," *History and Theory* 61, no. 3 (September 2022): 391–425.

64 Drucker, *Visualization and Interpretation*, 117.

65 Drucker, *Visualization and Interpretation*, 123.

66 Erin Griffith and Cade Metz, "Tech Slump Doesn't Slow New Boom in A.I. Field," *New York Times* (January 7, 2023), B1, B4.

67 Hannah Zeavin, "A New AI Lexicon: EMPATHY," AI Now Institute (September 16, 2021), accessed February 27, 2023, https://medium.com/a-n32-ai-lexicon-empathy-4da12b82e280.

Conclusion: On Not Knowing At All

To return to where I began with the 2004 assessment that science methodologies were more attuned to "discovery" than the humanities. One implication is that the use of metrics in new research initiatives would lead humanities disciplines to be taken more seriously after having reformulated more realizable computer-assisted goals. But, while we are examining disciplines, we also need to acknowledge approaches to the sciences that think about the elusiveness of scientific knowledge proof. Closer consideration reveals the magnitude of unresolved scientific research questions, as dramatized by the end of Siddartha Mukherjee's *The Song of the Cell* with the author's summary on the state of research in cellular biology: "These are mysteries beyond mysteries [. . .] We don't know what we don't know."[68] Or, following neuroscientist Stuart Firestein, who in *Ignorance: How it Drives Science* sees "not knowing" as a "condition of science," that is, the absence of fact as well as understanding. With Firestein's concept of "knowledgeable ignorance" as a way of thought leading to even better questions, we seem to find ourselves on the other side of verifiable knowledge.[69] What, then, if there is another justification for testing models of scientific inquiry on cultural history that is quite the opposite of the measurable outcomes of "discovery"? The obverse would be in "never" discovering, that is, in demonstrating phenomenological loss, forgetting, and non-existence, or the search that yields no data. What is required are methodologies based on the failures of the enumerable and measurable, which call reflexive attention to the immeasurable. What, however, is the reward for the search in vain that hits the limits of the "knowable"? We are asking how we face the impossibility of finding what we expected, of finding at all, when we thought that such a search would at least lead to "knowing more," even if not knowing for sure.

Much of the literature on computation and the humanities seems far from the philosophical literature on epistemology, which leads back to the question of existence, reaching beyond the immeasurable to the completely "unknowable." Perhaps we're called upon to think in two modalities at once – discoverable, categorizable data *and* the realm of the totally undiscoverable. This is reflected in Sarah-Mai Dang's question "Are databases also able to account for what may not be known

68 Siddartha Mukherjee, *The Song of the Cell: An Exploration of Medicine and The New Human* (New York: Simon & Schuster, 2022), 361.

69 Stuart Firestein, *Ignorance: How It Drives Science* (New York: Oxford University Press, 2012), 6–7.

and why it remains unknown?"[70] Taken one way, this question may be an invitation to continue the search for yet-to-be-discovered women. Taken another way, the state of being "unhistoricized" refers not only to women who may have existed, but also those whose lives have either yet to be deemed important enough to search for, or who may never be "discovered." For "unhistoricized" also marks a futile search for those female workers for whom no names were recorded, given the anonymity of early film industry employees.[71] We may be closer to this than one might think. Indeed, developments within the field of feminist media studies point to innovation challenging traditional historiographic scholarship.[72]

A promising model is the kind of counterfactual speculation and "thought experiment" that follows Catherine Gallagher's elucidation of the long legacy of counterfactual history.[73] Although there is as yet relatively little work on how to study the object that never existed, the event that never took place has been seriously taken up by the "counterfactual" approach that answers "What if?" with a fiction that freely departs from factuality. I have argued elsewhere that the counterfactual alternative set of events organized as a timeline is especially effective when fictionalization departs from events verified and consequently established in a field to *fill in* where we do not yet or may never know.[74] One can imagine future projects in which search results are strategically combined with historical speculation. Here we might draw a sharp distinction between the machine's computational timeline and the imaginative alternate account that, defying quantification, cannot be made to "stay on the line."

Yet something may really be afoot. What has emerged coincident with Digital Humanities film and media projects is the serious study of the "lost," the "unwatched," the "incomplete," or "unfinished" artistic project, with an empha-

70 Dang, "Unknowable Facts and Digital Databases," 4. Hoyt, in "Arclights and Zoom Lenses," 87, asks "What historical materials, processes, and experiences do not easily lend themselves to digitization and what effect does their omission have on results"?

71 Dang, "Unknowable Facts and Digital Databases," 11; see Jane M. Gaines, "Anonymities: Uncredited and 'Unknown' Contributors in Early Cinema," in *A Companion to Early Cinema*, ed. André Gaudreault, Nicholas Dulac, and Santiago Hidalgo (London: Wiley-Blackwell, 2012), 443–459.

72 Allyson Nadia Field, "Editor's Introduction: Acts of Speculation," *Feminist Media Histories* 8, no. 3 (2022): 1–7, a double issue on "Speculative History."

73 Catherine Gallagher, *Telling It Like It Wasn't: The Counterfactual Imagination in History and Fiction* (Chicago: University of Chicago Press, 2018).

74 Jane M. Gaines, "Counterfactual Speculation: What if Antonia Dickson Had Invented the Kinetoscope?" *Feminist Media Histories* 8, no. 3 (2022): 8–34, accessed June 30, 2023, https://online.ucpress.edu/fmh/article/8/3/8/190671/Counterfactual-SpeculationWhat-if-Antonia-Dickson.

sis on film and video works produced by women.[75] These projects may not have been conceived in defiance of the measurable or in opposition to the so-called "digital turn." And yet. Taken together, the "unwatched," "incomplete," and "never made," along with the "unhistoricized," constitute a field of inquiry to parallel the computational promise of measurable data.[76] We could then balance knowledge as certainty with "unknowable" phenomena within a speculative historiography that takes seriously the likelihood of never knowing at all.

References

Acland, Charles R., and Eric Hoyt, eds. *The Arclight Guidebook to Media History and the Digital Humanities*. Falmer: REFRAME Books, 2016. Accessed June 30, 2023. https://projectarclight.org/book/.

Anderson, Steve F. *Technologies of History: Visual Media and the Eccentricities of the Past*. Hanover, NH: Dartmouth College Press, 2011.

Ankersmit, Frank. "Forum Debate on Jouni-Matti Kuukkanen's Postnarrativist Philosophy of Historiography." *Journal of the Philosophy of History* 11 (2017): 1–10.

Ankersmit, Frank. "Bibliographical Essay." In *A New Philosophy of History*, edited by Frank Ankersmit and Hans Kellner, 278–283. Chicago: University of Chicago Press, 1995.

Appiah, Anthony. *Thinking It Through: An Introduction to Contemporary Philosophy*. New York: Oxford University Press, 2003.

Barthes, Roland. "From Work to Text." In *Image/Music/Text*, 155–164. Translated by Stephen Heath. New York: Hill and Wang, 1977.

Beeston, Alix, and Stefan Solomon. "Pathways to the Feminist Incomplete: An Introduction, a Theory, a Manifesto." In *Incomplete: The Feminist Possibilities of the Unfinished Film*, edited by Alex Beeston and Stefan Solomon, 1–38. Berkeley: University of California Press, 2023.

Berliner, Lauren S. "Towards a Methodology of Unwatched Digital Media." *Feminist Media Histories* 8, no. 2 (2022): 219–230.

75 Allyson Nadia Field, "The Archive of Absence: A Manifesto for Looking at Lost Film," in *Uplift Cinema: The Emergence of African American Film and the Possibility of Black Modernity* (Durham, NC: Duke University Press, 2015), 23–28; Lauren S. Berliner, "Towards a Methodology of Unwatched Digital Media," *Feminist Media Histories* 8, no. 2 (2022): 219–230; Jane M. Gaines, "Never," in *Incomplete: Feminist Possibilities of the Unfinished Film*, ed. Alex Beeston and Stefan Solomon (Berkeley: University of California Press, 2023), 39–61; Alix Beeston and Stefan Solomon, "Pathways to the Feminist Incomplete: An Introduction, a Theory, a Manifesto," in *Incomplete: Feminist Possibilities of the Unfinished Film*, ed. Alex Beeston and Stefan Solomon (Berkeley: University of California Press, 2023), 1–38.

76 See Alex R. Galloway, "Golden Age of Analog," *Critical Inquiry* 48 (2021): 215, where he sees a paradox: the very age of computation is accompanied by the most analog of approaches – the serious study of affect, sensation, and contingency.

Biltereyst, Daniel, Richard Maltby, and Philippe Meers. "Introduction: The Scope of New Cinema History." In *The Routledge Companion to New Cinema History*, edited by Daniel Biltereyst, Richard Maltby, and Philippe Meers, 1–12. London: Routledge, 2019.

Borgman, Christine L. *Big Data, Little Data, No Data: Scholarship in the Networked World*. Cambridge, MA: MIT Press, 2015.

Dang, Sarah-Mai. "Unknowable Facts and Digital Databases: Reflections on the Women Film Pioneers Project and Women in Film History." *Digital Humanities Quarterly* 14, no. 4 (2020). Accessed February 27, 2023. http://digitalhumanities.org/dhq/vol/14/4/000528/000528.html.

Davidson, Cathy, and David Theo Goldberg. "A Manifesto for the Humanities in a Technological Age." *The Chronicle of Higher Education* 50, no. 23 (February 13, 2004): B7–B9. Accessed February 28, 2023. https://www.chronicle.com/article/a-manifesto-for-the-humanities-in-a-technological-age/.

Dickel, Henri, Matija Miskovic, Karazm Noori, Christian Schmidt, Atefeh Soltanifard, Sarah-Mai Dang, Thorsten Thormählen. "Women Film Pioneers Explorer, 2021." Accessed June 30, 2023. https://www.online.uni-marburg.de/women-film-pioneers-explorer/index.html.

Drucker, Johanna. *Visualization and Interpretation: Humanistic Approaches to Display*. Cambridge, MA: MIT Press, 2020.

Field, Allyson Nadia. "Editor's Introduction: Acts of Speculation." *Feminist Media Histories* 8, no. 3 (2022): 1–7.

Field, Allyson Nadia. "The Archive of Absence: A Manifesto for Looking at Lost Film." In *Uplift Cinema: The Emergence of African American Film and the Possibility of Black Modernity*, 23–28. Durham, NC: Duke University Press, 2015.

Firestein, Stuart. *Ignorance: How It Drives Science*. New York: Oxford University Press, 2012.

Flückiger, Barbara, and Gaudenz Halter. "Methods and Advanced Tools for the Analysis of Film Colors in Digital Humanities." *Digital Humanities Quarterly* 14, no. 4 (2020). Accessed June 30, 2023. http://digitalhumanities.org/dhq/vol/14/4/000500/000500.html.

Gaines, Jane M. "Never." In *Incomplete: Feminist Possibilities of the Unfinished Film*, edited by Alix Beeston and Stefan Solomon, 39–61 (Berkeley: University of California Press, 2023).

Gaines, Jane M. "How Wrong We Were: Women in the Silent Era American Film Industry." American Film Institute. Accessed June 30, 2023. https://devafilcalmjediwestussa.blob.core.windows.net/images/sites/3/2023/01/AFI-Women_Gaines.pdf.

Gaines, Jane M. "What Next? The *Historical Time* Theory of Film History." In *How Film Histories Were Made: Materials, Methods, Discourses*, edited by Malte Hagener and Yvonne Zimmermann, 59–84. Amsterdam: Amsterdam University Press, 2023.

Gaines, Jane M. "Counterfactual Speculation: What If Antonia Dickson Had Invented the Kinetoscope?" *Feminist Media Histories* 8, no. 3 (2022): 8–34. Accessed June 30, 2023. https://online.ucpress.edu/fmh/article/8/3/8/190671/Counterfactual-SpeculationWhat-if-Antonia-Dickson.

Gaines, Jane M. *Pink-Slipped: What Happened to Women in the Silent Film Industries?* Urbana: University of Illinois Press, 2018.

Gaines, Jane M. "What Happened to the Philosophy of Film History?" *Film History* 25, nos. 1–2 (2013): 70–80.

Gaines, Jane M. "Anonymities: Uncredited and 'Unknown' Contributors in Early Cinema." In *A Companion to Early Cinema*, edited by André Gaudreault, Nicholas Dulac, and Santiago Hidalgo, 443–59. London: Wiley-Blackwell, 2012.

Gallagher, Catherine. *Telling It Like It Wasn't: The Counterfactual Imagination in History and Fiction*. Chicago: University of Chicago Press, 2018.

Galloway, Alex. "Golden Age of Analog." *Critical Inquiry* 48, no. 2 (2022): 211–232.
Gitelman, Lisa, and Virginia Jackson. "Introduction." In *"Raw Data" is an Oxymoron*, edited by Lisa Gitelman, 1–4. Cambridge, MA: MIT Press, 2013.
Griffith, Erin and Cade Metz. "Tech Slump Doesn't Slow New Boom in A.I. Field." *New York Times* (January 7, 2023), B1, B4.
Halpern, Orit, Patrick Jagoda, Jeffrey West Kirkwood, and Leif Weatherby. "Surplus Data: An Introduction." *Critical Inquiry* 48, no. 2 (2021): 197–210. Accessed June 30, 2023. https://www.journals.uchicago.edu/doi/full/10.1086/717320.
Hansen, Mark B. N. *Feed-Forward: On the Future of Twenty-First Century Media*. Chicago: University of Chicago Press, 2015.
Hartley, John. "Digital Scholarship and Pedagogy, the Next Step: Cultural Science." *Cinema Journal* 48, no. 2 (2009): 138–145.
Hielscher, Eva. "The Phenomenon of Interwar City Symphonies: A Combined Methodology of Digital Tools and Traditional Film Analysis Methods to Study Visual Motifs and Structural Patterns of Experimental-Documentary City Films." *Digital Humanities Quarterly* 14, no. 4 (2020). Accessed June 30, 2023. http://www.digitalhumanities.org/dhq/vol/14/4/000495/000495.html.
Hill, Kashmir. "With A.I. Appropriating Their Style, Some Artists Join the Resistance," *New York Times* (February 19, 2023), 6.
Hong, Sun-ha. *Technologies of Speculation: The Limits of Knowledge in a Data-Driven Society*. New York: NYU Press, 2020.
Hoyt, Eric. "Arclights and Zoom Lenses: Searching for Influential Exhibitors in Film History's Big Data." In *The Routledge Companion to New Cinema History*, edited by Daniel Biltereyst, Richard Maltby, and Philippe Meers, 83–95. New York, London: Routledge, 2019.
Hoyt, Eric, Kit Hughes, and Charles R. Acland. "A Guide to the Arclight Guidebook." In *The Arclight Guidebook to Media History and the Digital Humanities*, edited by Charles R. Acland and Eric Hoyt, 11–39. Falmer: REFRAME Books, 2016. Accessed June 30, 2023. http://projectarclight.org/book/.
Hu, Tung-Hui. *A Prehistory of the Cloud*. Cambridge, MA: MIT Press, 2015.
Jordheim, Helge. "Natural Histories for the Anthropocene: Koselleck's Theories and the Possibility of a History of Lifetimes." *History and Theory* 61, no. 3 (September 2022): 391–425.
Kinder, Marsha. "Medium Specificity and Productive Precursors: An Introduction." In *Transmedia Frictions: The Digital, the Arts, and the Humanities*, edited by Marsha Kinder and Tara McPherson, 3–19. Berkeley: University of California Press, 2014.
Kinder, Marsha. "Designing a Database Cinema." In *Future Cinema: The Cinematic Imaginary After Film*, edited by Jeffrey Shaw and Peter Weibel, 346–353. Karlsruhe, Germany: ZKM, 2003.
Kinder, Marsha, and Tara McPherson. "Preface: Origins, Agents, and Alternative Archaeologies." In *Transmedia Frictions: The Digital, the Arts, and the Humanities*, edited by Marsha Kinder and Tara McPherson, xiii–xvii. Berkeley: University of California Press, 2014.
Koselleck, Reinhart. *The Practice of Conceptual History: Timing History, Spacing Concepts*. Translated by Todd Samuel Presner and others. Stanford, CA: Stanford University Press, 2002.
Kracauer, Siegfried. "Photography." In *The Mass Ornament: Weimar Essays*, edited and translated by Thomas Y. Levin, 47–66. Cambridge, MA: Harvard University Press, 1995.
Kracauer, Siegfried. *History: The Last Things before the Last*. New York: Oxford University Press, 1969.
Liu, Alan. "Where Is Cultural Criticism in the Digital Humanities?" In *Debates in the Digital Humanities*, edited by Matthew K. Gold, 490–509. Minneapolis: University of Minnesota Press, 2012.
Mackenzie, Adrian. "The Production of Prediction: What Does Machine Learning Want?" *European Journal of Cultural Studies* 18, nos. 4–5 (2015): 429–445.
Manovich, Lev. *Cultural Analytics*. Cambridge, MA: MIT Press, 2020.

Manovich, Lev. "Database as Symbolic Form." *Convergence* 5, no. 2 (June 1999): 80–99.
Marino, Mark. *Critical Code Studies*. Cambridge, MA: MIT Press, 2020.
McNeil, Joanne. *Lurking: How a Person Became a User*. New York: Farrar, Straus and Giroux, 2020.
McPherson, Tara. "In Focus: Digital Scholarship and Pedagogy." *Cinema Journal* 48, no. 2 (2009): 119–123.
Miller, John David, and John Maeda. "A Stitch in Time: Visualizing History Through Unit Forms and Repetition Structures." 2015. Accessed February 27, 2023.https://www.researchgate.net/publication/277250414_A_Stitch_in_Time_Visualizing_History.
Mukherjee, Siddhartha. *The Song of the Cell: An Exploration of Medicine and the New Human*. New York: Scribner, 2022.
Nietzsche, Friedrich. *The Use and Abuse of History* [1873]. New York: Cosimo Classics, 2010.
Petro, Patrice. "In the Wings." In *Idols of Modernity: Movie Stars of the 1920s*, edited by Patrice Petro, 270–283. New Brunswick, NJ: Rutgers University Press, 2010.
Posner, Miriam, and Lauren F. Klein. "Editor's Introduction." *Feminist Media Histories* 3, no. 3 (2017): 1–8.
Salt, Barry. *Moving into Pictures: More on Film History, Style, and Analysis*. London: Starword, 2006. Accessed June 30, 2023. https://www.starword.com/index.html.
Schöch, Christof. "Big? Smart? Clean? Messy? Data in the Humanities." *Journal of Digital Humanities* 2, no. 3 (2013): 1–13. Accessed February 28, 2023.http://journalofdigitalhumanities.org/2-3/big-smart-clean-messy-data-in-the-humanities/.
Wang, Yiman. "'Speaking in a Forked Tongue': Anna May Wong's Linguistic Cosmopolitanism." In *Revisiting Star Studies: Cultures, Themes, Methods*, edited by Sabrina Qiog Yu and Guy Austin, 65–82. Edinburgh: Edinburgh University Press, 2017.
Williams, Mark. "The Media Ecology Project: Collaborative DH Synergies to Produce New Research in Visual Culture History." *Digital Humanities Quarterly* 15, no. 1 (2021). Accessed June 30, 2023, http://www.digitalhumanities.org/dhq/vol/15/1/000524/000524.html.
Yogerst, Chris. "Review of *Explorations in New Cinema History*." *Journal of Cinema and Media Studies* 60, no. 3 (2021): 210.
Zeavin, Hannah. "A New AI Lexicon: EMPATHY." AI Now Institute (September 16, 2021). Accessed February 27, 2023. https://medium.com/a-n32-ai-lexicon-empathy-4da12b82e280.