

## ARTICLE

### OPENING THE BLACK BOX OF INTERPRETATION: DIGITAL HISTORY PRACTICES AS MODELS OF KNOWLEDGE

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#### ABSTRACT

Digital history is more than just the implementation of algorithmic and other data practices in the practice of history writing. It places our discipline under a microscope and enables us to focus in on what history writing is in the first place: writing about the past under specific social and societal conditions. This article argues for a closer look at the traditions of history writing in order to understand its principles and to determine what the digital condition contributes to historiography. Does the work of historians actually change in principle, or does digital history instead reflect the digital condition under which we operate? The article begins with a reflection on the works of Wilhelm Dilthey and Michel de Certeau to discuss how the society in which the historian writes influences the practices of interpretation. The article then presents what can be understood as the digital condition of our present societies and shows how algorithms function as “black boxes” that influence our social interactions, communication, and understanding of the world. The article’s third part brings together the earlier discussions of practices of history writing and the digital condition in order to examine the role of modeling for knowledge production in the sciences and the humanities. The closing argument then focuses on the use of visualizations in digital history as an example of the operational use of models of knowledge in opening the “black box” of interpretation.

*Keywords:* algorithms, digital condition, digital history, historiography, history of science, interpretation, modeling, research practices

All models are wrong, but some are useful.  
—G. E. P. Box<sup>2</sup>

Digital history has long been regarded as a mainly methodological endeavor. At its center lies the task of “gathering, preserving, and presenting the past” (to borrow

1. I would like to thank Manuel Burghardt at the University of Leipzig (<https://ch.uni-leipzig.de/burghardt/>) and the Digital Humanities Theorie working group (<https://dhtheorien.hypotheses.org/>) for a first and inspiring discussion of the ideas presented in this article.

2. G. E. P. Box, “Robustness in the Strategy of Scientific Model Building,” in *Robustness in Statistics*, ed. Robert L. Launer and Graham N. Wilkinson (New York: Academic Press, 1979), 201–36.

phrasing from the title of Daniel J. Cohen and Roy Rosenzweig's 2006 book).<sup>3</sup> But is that task specific to the practices of *digital* history? What this partial title of a well-known book, written by two of the most prominent figures in the field, makes apparent is that the question "What makes history digital?" might not be phrased correctly. This question comes from the title of a recent virtual roundtable, "What Makes History Digital? Why (and How) Digital History Is Happening Now," which was held (and in which I took part) on 6 May 2022. Turning my attention to the roundtable's subtitle, I will focus on the parenthetical "how" and rephrase the question as follows: How does the "digital" help us to understand how history is done (today)?

#### HISTORY WRITING AS INTERPRETATION

The history of historiography is long—as is the reflection on the motivations and practices of history writing. One of the earliest definitions of what historians do came from Wilhelm Dilthey and his famous differentiation between the natural sciences and the humanities in respect to their most important paradigms: "explanation" (which he associated with the natural sciences) and "understanding" (which he associated with the "human sciences"). According to Dilthey, "the truths of the human sciences are based on lived experience and understanding."<sup>4</sup> Dilthey argued that the knowledge of lived experience, especially that of past experiences, depends on the "interpretation of the objectifications of life"—that is, it depends on interpreting cultural artifacts as historical sources.<sup>5</sup> It is this focus on interpretation that still lies at the core of what we call the humanities, and it has informed many reflections on the practices of history writing. This focus also brings with it the danger of transpositions and ahistorical conclusions. Dilthey already knew this, but he was adamant that "what is close to us helps us to understand what is distant and past."<sup>6</sup>

In *The Writing of History*, which was first published in Paris in 1975, Michel de Certeau reflected on historiographical practices and discourses. In so doing, he highlighted four points that structure his observations:

- 1) The treatment of religious ideology by contemporary historiography requires us to recognize the ideologies that are already invested in history itself.
- 2) There exists a historicity of history, implying the movement which links an interpretive practice to a social praxis.
- 3) History thus vacillates between two poles. On the one hand, it refers to a practice, hence to a reality; on the other, it is a closed discourse, a text that organizes and concludes a mode of intelligibility.

3. Daniel J. Cohen and Roy Rosenzweig, *Digital History: A Guide to Gathering, Preserving, and Presenting the Past on the Web* (Philadelphia: University of Pennsylvania Press, 2006).

4. Wilhelm Dilthey, "The Formation of the Historical World in the Human Sciences," in *Selected Works*, vol. 3, ed. Rudolf A. Makkreel and Frithjof Rodi (Princeton: Princeton University Press, 1985), 163.

5. *Ibid.*, 174.

6. *Ibid.*, 182.

- 4) History is probably our myth. It combines what can be thought, the “thinkable,” and the origin, in conformity with the way in which a society can understand its own working.<sup>7</sup>

In this passage, de Certeau described history writing as an “interpretive practice” that always relates back to a “social praxis” or some other kind of social reality. Historiography becomes a representation of the things that a society believes to know about the past and how it understands its own identity: “Historical discourse makes a *social identity* explicit, not so much in the way it is ‘given’ or held as stable, as in the ways it is *differentiated* from a former period or another society.”<sup>8</sup> De Certeau added that this is what enables practices of history writing themselves to become objects of historical study.<sup>9</sup>

#### THE DIGITAL CONDITION

Of course, historians and social theorists have examined how the changing conditions of society, and especially the ongoing process of digitization, shape historiographical practices and our understanding of the past. One influential paradigm is that of an acceleration of (historical) time through technology and digitization. Paul Virilio has located the end of history in the understanding of time as “*an instantaneity without history* made possible by the technologies of the hour.”<sup>10</sup> For him, the digital age is “the implosion of real time” that “now conditions all exchanges” and brings about “dramatic breaks in the field of trade and social communication.”<sup>11</sup>

On a more methodological note, the title of Chris Anderson’s 2008 *Wired* article proclaimed “The End of Theory: The Data Deluge Makes the Scientific Method Obsolete.”<sup>12</sup> At the core of his argument lies the diagnosis that, in “a world where massive amounts of data and applied mathematics replace every other tool,” scientific theories—be it from the natural, the social, or the human sciences—are no longer needed to make sense of the world.<sup>13</sup> Machine learning algorithms have taken over as sense-making tools in such cases in which data is incomprehensible because of its vastness, its missing structures, and its models. Algorithms produce models of sense-making by giving us patterns that we did not—and cannot—see with our traditional methodologies. But is that the paradigm shift that digital history promotes?

Big data undoubtedly influences the conditions of historiographical practices in a way that we have not previously seen. This is especially true for studies that

7. Michel de Certeau, *The Writing of History*, transl. Tom Conley (New York: Columbia University Press, 1988), 21.

8. *Ibid.*, 45.

9. *Ibid.*, 41: “In effect, if historiography can have recourse to semiotic procedures in order to renew its practices, it likewise offers itself to these procedures as an object of study, inasmuch as it makes up a story or a discourse of its own.”

10. Paul Virilio, *Polar Inertia*, transl. Patrick Camiller (London: Sage, 2000), 25.

11. *Ibid.*, 78.

12. Chris Anderson, “The End of Theory: The Data Deluge Makes the Scientific Method Obsolete,” *Wired*, 23 June 2008, <https://www.wired.com/2008/06/pb-theory/>.

13. *Ibid.*

draw their “facts” and sources from extensive computational databases and that have faced critiques similar to those directed at the quantitative social history of the 1970s and 1980s.<sup>14</sup> But does that change the general approaches to history and its methods, as described by de Certeau?

I argue that it does not—and I am not the only one to do so. Shawn Graham, Ian Milligan, and Scott Weingart have argued that, “on a philosophical level, however, the digital transformation of sources does not represent a significant challenge to historical practices. Historians are always changing their sources and are always engaged in choices and decisions.”<sup>15</sup> Although one can argue that these general practices do remain the same, the conditions under which we apply and evaluate them do change. And as we have seen with the above examples, historians are especially qualified to analyze this very relationship of practices, conditions, and change.

Following de Certeau and his thoughts on the social identities that are present in our historiographical work, I contend that it is necessary to take a closer look at what the “digital condition” might be that determines the “digital” in “digital history.” In *The Digital Condition* (2018), which was first published in German as *Kultur der Digitalität* (2015), Felix Stalder characterized the digital condition as the result—or, rather, as an accompaniment—of a larger cultural transformation at whose center lies an “enormous proliferation of cultural possibilities”<sup>16</sup> that were brought about by, among other things, the “growing significance of complex technologies” and the “development of the internet as a mass medium.”<sup>17</sup> According to Stalder, “it is only because specific forms of culture, exchange, and expression are prevalent across diverse varieties of content, social spheres, and locations that it is even possible to speak of the digital condition in the singular.”<sup>18</sup> In addition to offering a media history argument for the development of a digital condition, Stalder also identified and analyzed three dominant forms of cultural practices: *referentiality*, *communality*, and *algorithmicity*.

Although all three forms are also important features of many digital history projects, I will focus on the last one. For Stalder, *algorithmicity* is characterized “by automated decision-making processes that reduce and give shape to the glut of information, by extracting information from the volume of data produced by machines. . . . Faced with the enormous amount of data generated by people and machines, we would be blind were it not for algorithms.”<sup>19</sup> Although Stalder’s diagnosis is less ominous than that of Anderson, Stalder also suggested that algorithms play prominent roles in our present society. They take root in many areas of interaction, communication, and decision-making, establishing rules and objectifying decisions made on the basis of patterns in data that humans did not previously know or see. This has manifold effects on societal conditions in

14. Shawn Graham, Ian Milligan, and Scott Weingart, *Exploring Big Historical Data: The Historian’s Macroscope* (London: Imperial College Press, 2015), 32.

15. *Ibid.*, 33.

16. Felix Stalder, *The Digital Condition*, transl. Valentine A. Pakis (Cambridge: Polity, 2018), 3.

17. *Ibid.*, 5.

18. *Ibid.*

19. *Ibid.*, 6.

different areas of application. One of these possible effects has to do with data and bias. In a 2018 article published by Reuters, for example, Jeffrey Dastin claimed that “Amazon.com Inc’s AMZN.O machine-learning specialists uncovered a big problem: their new recruiting engine did not like women.”<sup>20</sup> Dastin then described the hiring bias that was grounded in the biased data that had been used to train the algorithm (this is known as “confirmation bias”): the pattern that emerged from the data suggested that the most successful job candidates were most likely men. The data mirrored the gender bias that is present in existing hiring decisions.

Although algorithms seemingly arrive at the same biased conclusions that society would have (mirrored in the data provided), the process by which they arrive at this conclusion is incomprehensible to humans. Algorithms are thus “black boxes,” a technical term used in computer science to refer to situations in which the focus is on input and output data. An algorithm should always arrive at the same output if it deals with the same input. What happens in between is described as a “black box.” Although the algorithm itself is a set of clearly defined steps that are generally written in a formal language and that machines can always execute in the same way,<sup>21</sup> the incomprehensibility of its operations still poses a problem to humanists. Turning to algorithmic methods in digital history often leads to the same question: How do we evaluate the results of topic model algorithms, data mining, and data visualizations if we do not understand how they were produced?

Why is it important to think about algorithms in order to understand the digital condition in which we live? First, algorithms represent a specific way of dealing with data that is increasingly present in our daily lives. Second, algorithms suggest patterns and rules in decision-making processes, recognition, and classification that are highly influential in politics, policies, and everyday communication and interaction. Third, if historiographical practices are indicative of social practices and influential in creating social identities, we need to reflect on the influence of algorithms on social life. And fourth, if algorithms enter the field of historiographical methodology, it is essential that we reflect on not only the role of data and modeling in digital history but also how that role links back to historiographical practices of interpretation.

Generally speaking, the step-by-step process of interpretation—the iterative practice of selecting “facts” and sources, transforming historical material into data, and processing that data in a specific way—suggests that the historiographical method can be described as algorithmic. Although this might seem to be quite a leap, algorithmic thinking has long been present in the humanities. In his *Discourse on Method*, which was originally published in 1637, René Descartes described himself as “seeking the true method for arriving at the knowledge of everything of which my mind would be capable.”<sup>22</sup> He then drafted a set of

20. Jeffrey Dastin, “Amazon Scraps Secret AI Recruiting Tool That Showed Bias against Women,” Reuters, 10 October 2018, <https://www.reuters.com/article/us-amazon-com-jobs-automation-insight-idUSKCN1MK08G>.

21. For a definition of “algorithm,” see Donald E. Knuth, “Algorithms,” *Scientific American* 236, no. 4 (1977), 63–81.

22. René Descartes, *Discourse on Method and Meditations on First Philosophy*, 4th ed., transl. Donald A. Cress (Indianapolis: Hackett Publishing Company, 1998), 10.

step-by-step instructions for arriving at “true knowledge”; these instructions closely resemble algorithmic thinking. In particular, Descartes’s second point (dividing a problem into manageable steps) and his fourth point (the need for detailed documentation) resemble the general assumptions of algorithms (which I have presented above).<sup>23</sup> In this way, algorithmic thinking lies at the heart of what the digital adds to the historical method.

We need to break our research interests down into manageable steps, document our hypotheses and conclusions, and open the “black box” of our interpretation processes. Therein lies the true potential of engaging with formalization in the humanities. But we must go further than that: “Beyond merely applying them, DH includes the conception, development and critical evaluation of these computer-aided procedures, working techniques and tools as well as the study of the theories and models behind them.”<sup>24</sup> Algorithms themselves—not only our use of them, but the rules inscribed into them in the process of programming—are integral parts of the digital condition and must be analyzed as such. Stalder described algorithms as consisting of variables as well as manifold possibilities for connecting these variables to one another. Variables, relations, and data are never “raw”<sup>25</sup> or neutral; “they are engendered through cultural operations and formed within cultural categories. With every use of produced data and with every execution of an algorithm, the assumptions embedded in them are activated, and the positions contained within them have effects on the world that the algorithm generates and presents.”<sup>26</sup>

Algorithmic thinking represents a certain approach to framing what we know about the world—and it is a formalized approach. Implementing such a formal approach into the humanities does not necessarily require a genuinely new way of thinking, as Graham, Milligan, and Weingart have suggested.<sup>27</sup> I argue that it requires a new approach to well-known reflections on historiographical methods that date back to the seventeenth century but have been updated by the widespread use of algorithms and the omnipresence of data. It requires thinking in models.

#### MODELS OF KNOWLEDGE

De Certeau identified a close connection between interpretation, as he understood it, and the practice of modeling. For him, models are also closely linked to ideologies as patterns of thought and representations of worldviews. Although historiographers often forget to explicitly mention the ideology to which they refer, “it resurfaces as the *presupposition* of the models that characterize a type of explanation; it is implied by each system of interpretation.”<sup>28</sup> Explicating the models

23. Ibid., 11.

24. Malte Rehbein, “Digitizing the Humanities,” in *Handbook Industry 4.0: Law, Technology, Society*, ed. Walter Frenz (Berlin: Springer, 2022), 1172.

25. For this point, Stalder referred to the famous book “*Raw Data*” *Is an Oxymoron*, ed. Lisa Gitelman (Cambridge, MA: MIT Press, 2013).

26. Stalder, *The Digital Condition*, 117.

27. Graham, Milligan, and Weingart, *Exploring Big Historical Data*, 25.

28. De Certeau, *The Writing of History*, 29.

underlying our scientific narratives would also explicate the parameters of our interpretation processes. This includes the hypotheses we derive from theoretical assumptions that feed into the models that we then apply to the (empirical) data in order to test the hypotheses.

Historians and philosophers of science have analyzed practices of modeling in relation to knowledge production in different scientific disciplines. One famous example is Mary S. Morgan's 2012 book *The World in the Model: How Economists Work and Think*,<sup>29</sup> which focuses on the history of modeling practices in the field of economics and identifies modeling as one of the field's core practices. Of particular importance for the questions this article asks is the observation that economists' models do have a strong operational value; that is, they are abstract and simplified representations of the world, but they serve as "working objects" because the sciences "rely on such objects in their search to comprehend the world."<sup>30</sup> Here, Morgan also explicitly included the humanities and their quest for making sense of the world. Morgan also made a historical claim, explaining that, in economics, the advent of modeling "involved a change in language and format of expression to create new working objects that represented the economy in models that held certain qualities of smallness, typicality, manageability, and expressiveness."<sup>31</sup> This is exactly what happened in the humanities with the advent of digital methods. Digital history has been developing a new language and has made use of explicit models. A community of scientists has been formed around that language and its entailing models of knowledge. But as with the economists in Morgan's analysis, the adaptation of such models might significantly change the way we think about doing history and how we make sense of the world under the digital condition.<sup>32</sup>

Why, then, do historians not talk about modeling (any) more? In digital history, and in the digital humanities more generally, modeling is an important practice that is needed to facilitate the use of computational methods. For John Unsworth, the digital humanities is itself "a practice of representation, a form of modeling or . . . mimicry. It is . . . a way of reasoning and a set of ontological commitments, and its representational practice is shaped by the need for efficient computation on the one hand, and for human communication on the other."<sup>33</sup> It is important to differentiate the practice of modeling from the necessity of deterministic laws that might be present in programming and algorithms; models are nondeterministic and do not aim at postulating objective laws. Misunderstanding the role of generalization in formalization might be one reason why historians have stopped speaking of modeling.

29. Mary S. Morgan, *The World in the Model: How Economists Work and Think* (Cambridge: Cambridge University Press, 2012).

30. *Ibid.*, 386.

31. *Ibid.*, 405.

32. Morgan attested that economists have since begun to "confidently describe, analyse, and explain all kinds of activities of life in terms of their models" (*The World in the Model*, 408).

33. John Unsworth, "What Is Humanities Computing (and What Is Not)?" (lecture, Distinguished Speakers Series, Maryland Institute for Technology in the Humanities, University of Maryland, College Park, MD, 5 October 2000), <https://johnunsworth.name/mith.00.html>.

Others have described the role of the digital humanities or digital history as “ensur[ing] that digitization does not create black boxes, but meets scientific criteria of transparency, traceability and reproducibility.”<sup>34</sup> In a way, this results in digital historians modeling the research practices of their own discipline—history and history writing—in a way that resembles a new way of thinking but that is, in fact, what it always was, a mirror of the social condition in which history writing takes place. The models of knowledge in digital history refer back to the theories and traditions of historical research while digital historians also develop models for integrating the formalized thinking that is present in digital society. In doing this, their reflections on modeling and algorithms do not give way to new “black boxes” but rather help to open the “black box” of interpretation in which historians’ deliberations, hypotheses, and conclusions (which are seldom explicated in their scientific work) take place. In *Cultural Analytics*, Lev Manovich discussed the potential ways computer simulation can be used for understanding cultural processes: “Because computer simulation requires developing an explicit and precise model of a phenomenon being simulated, thinking of how cultural processes can be simulated can help us to develop more explicit and detailed theories of cultural processes.”<sup>35</sup> For my closing argument, I will turn to the use of visualizations in history to argue for the power of digital history to open the “black box” of interpretation.

#### OPENING THE BLACK BOX OF INTERPRETATION THROUGH VISUALIZATION<sup>36</sup>

Visual modeling is a specific form of model-based reasoning.<sup>37</sup> It is present in the practices of economists who regard modeling as such as a way to visualize their object of study, the economy.<sup>38</sup> In her research on physicists’ practices, Karin Knorr Cetina identified visual practices of communication that she called “vis-courses,” which replace written discourse about research results.<sup>39</sup>

What we visualize in digital history usually already depends on a model that has been derived from the description of our sources. Topic models, word clouds, charts, and diagrams represent what we know about our data, and they themselves become objects of historiographical interpretation. We categorize certain

34. Rehbein, “Digitizing the Humanities,” 1172–73.

35. Lev Manovich, *Cultural Analytics* (Cambridge, MA: MIT Press, 2020), 51.

36. Some of the arguments in the following section have been discussed in more detail in Silke Schwandt, “Visualisierungen als Quelle für historische Erkenntnis? Modellierungspraktiken in der (digitalen) Geschichtswissenschaft,” *Geschichtstheorie am Werk* (blog), 12 April 2022, <https://gtw.hypotheses.org/3675>, and Silke Schwandt, “Geschichte visualisieren: Digitale Praktiken in der Geschichtswissenschaft als Praktiken der Wissenschaftsreflexion,” in *Digital History: Konzepte, Methoden und Kritiken Digitaler Geschichtswissenschaft*, ed. Karoline Döring, Stefan Haas, Mareike König, and Jörg Wettlaufer (Berlin: DeGruyter Oldenbourg, 2022), 191–211.

37. See Nancy J. Nersessian, “Model-Based Reasoning in Conceptual Change,” in *Model-Based Reasoning in Scientific Discovery*, ed. Lorenzo Magnani, Nancy J. Nersessian, and Paul Thagard (New York: Kluwer Academic, 1999), 5–22.

38. Morgan, *The World in the Model*, 93.

39. See Karin Knorr Cetina, “‘Viskurse’ in der Physik: Konsensbildung und visuelle Darstellung,” in *Mit dem Auge denken: Strategien der Sichtbarmachung in wissenschaftlichen und virtuellen Welten*, ed. Bettina Heintz and Jörg Huber (Zurich: Springer, 2001), 305–20.



features of the material, creating a data model: “The resulting in-depth scholarly indexing of historical, literary and other cultural sources and their provision as an information system . . . has been a core task of the Digital Humanities since its inception.”<sup>40</sup> It becomes clear that the discrete mapping that we are used to in diagrams does not fit humanities practices and needs to be translated, but if the diagrams are designed well, they can make the parameters of historiographical interpretation apparent: they can thus open the “black box” of interpretation.

I follow Johanna Drucker in calling for visualizations to be part of knowledge production and to produce data rather than to merely map it; for visualizations to allow for ambiguity, comparative practices, and contradiction; and for measures and parameters to be derived from interpretations (for example, which distance measures are appropriate for mapping “discourse”) rather than making the latter dependent on the former.<sup>41</sup> Visualization itself has to be understood as a practice that is part of the research process and serves less as its outcome—that is, as a presentation tool. In order to enable cognition, it must be interactive, because the acquisition and production of knowledge are active processes of “user-centered interpretation.”<sup>42</sup>

Models of knowledge and the resulting visualization practices open historiographical practices up for what has been called an “operative epistemology”<sup>43</sup> that brings historiographical traditions together with mathematical formalizations and algorithms. Following my line of thought, one could argue that the digital turn—or, rather, the digital condition—has not been a methodological turn but has given us new tools for reflecting on our traditional research practices. What the digital adds to history is a clearer picture of what we actually do when we write history.

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40. Rehbein, “Digitizing the Humanities,” 1175.

41. Johanna Drucker, *Visualization and Interpretation: Humanistic Approaches to Display* (Cambridge, MA: MIT Press, 2020), 113.

42. *Ibid.*, 111.

43. Gabriele Gramelsberger, *Operative Epistemologie: (Re-)Organisation von Anschauung und Erfahrung durch die Formkraft der Mathematik* (Hamburg: Felix Meiner, 2020).