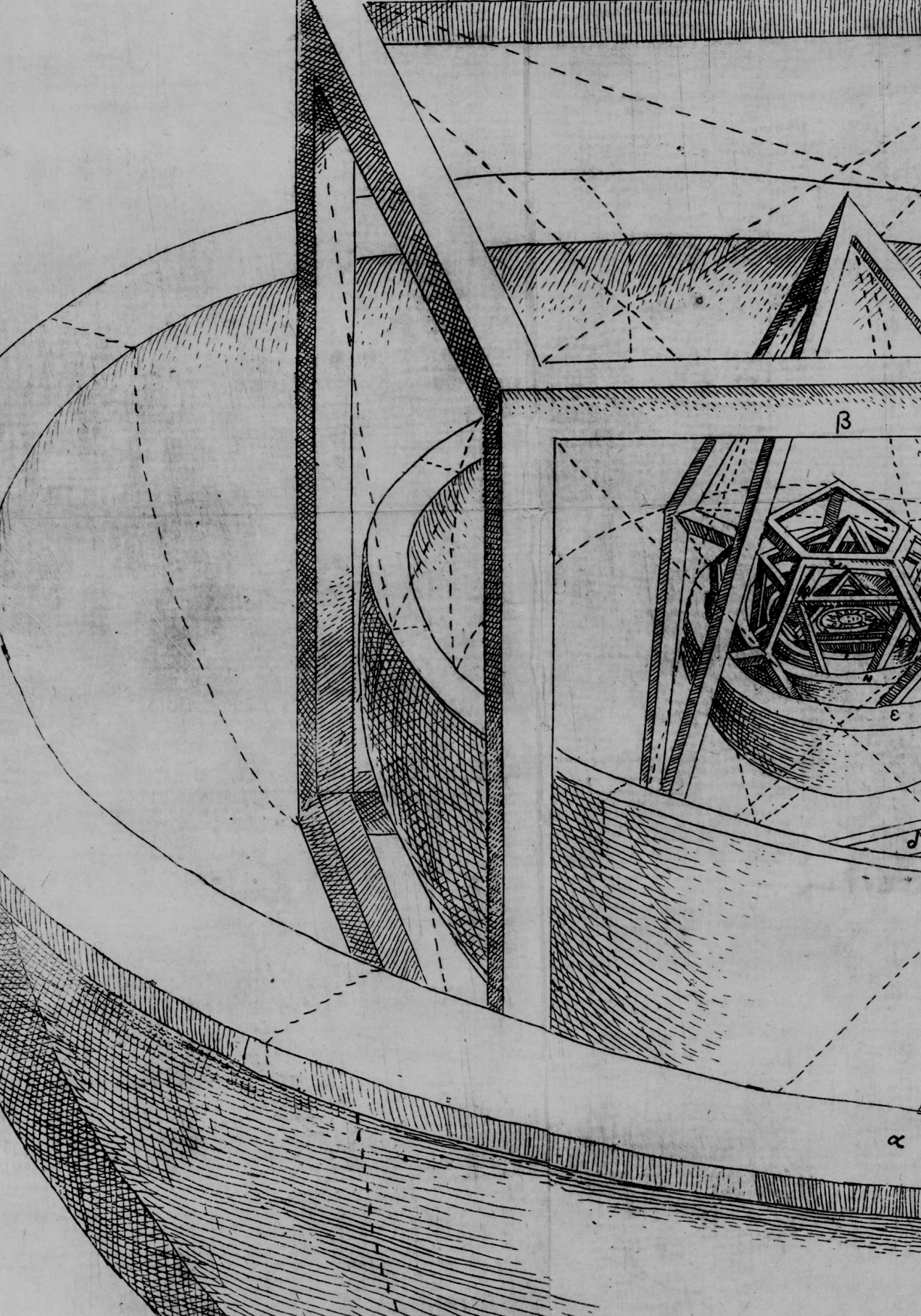
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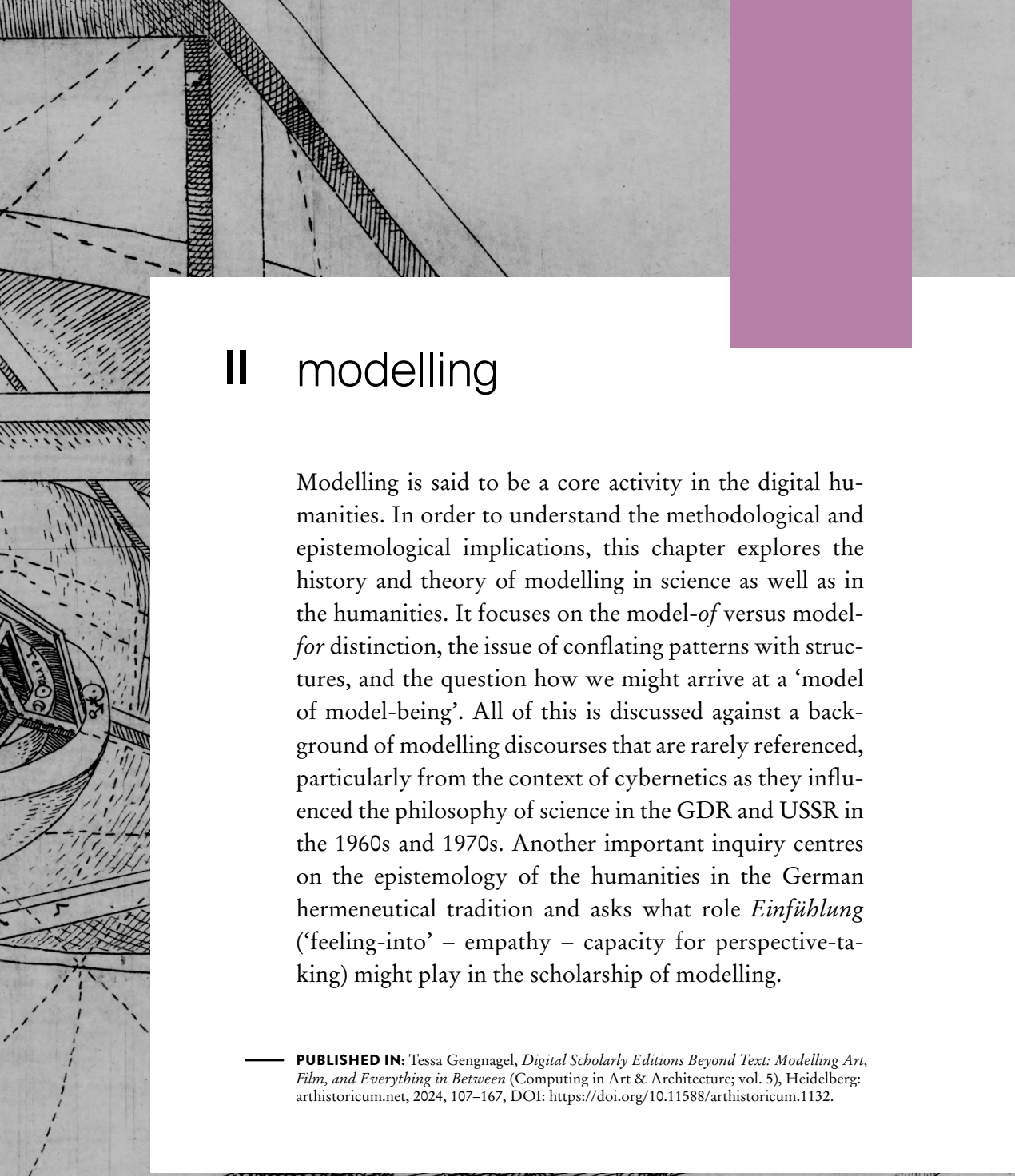

II modelling

Modelling is said to be a core activity in the digital humanities. In order to understand the methodological and epistemological implications, this chapter explores the history and theory of modelling in science as well as in the humanities. It focuses on the model-*of* versus model-*for* distinction, the issue of conflating patterns with structures, and the question how we might arrive at a 'model of model-being'. All of this is discussed against a background of modelling discourses that are rarely referenced, particularly from the context of cybernetics as they influenced the philosophy of science in the GDR and USSR in the 1960s and 1970s. Another important inquiry centres on the epistemology of the humanities in the German hermeneutical tradition and asks what role *Einfühlung* ('feeling-into' – empathy – capacity for perspective-taking) might play in the scholarship of modelling.

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All models are approximations. Assumptions, whether implied or clearly stated, are never exactly true. All models are wrong, but some models are useful. So the question you need to ask is not 'Is the model true?' (it never is) but 'Is the model good enough for this particular application?'

George E. P. Box, Alberto Luceño and María Del Carmen Paniagua-Quiñones, *Statistical Control by Monitoring and Adjustment*, Hoboken, New Jersey: Wiley, ²2009, 61 [originally published 1997].

II

modelling as a method
in the digital humanities

Conversations about 'models' and 'modelling' are ubiquitous in science.[1] This could be observed during the COVID-19 pandemic: "We're building simplified representations of reality. Models are not crystal balls," a leading scientist was quoted as saying in a special report in *Nature* in April 2020, during the height of the initial response, evidently trying to manage some of the expectations that policy-makers were directing at their scientific advisors.[2] The type of modelling that was under public scrutiny at the time can be referred to as 'epidemiological modelling'. Typically, this implies either equation-based or agent-based modelling. Both can be variations of computational modelling that simulates future scenarios and projects outcomes by using mathematical models to extrapolate from existing health data. As might be expected, predicting developments is not an act of divination and therefore involves assumptions and uncertainties. In a fast-developing epidemiological situation, this issue may be exacerbated by the fact that "some crucial information remains hidden from the modellers"[3] (referring to real-time accurate

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1 In terms of popular science, the first example that might come to mind is Stephen Hawking's exploration of 'model-dependent realism' as a way of scientific reasoning, cf. Stephen Hawking and Leonard Mlodinow, *The Grand Design*, New York: Bantam Books, 2010, 7.

2 For a reflection on this that occurred early on, see David Adam, "Modelling the Pandemic: The Simulations Driving the World's Response to COVID-19," in: *Nature* 580 (2020), 316–318, online: <https://doi.org/10.1038/d41586-020-01003-6>. Quote from Neil Ferguson ibid., 317.

3 Ibid., 318.

data on infection rates and circulation) and that it is difficult to obtain "data [...] against which to judge the model's predictions."[4]

While this represents only a specific example of a specific type of scientific modelling, far removed from the topic of this book, it already indicates the wide range of disciplines within which the theory and practice of modelling are of relevance. A famous quote by Nelson Goodman is often cited to illustrate this point:

> Few terms are used in popular and scientific discourse more promiscuously than 'model'. A model is something to be admired or emulated, a pattern, a case in point, a type, a prototype, a specimen, a mock-up, a mathematical description—almost anything from a naked blonde to a quadratic equation—and may bear to what it models almost any relation of symbolization.[5]

If we are to agree with Goodman's observation, then his statement begs the question how one might discuss models and modelling at all, within science and beyond science. How are we to move towards a specific understanding of modelling in the digital humanities and in digital scholarly editing if we cannot proceed from a shared, generalized understanding? Authors like Willard McCarty have long been engaged in laying the groundwork for answering that question[6] and we will return

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4 Adam 2020, 318.

5 Nelson Goodman, *Languages of Art: An Approach to a Theory of Symbols*, Indianapolis: Hackett, ²1976, 171.

6 See his chapter on modelling in Willard McCarty, *Humanities Computing*, Basingstoke [et al.]: Palgrave Macmillan, 2005, 20–72, as well as more recent literature, including Willard McCarty, "Modelling What There Is: Ontologising in a Multidimensional World," in: *Historical Social Research* suppl. 31 (2018), 33–45, online: <https://doi.org/10.12759/hsr.suppl.31.2018.33-45>, and Willard McCarty, "Modeling, Ontology, and Wild Thought: Toward an Anthropology of the Artificially Intelligent," in: *Science in the Forest, Science in the Past*, ed. by Geoffrey E. R. Lloyd and Aparecida Vilaça, London: HAU Books, 2020, 209–236, here esp. 210–212 [confusingly, a collected volume with a similar title, *Science in the Forest, Science in the Past: Further Interdisciplinary Explorations*, ed. by the same editors together with Willard McCarty, was published by Routledge in 2022 with a similar but different list of contributions which, in turn, had been first published in vol. 46/3 of *Interdisciplinary Science Reviews* (2021); it appears that the volumes are based on a series of successive workshops; this as a bibliographical side note].

to those discourses specific to the digital humanities[7] – if they are specific, which could be subject for debate – but first it would seem prudent to try and find a more universal approach to the topic which, in my case, always means a historically informed one. It is also interesting to think, however briefly, about the discursive function of the terminology that we operate with.

Etymologically, the word 'model' shares a common root with many of its equivalents in other languages such as *Modell* (German), *modèle* (French), *modello* (Italian), or *модель* (Russian). According to the research literature, it goes back to the Vulgar Latin *modellus*, in itself derived from the diminutive *modulus* for *modus*, meaning 'measure' or 'scale'.[8] Originally, the word found its way into Old High German as *modul*, into Middle High German as *model* and into English as 'mould', among other European languages.[9] Around the 16th century, it was reintroduced via the Old Italian *modello*, specifically referring to models in architecture and art (sculpturing).[10] The meaning was that of a pattern or form, the mould in which to pour plaster, the name of flowerbed figurines designed for French gardens,[11] even the types intended for print

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7 Other relevant authors would be, among others, Arianna Ciula, Øyvind Eide, and Cristina Marras. See, to start with, Øyvind Eide, "Modelling and Networks in Digital Humanities," in: *Routledge International Handbook of Research Methods in Digital Humanities*, ed. by Kristen Schuster and Stuart Dunn, London / New York: Routledge, 2020, 91–108, online: <https://doi.org/10.4324/9780429777028>; Ciula [et al.] eds. 2018; Arianna Ciula and Øyvind Eide, "Modelling in Digital Humanities: Signs in Context," in: *Digital Scholarship in the Humanities* 32 suppl. 1 (2017), 33–46, online: <https://doi.org/10.1093/llc/fqw045>; Arianna Ciula and Cristina Marras, "Circling Around Texts and Language: Towards 'Pragmatic Modelling' in Digital Humanities," in: *Digital Humanities Quarterly* 10/3 (2016), online: <http://www.digitalhumanities.org/dhq/vol/10/3/000258/000258.html> (accessed 12 February 2023).

8 Cf. Walther von Wartburg, 'modulus,' in: *FEW* (Französisches Etymologisches Wörterbuch; vol. 6/3: Mobilis–Myxa), Basel [et al.]: Zbinden [et al.], 1966, 14–19, esp. 18–19, and Herbert Stachowiak, *Allgemeine Modelltheorie*, Wien [et al.]: Springer, 1973, 129, fn. 2.

9 Cf. ibid. Today still recognizable in the German verb *modeln* = 'to form'.

10 Cf. Jacob Grimm and Wilhelm Grimm, 'Modell,' in: *DWB* (Deutsches Wörterbuch; vol. 12), Leipzig: Hirzel, 1885, col. 2439f., online: <http://www.woerterbuchnetz.de/DWB?lemma=modell> (accessed 7 February 2023). Cf. also Bernd Mahr, "Ein Modell des Modellseins: Ein Beitrag zur Aufklärung des Modellbegriffs," in: *Modelle*, ed. by Ulrich Dirks and Eberhard Knobloch, Frankfurt am Main [et al.]: Peter Lang, 2008, 187–220, here 191.

11 Cf. Grimm and Grimm 1885.

because they were formed by pouring metal into casting moulds that corresponded with letters.[12] The diminutive origin of the word reflected its usage where it denoted the formation of an exemplary copy of an original on a smaller scale.

Already, in this linguistic evolution, we can sense some of the activities that we still associate with models in a scientific context to this day: the forming and shaping of something *in the image of* something else, sometimes even tangibly with our own hands; the creation of prototypes, of blueprints, of something *in the image of which* something else is created; the representation of something not *as is* but rather *as-if*, on a different scale, in a simplified form, in an idealized form, in a manipulable form; the manifestation of a representation in a concrete object or visualization where certain elements and their relation to each other are highlighted.

A.
MODELS IN SCIENCE

When we go back in history and apply this terminology to describe phenomena that may not have been described thusly at the time – although it should be noted that Bernd Mahr has argued that the first tenuously related use of *modulus* can be traced to the architectural writings of Vitruvius, 1st century BC[13] –, then we find that modelling becomes an anthropological constant in the sense that it seems to have been a vital step in processes of creation for as long as humans have sought to re-create or pre-create a more all-encompassing original in reduced form to measure, scale, and test its properties and dimensions and how they relate to each other or, simply, to evaluate it aesthetically. A comprehensive cultural history of models and the practice of modelling has yet to be written which is why no one has stated with any certainty when the transformation from models as mere representations to models as modes of understanding occurred; if such a transformation

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12 Cf. Wartburg 1966, 19.
13 Cf. Mahr 2008, 190.

occurred.[14] Bernd Mahr has suggested that there was a "progression [...] from a concrete technique to the methodical abstraction"[15] or what we might in academic language call a progression from models rooted in *tékhnē* to models servicing the acquirement of *epistēmē*. What we can state and observe for certain are dates that emerge from the stream of time because they are associated with something that was deemed important then or came to be regarded as such later on and therefore draws our attention. One such date is the year 1596 in which Johannes Kepler published his first book *Prodromus dissertationum cosmographicarum, continens mysterium cosmographicum*.[16] In this book, he presented his vision of the solar system and the planets within in the form of a model. This model was not a material model but a two-dimensional graphical depiction of a three-dimensional model that one can imagine as physical and mobile instead, even though it represents an abstracted vision of that which it approximates.

If we take diagrammatic representations of knowledge into account, then we must date the use of models as a way of furthering the comprehension and insight into a matter even earlier, at the very least into the 12th century when diagrammatic works such as the *Liber figurarum* by Joachim of Fiore or the *Compendium historiae in genealogia Christi* by Peter of Poitiers achieved widespread circulation.[17] It would be possible

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14 One of the studies that arguably comes closest and certainly counts among the most comprehensive is still Roland Müller, "Zur Geschichte des Modelldenkens und des Modellbegriffs," in: *Modelle: Konstruktion der Wirklichkeit*, ed. by Herbert Stachowiak, München: Fink, 1983, 17–86.

15 "Entwicklung [...] von einer konkreten Technik hin zu dem methodischen Abstraktum" (Mahr 2008, 190). See also Bernd Mahr, "Modellieren: Beobachtungen und Gedanken zur Geschichte des Modellbegriffs," in: *Bild, Schrift, Zahl*, ed. by Sybille Krämer and Horst Bredekamp, München: Fink, 2003, 59–86.

16 Title often shortened to *Mysterium cosmographicum*. For the full title and a digitized version, see Johannes Kepler, *Prodromus dissertationum cosmographicarum* [...], Tübingen: Georg Gruppenbach, 1596, [digitized version available at ETH Library Zürich, RAR 1367: 1, online: <https://doi.org/10.3931/e-rara-445>]. With regard to that print, see also the entry on the 'Mysterium cosmographicum,' in: *… die Wahrheit in den Wissenschaften suchen: Buchschätze der ETH-Bibliothek aus vier Jahrhunderten*, ed. by Rudolf Mumenthaler, Wolfram Neubauer and Margit Unser, Zürich: ETH-Bibliothek, 2003, 66f.

17 See Andrea Worm, *Geschichte und Weltordnung: Graphische Modelle von Zeit und Raum in Universalchroniken vor 1500*, Berlin: Deutscher Verlag für Kunstwissenschaft,

to name many more examples from other contexts and time periods here[18] but as it is not the purpose of this book to write that cultural history and ruminate on the origins of modelling as a scholarly practice, suffice it to say that once we enter the 'modern era' (or, in the German term, the *Neuzeit*), models and modelling are fully embedded in or fully starting to be embedded in scholarship, albeit not necessarily featuring as objects of discussion themselves, in an explicit meta-methodological view.

One science that showcases how models came to take on a variety of meanings and also brings us closer to issues of models and modelling in humanities computing is mathematics. To name but two examples: In the 19th century, mathematicians like Julius Plücker, Felix Klein, and Ernst Kummer began to take an interest in geometrical models of surfaces;[19] these were actively built, such as in Plücker's case out of wood,[20] and referred to as 'models' (or rather the German equivalent *Modelle*).[21]

Later, in the 1950s, Polish logician Alfred Tarski established a semantic model theory based on his influential *Wahrheitsbegriff* ('definition of truth') that he had first developed in the 1930s.[22] The impetus was to

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2021; Alexander Patschovsky (Ed.), *Die Bildwelt der Diagramme Joachims von Fiore: Zur Medialität religiös-politischer Programme im Mittelalter*, Ostfildern: Thorbecke, 2003; and Adam S. Cohen, "Diagramming the Diagrammatic: Twelfth-Century Europe," in: *The Visualization of Knowledge in Medieval and Early Modern Europe* (Studies in the Visual Cultures of the Middle Ages; vol. 16), ed. by Marcia Kupfer, Adam S. Cohen and Jeffrey Howard Chajes, Turnhout: Brepols, 2020, 383–404. See also Eckart Conrad Lutz, Vera Jerjen and Christine Putzo (Eds.), *Diagramm und Text: Diagrammatische Strukturen und die Dynamisierung von Wissen und Erfahrung*, Wiesbaden: Reichert, 2014, and Charlotte Bigg, "Diagrams," in: *A Companion to the History of Science*, ed. by Bernard Lightman, Chichester: John Wiley & Sons, 2016, 557–571.

18 See, for example, on the use of 3D models to study phenomena since antiquity, Joshua Nall and Liba Taub, "Three-Dimensional Models," in: *A Companion to the History of Science*, ed. by Bernard Lightman, Chichester: John Wiley & Sons, 2016, 572–586.

19 Cf. David E. Rowe, *A Richer Picture of Mathematics: The Göttingen Tradition and Beyond*, Cham: Springer, 2018, 81–94.

20 For images of these models, see the 'Plücker Collection' of the *London Mathematical Society*, <http://www.lms.ac.uk/archive/plucker-collection> (accessed 7 February 2023). As mentioned there, the models are also described in Arthur Cayley, "On Plücker's Models of Certain Quartic Surfaces," in: *Proceedings of the London Mathematical Society* s1–3/1 (1869), 281–285, online: <https://doi.org/10.1112/plms/s1-3.1.281>.

21 See the contemporary letters reproduced in Rowe 2018, 92–94.

22 Cf. Anita Burdman Feferman and Solomon Feferman, *Alfred Tarski: Life and Logic*, Cambridge: Cambridge University Press, 2004, 109f.

represent theories and their axioms with the help of formal languages. Some points of interest are summarized in the *Stanford Encyclopedia of Philosophy*:

> A *theory* is taken to be a (usually deductively closed) set of sentences in a formal language. A *model* is a structure [...] that makes all sentences of a theory true when its symbols are interpreted as referring to objects, relations, or functions of a structure. The structure is a *model of* the theory in the sense that it is correctly described by the theory [...]. Logical models are sometimes also referred to as 'models of theory' to indicate that they are interpretations of an abstract formal system.[23]

Interestingly enough, Tarski's semantic concept underlies many of the assumptions prevalent in computer science, typically without direct reference to Tarski.[24] Discussions of languages are generally discussions of mathematical, especially set-theoretical, and logical expressions in this context and they have to be understood as a part of correspondence theory, where, in the case of Tarski, an object language and a meta language are differentiated; semantic objects are defined for the former in the latter.[25] The question of correspondence is a question of relation: Do we relate computational information processing to 'reality' or to the metalinguistic mathematical expressions (e.g. functions) ordering that

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23 Roman Frigg and Stephan Hartmann, 'Models in Science,' in: *The Stanford Encyclopedia of Philosophy* (Spring 2020 edition), ed. by Edward N. Zalta, online: <https://plato.stanford.edu/archives/spr2020/entries/models-science/> (accessed 11 February 2023). Emphasis in the original.

24 Cf. Martin Fischer, "Bedeutung und Metasprache: Alfred Tarski," in: *Abbild oder Konstruktion: Modellierungsperspektiven in der Informatik* (KIT Report; vol. 125), ed. by Martin Fischer, Gernot Grube and Fanny-Michaela Reisin, Berlin: Technische Universität, 1995, 35–40, here 37. See also Solomon Feferman, "Tarski's Influence on Computer Science," in: *The Lvov-Warsaw School: Past and Present* (Studies in Universal Logic), ed. by Ángel Garrido and Urszula Wybraniec-Skardowska, Cham: Birkhäuser, 2018, 391–404, online: <https://doi.org/10.1007/978-3-319-65430-0_29> [originally published in *Logical Methods in Computer Science* 2/3 (2006), [1–13], online: <https://doi.org/10.2168/LMCS-2(3:6)2006>].

25 Cf. Christiane Funken, *Modellierung der Welt: Wissenssoziologische Studien zur Software-Entwicklung*, Wiesbaden: Springer Fachmedien, 2001, 97.

reality?[26] The latter would seem uncontroversial, but it does leave one other question unanswered: How do these mathematical expressions themselves relate to reality?

Discussing this would be well outside the expertise of this book but it points in a direction that might be described as a debate over representational modelling (i.e. that the model ought to depict – *abbilden* – a portion of reality such that both can be compared) versus constructivist modelling (i.e. that that which is modelled is constituted through being modelled and does not exist independently from it): "If modelling, in the representational view, is the construction of the model, then it is, in the constructivist view, also the construction of the original."[27]

These perspectives have been explored in German research literature in the tradition of Herbert Stachowiak whom we will return to in a later section. It would be very easy to get lost in any of these questions as they are all suitably interesting but the pertinent issue at hand is how all of this relates to the digital humanities (as a scientific or otherwise scholarly discipline). It should be noted, for example, after shining a very brief spotlight on modelling in mathematics, from Plücker to Tarski, that, at least *prima facie*, the move from craftsmanship to abstraction that is assumed to have occurred in the practice of modelling throughout its overall history seems to be mirrored thus in one single field of study, albeit in its different subdivisions. If the digital humanities are indeed as predominantly focused on tools as is sometimes alleged,[28] one might

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26 Cf. Fischer 1995, 38.

27 Gernot Grube, "Modellierung in der Informatik," in: *Abbild oder Konstruktion: Modellierungsperspektiven in der Informatik* (KIT Report; vol. 125), ed. by Martin Fischer, Gernot Grube and Fanny-Michaela Reisin, Berlin: Technische Universität, 1995, 3–24, here 7; original: "Ist in der Abbildperspektive Modellierung die Konstruktion des Modells, so ist in der Konstruktionsperspektive Modellierung ebenso die Konstruktion des Originals."

28 And which subsequently has been grounds for a call for 'tool criticism', cf. Marijn Koolen, Jasmijn van Gorp and Jacco van Ossenbruggen, "Toward a Model for Digital Tool Criticism: Reflection as Integrative Practice," in: *Digital Scholarship in the Humanities* 34/2 (2019), 368–385, online: <https://doi.org/10.1093/llc/fqy048>. See also the way in which the proliferation of tools and a focus on tools in the digital humanities has been discussed as 'tool-based thinking' in connection with the verdict: "For better and for worse, the field of digital humanities is frequently understood as one in which its practitioners use tools." (Francesca Giannetti, "Against the Grain: Reading for

surmise that they could be destined for a similar trajectory: That the craftsmanship of data modelling, 3D modelling, in short: computationally influenced implementations of specific types of modelling, is starting to be – or in any case must be – supplemented by an awareness of the higher logic of things. Only then may we begin to understand what modelling as an activity can achieve in and for scholarship in this particular field.

B.
ABBILD AND *VORBILD*

The starting point of any inquiry into modelling theory as seen in the digital humanities is still Willard McCarty's aforementioned chapter on modelling in his *Humanities Computing* (2005) monograph, which, despite his more recent publications, represents his most comprehensive treatment of the topic. McCarty chooses a "philological and philosophical approach"[29] to explore models and modelling in a humanities computing context, quoting Michael Mahoney as saying: "In a real sense, [...] computers came into being for the sake of modelling."[30] To begin with, McCarty defines a model as "a representation of something for purposes of study, or a design for realizing something new"[31] and modelling as "the heuristic process of constructing and manipulating models."[32] In that, he adheres to Clifford Geertz and his differentiation between a model-*of* and a model-*for*.[33] This introduces a few questions that the literature has, to my knowledge, not yet fully addressed. McCarty acknowledges that every model *of* something is also a model *for* something and vice versa and states that "the model *of* exists to tell us what we do

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the Challenges of Collaborative Digital Humanities Pedagogy," in: *The Digital Humanities: Implications for Librarians, Libraries, and Librarianship*, ed. by Christopher Millson-Martula and Kevin Gunn, London / New York: Routledge, 2018, 123–135, here 129; for the section on 'tool-based thinking' see 129f.)

29 McCarty 2005, 21.

30 Ibid., 22.

31 McCarty 2005, 24. Original italicized.

32 Ibid. Original italicized.

33 Cf. McCarty 2005, 24.

not know [and] the model *for* to give us what we do not yet have."[34] But the implications that this has could stand further commentary. First of all: How can a model *of* something tell us what we do not know rather than describing what we *do* know, seeing as we are the ones creating the model and determining what it represents? Secondly: How can a model *for* something give us what we do not yet have rather than visualizing a conception that we *do* have and on the basis of which we can take further *action*? (It is, for example, entirely imaginable that we could skip the step of creating a model-for and still arrive at that which we do not yet have since it is not the model that realizes something; these discussions entirely depend, of course, on the question of whether a model that only exists as a conception or idea in our heads without being expressed as a clearly delineated model in some way, shape, or form is a *model* in any useful sense of the word and not just a thought.) One might argue that by modelling something, we may embark on a process of realizing all that we know and thereby *discover* what we do not know but upon discovery, it is not unknown anymore and therefore it is not for the model to tell us what we do not know. It is for us to tell the model (and thereby ourselves) what we know. Furthermore, McCarty's definition seems to be implicitly premised on the assumption that all that can be known can be modelled (although I suspect that he would not subscribe to that view) or that models can, at the very least, encompass a certain domain of structured and related information that is equated with knowledge as such. The simple question looming over this is: Whose and for whom?

Other modelling theorists, such as mathematician Bernd Mahr, have spoken of the model-of and model-for distinction in a context of a general model theory and they have been criticized for its lack of precision.[35]

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34 Ibid.

35 For a summary of Bernd Mahr's model theory, see his last article on the topic, Bernd Mahr, "Modelle und ihre Befragbarkeit: Grundlagen einer allgemeinen Modelltheorie," in: *Erwägen, Wissen, Ethik* 26/3 (2015), 329–342; for English-language versions of his thoughts on modelling, see Bernd Mahr, "Information Science and the Logic of Models," in: *Software & Systems Modeling* 8 (2009), 365–383, online: <https://doi.org/10.1007/s10270-009-0119-2>, and Bernd Mahr, "On the Epistemology of Models," in: *Rethinking Epistemology* (Berlin Studies in Knowledge Research; vol. 1), ed. by Günter Abel and James Conant, Berlin / Boston: De Gruyter, 2012, 301–352, online: <https://doi.org/10.1515/9783110253573.301>. For criticism of his approach to a gener-

There are other differentiations: between descriptive and prescriptive,[36] denotative and exemplary,[37] logical and representational,[38] to name a few. Whether these terms are seen as useful will differ depending on the disciplinary context. For the purposes of the discourse in the digital humanities, I propose that it might be helpful to introduce yet another differentiation to the discussion as carried out in the English language: *Abbild* ('the image of' something in the sense of a representational likeness), *Vorbild* ('in the image of which' something is done), and *Urbild* ('original image' – which I mention for completeness but do not intend to elaborate on as it speaks for itself). These are terms that regularly feature in the German literature about models in the tradition of the aforementioned Herbert Stachowiak without having yet, in this combination, come to the fore on their own in more recent discussions.[39] In

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al model theory, see the other articles in EWE issue 26/3 which are designed as critical responses on purpose; the most scathing and uncharitable of these responses is Christopher von Bülow, "Ein Modellfall eines schlechten Aufsatzes," in: *Erwägen, Wissen, Ethik* 26/3 (2015), 354–357. With regard to the model-of and model-for distinction, see in particular Herbert Neuendorf, "Die Frage nach dem Original: Modelle 'von etwas' und 'für etwas'," in: *Erwägen, Wissen, Ethik* 26/3 (2015), 394–396. Due to his passing, Bernd Mahr's reply to the critiques is only fragmentary, see Bernd Mahr, "Replik," in: *Erwägen, Wissen, Ethik* 26/3 (2015), 425–433.

36 Cf. Neuendorf 2015, *passim*.

37 We find this type of differentiation between a model as an exemplar and a model that denotes in Goodman ²1976, 171f.

38 Cf. Frigg and Hartmann 2020.

39 See, by way of example, Ivor Nissen and Bernhard Thalheim, "Modelle, Modellieren, Modellierung: Eine Kieler Begriffsbestimmung," in: *Wissenschaft und Kunst der Modellierung: Kieler Zugang zur Definition, Nutzung und Zukunft* (Philosophische Analyse; vol. 64), ed. by Bernhard Thalheim and Ivor Nissen, Berlin / Boston: De Gruyter, 2015, 29–36, here 34f., online: <https://doi.org/10.1515/9781501501234-003>. Both Herbert Stachowiak and in particular Roland Müller employ the terms at length and very explicitly in connection with each other and with model theory; cf. Müller 1983, esp. 20f., 24–28 and 62f., and Herbert Stachowiak, "Erkenntnisstufen zum Systematischen Neopragmatismus und zur Allgemeinen Modelltheorie," in: *Modelle: Konstruktion der Wirklichkeit*, ed. by Herbert Stachowiak, München: Fink, 1983, 87–146, here esp. 89. As Benjamin Rathgeber points out, Mathias Gutmann's use of *Abbild* and *Vorbild* with regard to models can also be cited in this context and it would seem to confirm that there is often an equation made between *Abbild* and *Vorbild* models and models-of and models-for, cf. Benjamin Rathgeber, *Modellbildung in den Kognitionswissenschaften* (Hermeneutik und Anthropologie; vol. 4), Münster: LIT, 2011, 92f., and Mathias Gutmann, *Die Evolutionstheorie und ihr Gegenstand: Beitrag der methodischen Philosophie zu einer konstruktiven Theorie der Evolution* (Studien zur Theorie der Biologie; vol. 1), Berlin: VBW, 1996, 176. For a discussion of Stachowiak's contribution to modelling

a digital humanities context and more specifically the context of digital art history, for example, Georg Schelbert writes about the *abbildendes Modell* (in his sense perhaps best translated as 'depicting model'), contrasts it with or rather adds to it the *konzeptionelles Modell* ('conceptual model') and suggests to consider the *digitales Modell* ('digital model') as an opportunity for a synthesis of *Bild* ('picture' or 'image'), concept, and information.[40] Why, however, is a conceptual model not one that in itself depicts that which it models? A conceptual model is necessarily *abbildend* in the sense that it is necessarily the result of a cognitive process which creates *an image of* something else, even if that image is ideational and reduced in that which it reproduces. Schelbert's *abbildendes Modell* is rather specifically a pictorial or similarly realized model that mirrors certain spatial or visual qualities of that which it depicts, a representation in the vein of an architectural model.[41] One could argue that there are models that depict and models that do not, but that argument necessarily hinges on an emphasis of a *primary* function rather than a fundamental difference, even if only in terminology, or else it creates a false dichotomy. (Note that the primary function of a model is contingent on what the model functions as in a given moment and for a given spectator or user perceiving the model as a model.) It might therefore not be sensible to discuss the *Abbild* qualities of a model without discussing its *Vorbild* qualities and vice versa, much like discussing models-of and models-for, only that in the case of the *Abbild* model and *Vorbild* model, model-of and model-for are made more precise since *Abbild* and *Vorbild* focus our attention on the visuality and directionality of conception, mentally – which is also to say *conceptually* – or otherwise: A model that is primarily *abbildend* seeks to distill an essence – that is to say, it seeks to

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with regard to an *Abbildtheorie* commonly espoused in German literature, see Mahr 2003, 79–81.

40 Cf. Georg Schelbert, "Ein Modell ist ein Modell ist ein Modell: Brückenschläge in der Digitalität," in: *Der Modelle Tugend 2.0: Digitale 3D-Rekonstruktion als virtueller Raum der architekturhistorischen Forschung* (Computing in Art and Architecture; vol. 2), ed. by Piotr Kuroczyński, Mieke Pfarr-Harfst and Sander Münster, Heidelberg: arthistoricum.net, 2019, 136–153, online: <https://doi.org/10.11588/arthistoricum.515.c7449>.

41 Cf. ibid., 139–143.

identify a *structure* in that which it represents and it must do so by respecting the *relationality* and, depending on the context, *scalability* of its elements; the scalability is obviously of importance in cases where a certain phenomenon or behaviour from an 'original' environment ought to be emulated in the modelled representation; the more abstract the model, the more it becomes an essential but, to speak with George E. P. Box et al., arguably less 'true' representation,[42] if the truth of a representation is measured by its proximity to that which it models. Such a model *in the image of* that which it models will be, obviously, illustrative, and it might, when a factor of time and other variables are added, become simulative which is also to say speculative, but it will not, in interpretation of McCarty's meaning, serve the creation of something tangibly new *in its image*. It can be a scientific model or a model employed in a context of science but it does not have to be and the criteria for its *Wissenschaftlichkeit* ('scientificity') will differ from discipline to discipline and the varying requirements for scholarly argument and rigour. In that, models are no different to other methodology and other uses of language, vis-à-vis a communication of knowledge in science and scholarship. We do not need to formulate general measures of 'scientificity' for a general theory of models so much as we need to apply those that already exist, where they exist; it could be argued, for example, that the use of simulations in historical studies is an inappropriate and objectionable approach because it falls into a similar category as counterfactual history, with all the caveats and criticisms that apply to that.[43] One simulation may

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42 Cf. George E. P. Box, Alberto Luceño and María Del Carmen Paniagua-Quiñones, *Statistical Control by Monitoring and Adjustment*, Hoboken, New Jersey: Wiley, ²2009, 61 [originally published 1997].

43 One example for the use of historical simulations that Schelbert 2019, 148, also refers to is the *Venice Time Machine* project in which Frédéric Kaplan, an expert for artificial intelligence, was involved in a leading capacity and on which he gave a TED talk; see, Frédéric Kaplan, "How to Build an Information Time Machine," presentation at *TEDxCaFoscariU* (June 2013), online: <https://www.ted.com/talks/frederic_kaplan_how_to_build_an_information_time_machine> (accessed 8 February 2023). It might be that these types of projects have led to an unwarranted amount of scrutiny. Some have argued that there is a case to be made for the usefulness of simulations in the historical sciences, cf. Leif Scheuermann, "Geschichte der Simulation / Simulation der Geschichte: Eine Einführung," in: *Digital Classics Online* 6/1 (2020), online: <https://doi.org/10.11588/dco.0.0.73395>. Their usefulness would obviously depend on the data

be grounded in more evidence than another and if one wishes to argue so for their particular case, they may do that, as with any other kind of argument, and they may be rejected on the basis of the support offered for it, as with any other kind of argument. Generally speaking – and this does apply to scholarship in general –, we must not create a fallacy akin to the notion 'when a scholar does it, that means it is scholarly', all the while we should also not assume to be able to accommodate every possible scenario of scholarly or scientific modelling with a shared rulebook.

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that they are based on, the behaviour that they ought to simulate (natural phenomena or human actions, to name only two), and the conclusions drawn from them. In that sense, one might call them *extrafactual* – building on that which is known and extrapolating within reasonable bounds. It would be naïve, however, to believe that there is no transition from the extrafactual to the counterfactual; and these can be difficult to separate. On the topic of counterfactual history or 'virtual history' which has been championed in particular by the historian Niall Ferguson and predates digital history or at least should not be conflated with it, even though the same critiques may apply here, see Richard J. Evans, *Altered Pasts: Counterfactuals in History*, Waltham: Brandeis University Press, 2014. In short, if one views the humanities as evidence-oriented sciences (here in the sense of *Wissenschaften*), then it stands to reason that arguments centred around the entertainment of speculative thought experiments about 'what might have happened' rather than being grounded in an analysis and understanding of the evidence of 'what did happen' or 'what do we think did happen' are inadmissible as scholarly arguments because they cannot be argued against, given the lack of a body of source materials for these 'alternate' scenarios which makes it impossible to verify or falsify any number of claims. That historiography involves speculative elements at all is another debate but the difference in this case would be that in 'virtual history', speculation is used to argue *contra* the existing evidence, not to plausibly bridge lacunae in the tradition. Whether one wants to entertain counterfactual thought experiments to exercise their own mental agility as Juliane Schiel, a Ferguson student, has implied is a matter of opinion but would not seem to legitimize 'virtual history' in any way from a scholarly point of view which must, as a communal effort, always take the *Argumentierbarkeit* ('argumentability') of the matter at hand into account and that *Argumentierbarkeit* must be, as stated, necessarily evidence-oriented where it can be evidence-oriented; a historian who argues *against* something for which there is not only an absence of evidence but a contradiction of evidence (that is to say, on the basis of alternative historiography contradicting what is known about history) will not have made an argument *for* something for which there is evidence, especially given that the tradition of evidence is largely arbitrary and alternative scenarios hinge on too many unknown variables to be plausibly designed. Still, for arguments for 'virtual history' – including the remarks by Juliane Schiel – see the collected volume Ronald Wenzlhuemer (Ed.), *Counterfactual Thinking as a Scientific Method* (Historical Social Research; special issue 34.2), Köln: Gesis, 2009. For more arguments in favour of 'virtual history', see Alexander Demandt, *Ungeschehene Geschichte: Ein Traktat über die Frage: Was wäre geschehen, wenn …?* Göttingen: Vandenhoeck & Ruprecht, 1986.

Abbild models may be scholarly insofar as creating them lends support to a scholarly argument or insofar as they may be used to illustrate a scholarly argument. Whether to explain, showcase, study, highlight elements and their relation to each other, the difference between a conceptual *Abbild* model and a concept as such is that the model will have identified elements and structures within the concept and it will have sought to depict them in a way that accurately maps the relations of these elements or rather accurately maps *our understanding* of the relations of these elements, which will have been identified not because they are the *only* identifiable elements and relations but because they are the identifiable elements and relations for the *intents* and *purposes* of a particular study from a particular point of view; and depending on the discipline, the accuracy of depiction may be verifiable through calculation and an observation of a congruence of *properties*, admitting for scale and other factors of concentration; this may, however, not necessarily apply to models in the humanities.

As far as the notion of an *Abbild* model is concerned, we may furthermore invoke Ludwig Wittgenstein who wrote, and I quote selectively:

> 2.1 Wir machen uns Bilder der Tatsachen. [...]
> 2.12 Das Bild ist ein Modell der Wirklichkeit.
> 2.13 Den Gegenständen entsprechen im Bilde die Elemente des Bildes. [...]
> 2.15 Daß sich die Elemente des Bildes in bestimmter Art und Weise zu einander verhalten, stellt vor, daß sich die Sachen so zu einander verhalten. Dieser Zusammenhang der Elemente des Bildes heiße seine Struktur und ihre Möglichkeit seine Form der Abbildung.
> 2.151 Die Form der Abbildung ist die Möglichkeit, daß sich die Dinge so zu einander verhalten, wie die Elemente des Bildes.[44]

Wittgenstein's use of *Bild* to mean forms of thought and sentences has often been translated as 'picture' – this part of his work is, in fact, re-

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44 Ludwig Wittgenstein, "Logisch-Philosophische Abhandlung," in: *Annalen der Naturphilosophie* (vol. 14), ed. by Wilhelm Ostwald, Leipzig: Unesma, 1921, 185–262, here 202.

ferred to as 'picture theory' in English – but some have argued that it should rather be translated as 'image'.[45] This would seem to fit well with the argument developed thus far, namely that a model-of is an image *in the image of* and a model-for an image *in the image of which*... (left open-ended here on purpose).

Furthermore, in Wittgenstein's formulations we find many of the aspects from the model discussion paralleled: Not only does he explicitly state that the *Bild* is a model of reality, he also states that the elements in the *Bild*, that is to say, the elements in the model, correspond to the objects they are modelling, that the relation of elements to each other in a certain way imagines things relating to each other in such a way, that the relationship of elements in the model may be referred to as its structure and their being-possible as its form; in short: that the form of the *Abbildung* is the possibility that things may relate to each other as the elements in the *Bild* do. This line of inquiry might be worth pursuing in future formulations of general model theories.[46]

As may have become clear by the length of discussion dedicated to the notion of an *Abbild* model (and conceptual models as *Abbild* models), their role in scholarship is more immediately apparent since their creation, in order to be useful, necessarily requires a thorough understanding of that which they model and can be used as a way to generate further understanding or satisfy and consolidate a certain type of understand-

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45 Cf. Hidé Ishiguro, "The So-Called Picture Theory: Language and the World in Tractatus Logico-Philosophicus," in: *Wittgenstein: A Critical Reader*, ed. by Hans-Johann Glock, Oxford: Blackwell, 2001, 26–46.

46 Philosophers might find this observation naïve and digital humanists might view it as similarly obvious or misplaced, given that Willard McCarty quotes Wittgenstein at the beginning of his modelling chapter without discussing this connection, cf. McCarty 2005, 20. Already in the 1980s, in an aside, Roland Müller drew attention to the fact that Wittgenstein studied the dynamic models of German physicist Heinrich Hertz and referenced them in one of the few references that Wittgenstein made at all in his *Tractatus*, cf. Müller 1983, 56, and Wittgenstein 1921, 215 (I want to note that I arrived at Wittgenstein and the connection to his writing independently from Müller, which might be taken as a sign for a desideratum to incorporate Wittgenstein in literature on model theory outside of strictly philosophical discourses). See also, on that point, David G. Stern, *Wittgenstein on Mind and Language*, Oxford [et al.]: Oxford University Press, 1995, 36f., and, in general, Wolfgang Stegmüller, "A Model Theoretic Explication of Wittgenstein's Picture Theory," in: id., *Collected Papers on Epistemology, Philosophy of Science and History of Philosophy* (vol. 1), Dordrecht: Springer, 1977, 137–155.

ing. If we turn to *Vorbild* models, the question is rather: What follows from them? It is not enough that they be illustrative and it is not enough that they further understanding or, merely, represent a certain type of understanding of a thing or, if we might say so, a system of things. They do not unveil patterns so much as provide patterns for a task that will often involve a physical act of building or the use of physical tools. But could it be that, in the case of humanities computing, they rather involve the creation of meta-models *in the image of which* project-specific implementations in the form of, for example, data models ought to be undertaken, which in turn will provide the necessary output *for* processing? The CIDOC Conceptual Reference Model, CIDOC-CRM, and the conceptual model underlying the TEI come to mind.[47] They are, of course, not the only types of *Vorbild* models one could imagine in a humanities computing context, but they would seem to be obvious ones; and they illustrate that the distinction should not be drawn between *abbildendes Modell* and conceptual model or, on the other hand, conceptual model and *vorbildendes Modell*. Perhaps an argument could be made that a conceptual model in a certain context of humanities computing will become a *Vorbild* model when it is a universal model while

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47 See <http://www.cidoc-crm.org/> and <https://tei-c.org/> (both accessed 8 February 2023). On the model implicitly underlying the TEI, cf. James Cummings, "Opening the Book: Data Models and Distractions in Digital Scholarly Editing," in: *International Journal of Digital Humanities* 1/2 (2019), 179–193, here 185–189, online: <https://doi.org/10.1007/s42803-019-00016-6>. He states that "it is inaccurate to say that the TEI is a data model itself. Used properly, it is more of a framework for constructing and documenting data models for particular editorial projects" (ibid., 185). See also James Cummings, "A World of Difference: Myths and Misconceptions about the TEI," in: *Digital Scholarship in the Humanities* 34 suppl. 1 (2019), i58–i79, online: <https://doi.org/10.1093/llc/fqy071> ("It is important that it is the prose of the TEI Guidelines that is considered normative, not the current markup language they are written in or recommend, nor the schemas generated from them. What is written in the Guidelines in prose is more important than the rules of any generated schema. There are constraints in the prose of the TEI Guidelines (such as honest adherence to the abstract model) which will never be able to be modelled in any schema language." (ibid., i59)) and Desmond Schmidt, "Towards an Interoperable Digital Scholarly Edition," in: *Journal of the Text Encoding Initiative* 7 (2014), online: <https://doi.org/10.4000/jtei.979> ("[T]he purpose of the TEI Guidelines […] is to provide a general encoding scheme for texts of all types […]. TEI-encoded texts […] often form an important part of a digital scholarly edition (DSE), which may be defined as the modeling in the digital medium of the scholar's interactions with the text." (Ibid.))

it will become an *Abbild* model when it is a case-specific model; with the opposite being true for other types of models, where the universal model is an *Abbild* model because it uncovers or illustrates a principle, such as in Niels Bohr's atom model,[48] while a case-specific model may be a *Vorbild* model e.g. because it carries within it specific instructions for the creation of a specific object (in the broadest sense of the term). On the topic of universality and specificity, distinguished in that way, the research literature remains silent; this must, therefore, be regarded as a preliminary suggestion in need of more thought.

C.
COLD WAR REMNANTS

On a related note and for that matter, I will include the following brief section to draw attention to research literature that has gone unnoticed in the Anglophone discourse on modelling within the digital humanities. By highlighting several authors and their arguments before turning to models in the humanities in order to unearth a core issue for modelling concerns in humanities computing, I wish to make the case that a furtherance of debate depends on the influences it draws upon.

Many have written about modelling and some have been cited. We could name more: Max Black who wrote about models and metaphors in 1962;[49] Danielle and George Arthur Mihram who differentiated between physical, symbolic, and hybrid models in 1974;[50] Marx W. Wartofsky

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48 On the topic of which, see Helge Kragh, *Before Bohr: Theories of Atomic Structure 1850–1913* (Research Publications on Science Studies; vol. 10), Aarhus: Centre for Science Studies, University of Aarhus, 2010, and Helge Kragh, *The Early Reception of Bohr's Atomic Theory (1913–1915): A Preliminary Investigation* (Research Publications on Science Studies; vol. 9), Aarhus: Centre for Science Studies, University of Aarhus, 2010. See also Niels Bohr, "On the Constitution of Atoms and Molecules, Part I," in: *Philosophical Magazine* 26 (1913), 1–25 [part II 'Systems Containing Only a Single Nucleus' and part III 'Systems Containing Several Nuclei' in the same issue, 476–502 and 857–875 respectively]. See furthermore Niels Bohr, "Atomic Structure," in: *Nature* 107/2682 (1921), 104–107, online: <https://doi.org/10.1038/107104a0>.

49 See Max Black, *Models and Metaphors: Studies in Language and Philosophy*, Ithaca: Cornell University Press, 1962.

50 See Danielle Mihram and George Arthur Mihram, "Human Knowledge: The Role of Models, Metaphors, and Analogy," in: *International Journal of General Systems* 1 (1974), 41–60.

who published his writing on models in science in the form of an essay collection in 1979;[51] Mary S. Morgan and Margaret Morrison who heralded a communicative view on models in the late 1990s, arguing that models are 'autonomous mediators' and that "their relationship to theory draws our attention away from the processes of constructing models and manipulating them."[52] The list could go on. However, there is a noticeable lack of references in Anglophone literature to a number of important writers who presented extensive thoughts on modelling theory in the context of a general philosophy of science in the 1960s and 1970s. It would seem that this lack is rooted in a lack of translations which might be, in turn, rooted in the geopolitical situation of the time, at least in some cases. I speak, of course, in vaguely broad terms, of the East-West divide during the so-called 'Cold War'.[53] This is relevant here in a rather specific disciplinary context, namely the context of cybernetics.[54]

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51 See Marx W. Wartofsky, *Models: Representation and the Scientific Understanding*, ed. by Robert S. Cohen, Dordrecht: Springer, 1979.

52 Margaret Morrison and Mary S. Morgan, "Introduction," in: *Models as Mediators: Perspectives on Natural and Social Science*, ed. by Mary S. Morgan and Margaret Morrison, Cambridge: Cambridge University Press, 1999, 1–9, here 8. For a more recent communicative approach, see Christine Blätter, "Das Modell als Medium: Wissenschaftsphilosophische Überlegungen," in: *Wissenschaft und Kunst der Modellierung: Kieler Zugang zur Definition, Nutzung und Zukunft* (Philosophische Analyse; vol. 64), ed. by Bernhard Thalheim and Ivor Nissen, Berlin / Boston: De Gruyter, 2015, 107–138, online: <https://doi.org/10.1515/9781501501234-008>.

53 Observations like this must be treated with great caution during a literature review. The 1960s, for example, saw communication between scientists from the 'East' and the 'West' regardless of political divides and sometimes even prompted by political action, by which I mean in this case the period of the so-called 'Khrushchev Thaw' between the mid-1950s and mid-1960s, cf. Christopher D. Hollings, *Scientific Communication Across the Iron Curtain*, Cham [et al.]: Springer, 2015, 27–32. It is also likely that a lack of translations, regardless of the political situation, as well as a general myopia in Anglophone academia or, alternatively, a general 'historical amnesia' might have contributed to the situation we find ourselves in, where research traditions have been disrupted or never carried over.

54 Cybernetics gained popularity in the Soviet Union towards the end of the 1950s, around the time when the discipline became fragmented (e.g. branching off into artificial intelligence) in the USA, cf. Paul Erickson [et al.], *How Reason Almost Lost Its Mind: The Strange Career of Cold War Rationality*, Chicago / London: University of Chicago Press, 2013, 19f. For a general history of cybernetics, see Ronald R. Kline, *The Cybernetics Moment: Or Why We Call Our Age the Information Age*, Baltimore: John Hopkins University Press, 2015.

Cybernetics, as a field of study, is not a direct predecessor of the digital humanities, seeing as humanities computing existed concurrently; however, one might say that it is a sometimes-distant, sometimes-not-so-distant relative. The study of the relationship between 'man' and 'machine' was and is diversified across several disciplines but these boundaries between fields adjacent to computer science were never as clearly drawn as the different traditions might suggest; and today we see approaches and methods from the study of artificial intelligence, machine learning, computer linguistics, to name a few, mingle at digital humanities conferences and in digital humanities discourses.[55] A common denominator would seem to be a certain closeness to and relationship with notions that we also find in traditions such as structuralism and Russian formalism;[56] I note this because we briefly touched on this in **CHAPTER I**. The history and academic tradition of cybernetics – and I speak of its history and tradition since it arguably has been superseded as a discipline in its own right[57] – has not yet received widespread attention

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55 For information on the topics presented at digital humanities conferences from the 1960s to the present, see *The Index of Digital Humanities Conferences*, ed. by Scott B. Weingart [et al.], Carnegie Mellon University, 2020–present, <https://dh-abstracts.library.virginia.edu/> (accessed 8 February 2023) [also accessible under <https://doi.org/10.34666/k1de-j489>].

56 On the intersection between structuralism and computing history (especially cybernetics), see Bernard Dionysius Geoghegan, "Nine Pails of Ashes: Social Networks, Genocide, and the Structuralists' Database of Language," in: *History of Anthropology Review* 45 (2021), online: <https://histanthro.org/notes/nine-pails-of-ashes/> (accessed 13 January 2023). A conference on the relationship between Russian formalism and the digital humanities was held at the Stanford Humanities Center in 2015, see <https://digitalhumanities.stanford.edu/russian-formalism-digital-humanities/> (accessed 8 February 2023); for a conference report by one of the organizers, see Andrei Ustinov, "The Legacy of Russian Formalism and the Rise of the Digital Humanities," in: *Wiener Slavistisches Jahrbuch* 4 (2016), 287–289, online: <https://doi.org/10.13173/wienslavjahr.4.2016.0287>. Distant reading has been a particular focus of discussion in these contexts; cf. Basil Lvoff, "Distant Reading in Russian Formalism and Russian Formalism in Distant Reading," in: *Russian Literature* 122–123 (2021), 29–65, online: <https://doi.org/10.1016/j.ruslit.2021.07.003>. See also Basil Lvoff, *The Problem of Literary Development in Russian Formalism and Digital Humanities* (CUNY Academic Works), dissertation, 2020, online: <https://academicworks.cuny.edu/gc_etds/3881> (accessed 8 February 2023).

57 It is not entirely obsolete, as the continued existence of *The Cybernetics Society*, their conferences, and their publication of the journal *Kybernetes* would seem to indicate, for example. There, we can still find articles on modelling theory in recent years, such as

in a digital humanities context, despite tentative ventures in that direction by researchers such as, in the German discussion, Stefan Heßbrüggen-Walter and Toni Bernhart.[58] This is all the more surprising given that the closeness that existed at the time is also demonstrated in an Italian article from 1966, written by Roberto Busa, the traditionally appointed 'founding father' of the digital humanities, wherein he speculates about the impact that cybernetics (in his article in the sense of automation) will have on future societies and the human relationship with God.[59] The theological element does not negate the connection.

In the context of this book and this chapter, the field of cybernetics is not relevant in all its historical minutiae and particularities but rather in its promotion of a discourse on modelling theories, in which it seems to have notably eclipsed humanities computing in the concurrent time

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Maurice Yolles and Gerhard Fink, "A General Theory of Generic Modelling and Paradigm Shifts: Part 1 – The Fundamentals," in: *Kybernetes* 44/2 (2015), 283–298 [part 2 'Cybernetic Orders' in the same issue, 299–310, and part 3 'The Extension' in the same issue, 311–328]. This presence does not, however, equal the proliferation of the field in the latter half of the 20th century, nor would it seem to be in any way related to the literature under review here, if the cited article can be seen as exemplary for the current discourse in cybernetics.

58 See Stefan Heßbrüggen-Walter, "Die Angst vor dem 'Elektronengehirn': Topoi der Kybernetik-Kritik in der bundesdeutschen Nachkriegsphilosophie," in: *Konferenzabstracts DHd 2018*, ed. by Georg Vogeler, Köln: University of Cologne, 166–168, and Toni Bernhart, "'As a Hobby at First': Künstlerische Produktion als Modellierung," in: *Konferenzabstracts DHd 2020*, ed. by Christof Schöch, Paderborn: University of Paderborn, 2020, 77–80. See also Toni Bernhart, "Quantitative Literaturwissenschaft: Ein Fach mit langer Tradition?" in: *Quantitative Ansätze in Literatur- und Geistusdeswissenschaften: Systematische und historische Perspektiven*, ed. by Toni Bernhart [et al.], Berlin / Boston: De Gruyter, 2018, 207–220, online: <https://doi.org/10.1515/9783110523300-009>. In an Anglophone context, we might find articles that have a contemporary rather than a historical view on cybernetics, such as Alexander Galloway, "The Cybernetic Hypothesis," in: *differences: A Journal of Feminist Cultural Studies* 25/1 (2014) [special issue *In the Shadows of the Digital Humanities*, ed. by Elizabeth Weed and Ellen Rooney], 107–131, online: <https://doi.org/10.1215/10407391-2420021>. One might also encounter statements that centre current relevance: "Cybernetics [...] is supremely relevant in this age of digital humanities: indeed, it challenges us to think of both the digital and the human in a much broader way." (Leif Weatherby, "The Cybernetic Humanities," in: *Los Angeles Review of Books* (2 January 2017), online: <https://lareviewofbooks.org/article/the-cybernetic-humanities/> (accessed 8 February 2023).)

59 Cf. Roberto Busa, "Cybernetics and the Possibilities of a New Human Being," in: *One Origin of Digital Humanities: Fr Roberto Busa in His Own Words*, ed. by Julianne Nyhan and Marco Passarotti, Cham: Springer, 2019, 93–104 [originally published as "La Cibernetica e le possibilità dell'uomo nuovo," in: *Il Fuoco* 3 (1966), 19–33].

period. Norbert Wiener's thoughts on models in science are well-known and Wiener himself is referenced by McCarty in his most recent writings;[60] less well-known is the fact that cybernetics flourished in the GDR and USSR in the 1960s and 1970s and produced a wealth of literature on the topic.[61] In the case of the GDR, one might start by consulting Klaus Dieter Wüstneck's or Georg Klaus' writings on the matter.[62] Another

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60 For McCarty's elaborations on Wiener, cf. McCarty 2020, 210–212. Although Wiener is referenced, his modelling theory is not. Some brief information: Norbert Wiener was an American mathematician who is widely regarded as the founder of cybernetics. He differentiated between material and formal (or intellectual) models and, through his vision of cybernetics as a 'universal science', initiated the post-war dialogue on models and modelling in science together with Arturo Rosenblueth who was another pioneer in the field; cf. Arturo Rosenblueth and Norbert Wiener, "The Role of Models in Science," in: *Philosophy of Science* 12/4 (1945), 316–321. For this particular debate about modelling, see also Kline 2015, 44–55.

61 The history of the digital humanities in Russia has been contextualized in light of the tradition of cybernetics and its entanglement with mathematics and computer science; cf. Inna Kizhner [et al.], "The History and Context of the Digital Humanities in Russia," in: *Global Debates in the Digital Humanities* (Debates in the Digital Humanities; vol. 8), ed. by Domenico Fiormonte, Sukanta Chaudhuri and Paola Ricaurte, Minneapolis: University of Minnesota Press, 2022, 55–70, online: <https://doi.org/10.5749/9781452968919>. For a history of cybernetics in the USSR, see Slava Gerovitch, *From Newspeak to Cyberspeak: A History of Soviet Cybernetics*, Cambridge, Massachusetts / London: MIT Press, 2002. See also Egle Rindzeviciute, "Purification and Hybridisation of Soviet Cybernetics: The Politics of Scientific Governance in an Authoritarian Regime," in: *Archiv für Sozialgeschichte* 50 (2010), 289–310, and Benjamin Peters, "Normalizing Soviet Cybernetics," in: *Information & Culture* 47/2 (2012), 145–175. Yanina Prudenko has published a history of Soviet cybernetics and cybernetic art which is consciously described as part of a digital humanities tradition: "The Soviet Union had its own Digital Humanities." (Announcement by the publisher Garage, in which the title of the monograph is translated as *Cybernetics in Humanities and Arts in the USSR: Big Data Analysis and Computer Art*, see <https://garagemca.org/en/publishing/yanina-prudenko-cybernetics-in-humanities-and-arts-in-the-ussr-big-data-analysis-and-computer-art-by-yanina-prudenko> (accessed 8 February 2023).) For this publication, see Янина Пруденко, Кибернетика в гуманитарных искусствах и науках СССР, Москва́: Гараж, 2019 [Yanina Prudenko, *Cybernetics in Humanities and Arts in the USSR*, Moscow: Garage, 2019]. See also the discussion between Yanina Prudenko, Lev Manovich, Alexey Shulgin, Vladimir Velminsky, Vladimir Gubailovsky, Andrey Smirnov, and Nikolai Konstantinov about Soviet cybernetics in a digital humanities context, "Советские digital humanities и цифровое творчество," panel discussion (5 April 2019), online: <https://theoryandpractice.ru/videos/1426-kibernetika-stala-novoy-religiey-kak-razvivalis-digital-humanities-v-sssr> (transcription) and <https://www.youtube.com/watch?v=Af5G9MNBY3w> (video recording, both accessed 1 September 2023).

62 See Klaus Dieter Wüstneck, "Zur philosophischen Verallgemeinerung und Bestimmung des Modellbegriffs," in: *Deutsche Zeitschrift für Philosophie* 11/12 (1963),

example that still makes for very interesting reading today, not written by a cyberneticist but in the *Dunstkreis* ('orbit') of the discussion prompted by cyberneticists at the time, involving mathematicians and philosophers as well, is the 1966 monograph *Моделирование и философия* ('Modelling and Philosophy') by Victor Aleksandrovič Štoff, a professor of philosophy in Saint Petersburg (then Leningrad).[63] As for the connection of this work to cybernetics, we might cite what he states at the very beginning of his first chapter, namely that "in cybernetics, modelling is one of the main research methods"[64] and that it is "primarily through the achievements of cybernetics that the term model has spread among mathematicians and logicians, physicists and chemists, astronomers and biologists, economists and linguists and of course, first and foremost,

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1504–1532, and Klaus Dieter Wüstneck, "Einige Gesetzmäßigkeiten und Kategorien der wissenschaftlichen Modellmethode," in: *Deutsche Zeitschrift für Philosophie* 14/2 (1966), 1452–1463. He also published an article on models in the *Philosophisches Wörterbuch*, ed. by Georg Klaus and Manfred Buhr, Leipzig: Bibliographisches Institut, [6]1969, 729–734 [published in West Germany in three volumes as the *Marxistisch-Leninistisches Wörterbuch der Philosophie*, Hamburg: Rowohlt, 1972; I want to note that I have not been able to verify the page number via autopsy]. Georg Klaus, himself a philosopher, published extensively on cybernetics, which I mention to show how entwined these considerations were; see, for example, Georg Klaus, *Kybernetik und Erkenntnistheorie*, Berlin: Deutscher Verlag der Wissenschaften, 1966. For a contemporary West German view on Klaus and the flourishing of cybernetics in the East, see Friedrich Rapp, "Kybernetik und Erkenntnistheorie: Bemerkungen zur Konzeption von Georg Klaus," in: *Zeitschrift für allgemeine Wissenschaftstheorie / Journal for General Philosophy of Science* 5/2 (1974), 329–340, online: <https://www.jstor.org/stable/25170327>. See also Wolfgang G. Stock, "Georg Klaus über Kybernetik und Information: Studien zur philosophischen Vorgeschichte von Informatik und Informationswissenschaft in der Deutschen Demokratischen Republik," in: *Studies in Soviet Thought* 38/3 (1989), 203-236, online: <https://www.jstor.org/stable/20100467>.

63 Cf. Виктор Александрович Штофф, Моделирование и философия, Москва́ / Ленинград: Наука, 1966 [Victor Aleksandrovič Štoff, *Modelling and Philosophy*, Moscow / Leningrad: Science, 1966]. I have accessed the work through its (East) German translation, V. A. Štoff, *Modellierung und Philosophie*, transl. by Siegfried Wollgast, Berlin: Akademie-Verlag, 1969, and will subsequently be referring to this translation. The East German translation was commissioned by Hubert Laitko, a German philosopher and historian of science, and published in the GDR on his initiative. While only accessible to me as a second-hand purchase at the time of writing this book, De Gruyter has since published a reprint in 2022, online: <https://doi.org/10.1515/9783112645406>.

64 Štoff 1969, 17, original (German translation): "In der Kybernetik ist die Modellierung eine der hauptsächlichen Untersuchungsmethoden."

among cyberneticists themselves in the last decade."[65] While the monograph has to be read through a lens of source criticism,[66] it does illustrate the framework and milieu within which the discourse at the time operated.

Štoff himself was a philosopher of science and particularly interested in the epistemological role of models in science in general. To that end, he summarized the state of discussion and advanced his own classification of model types (see **FIG. 8**).[67] It should be noted that there are very few proposals for a comprehensive classification system of models in science. When compared to the distinction drawn between material and non-material models, which is also the distinction Arturo Rosenblueth and Norbert Wiener followed in their initiation of the post-war discourse about models in science,[68] Štoff's approach appears more sophisticated. His primary distinction is still that of material and non-material (or intellectual) models, but he divides each of them into three further categories: mathematically, physically, and spatially similar models on the one and symbolic, mixed (pictorial as well as symbolic), as well as pictorial (iconic) models on the other hand.[69]

What would a classification of models in the digital humanities look like? Would we dispense with the distinction between material and non-material models? One could imagine the use of material models in the digital humanities, but I am personally unaware of such a practice. The main distinction would, perhaps, lie between models that are visible, i.e. visualized, and those that are not. This obviously ties into their primary function and yet would seem to highlight a quality particular

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65 Ibid., original (German translation): "Vornehmlich durch die Erfolge der Kybernetik verbreitete sich im letzten Jahrzehnt der Terminus Modell unter Mathematikern und Logikern, Physikern und Chemikern, Astronomen und Biologen, Ökonomen und Sprachwissenschaftlern und natürlich in erster Linie unter den Kybernetikern selbst."
66 The circumstances of its creation are obvious, for example, in the emphasis on models being a *Widerspiegelung der Wirklichkeit* ('reflection of reality') in order to justify the study of the subject in the context of a philosophical dialectical materialism in the Marxist tradition, cf. Štoff 1969, 323–330. The observation that the entire *Abbild* discourse in these modelling theories is rooted in the epistemology of dialectical materialism is also the basis for Rapp's analysis of Klaus' writings, cf. Rapp 1974, 334f.
67 Cf. Štoff 1969, 48.
68 Cf. Rosenblueth / Wiener 1945, 317.
69 Cf. Štoff 1969, 48.

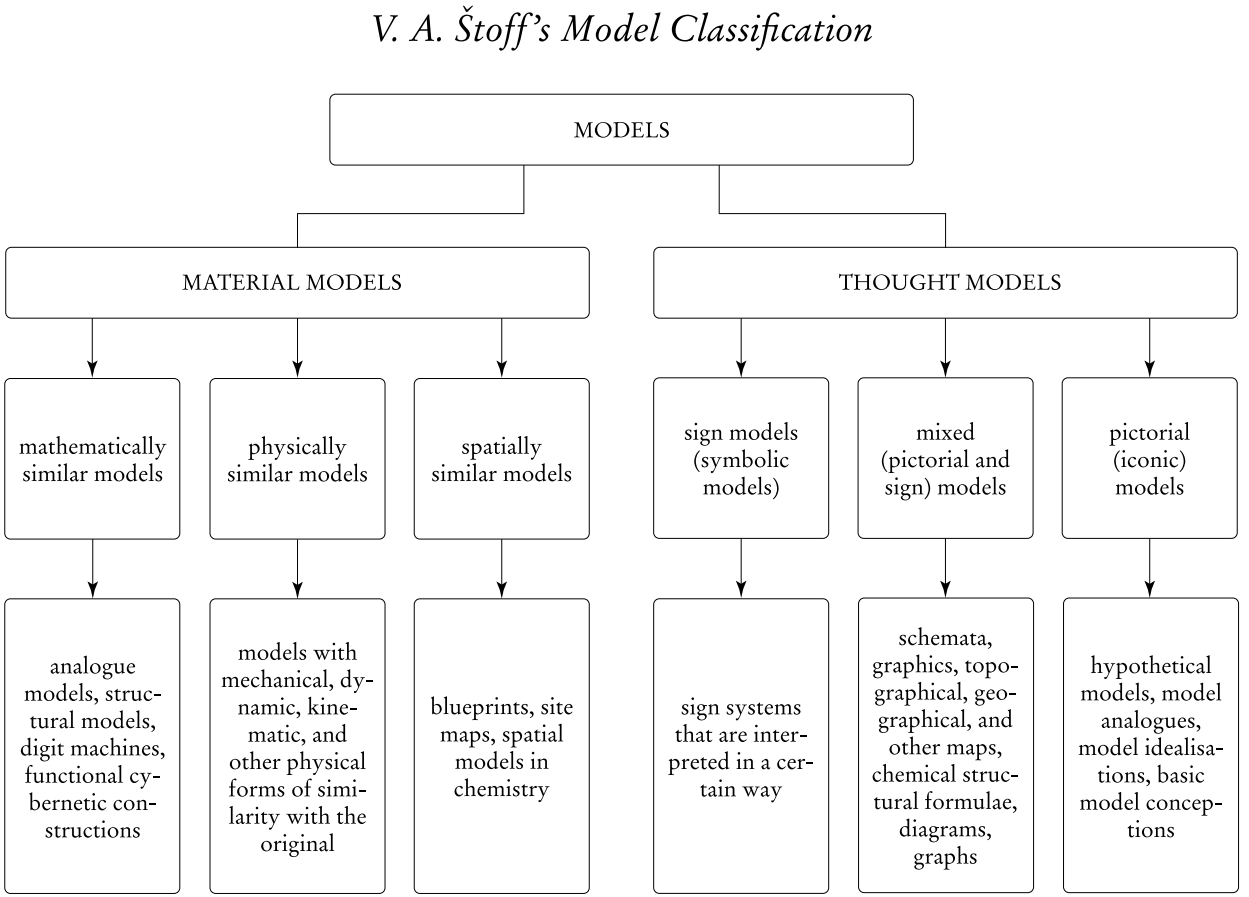

FIG. 8: V. A. Štoff's classification of scientific model types ("wissenschaftliche Erkenntnismodelle"), recreated in English here on the basis of its German translation; from V. A. Štoff, *Modellierung und Philosophie*, transl. by Siegfried Wollgast, Berlin: Akademie-Verlag, 1969, 48, online: <https://doi.org/10.1515/9783112645406>.

to this context. We might, in this instance, equate models in the digital humanities with models in computer science; and that might be a mistake. Until the question of models and modelling in the humanities has been clarified, it would not seem wise to make statements on the nature of models in the digital humanities, as far as our ability to classify them is concerned.

Another matter of interest – all of it is of interest, but within the confines of the present discussion – is Štoff's differentiation between a model and a theory which shall be reproduced here with the caveat that it is based on the German translation:

> So what is the difference between model and theory? The fundamental distinguishing feature between model and theory is not the degree of simplification (as I. T. Frolow supposes) nor the degree of abstraction nor, consequently, the number of realized abstractions but the way of expressing those abstractions and simplifications that is characteristic for the model. The content of a theory is expressed in a sum of assessments that are connected to each other through logical and specialized scientific rules and reflect the 'immediate' patterned, essential, and universal contexts and relations of reality. By contrast, in the model the same content is displayed in the form of typical situations, structures, schemata, a sum of idealized (i.e. simplified) objects etc., in which these patterned contexts and relations are realized or, which amounts to the same, in which the rules formulated in the theory are implemented but, so to speak, in 'pure form'. Because of this, a model is always a concrete construct that is, in a certain form or to a certain degree, illustrative, finite, and accessible for inspection or a practical activity.[70]

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70 Štoff 1969, 28, original (German translation): "Worin besteht also der Unterschied zwischen Modell und Theorie? Das wesentliche Unterscheidungsmerkmal zwischen Modell und Theorie ist nicht der Vereinfachungsgrad (wie I. T. Frolow annimmt), nicht der Abstraktionsgrad und folglich auch nicht die Menge der vollzogenen Abstraktionen, sondern die für das Modell charakteristische Ausdrucksweise dieser Abstraktionen und Vereinfachungen. Der Inhalt einer Theorie wird in einer Gesamtheit von Urteilen ausgedrückt, die untereinander durch logische und spezialwissenschaftliche Gesetze verbunden sind und ‚unmittelbar' gesetzmäßige, notwendige und allgemeine Zusammenhänge und Beziehungen der Wirklichkeit widerspiegeln. Im Modell wird der gleiche Inhalt dagegen in Form typischer Situationen, Strukturen, Schemata, Gesamtheiten idealisierter

With this pragmatic approach, Štoff achieves a synthesis of various aspects: He connects the oft-discussed model-qualities of simplification and abstraction with their narrowing of view on a given matter, while at the same time emphasizing that their form is their purpose, as it allows for a certain kind of study and a certain kind of subsequent action; in the context of science, that is, since he explicitly does not account for artistic models in his examination of 'model' definitions.[71] We can already sense, however, that the digital humanities also cannot be accounted for in this way: Neither have they proposed a definition of 'theory' that would allow for a differentiation with 'model' nor do they possess a theory of theory (or a theory about the relationship between theory and practice, the conceptual and the applied or implemented) in general.

Pragmatism leads us to another author who has been mentioned and should be discussed, even if briefly: Herbert Stachowiak, a German philosopher and cyberneticist whose modelling theory, influential in Germany to the present day,[72] has been neglected elsewhere,[73] compared

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(d.h. vereinfachter) Objekte usw. dargestellt, in denen diese gesetzmäßigen Zusammenhänge und Beziehungen realisiert oder, was dasselbe ist, die in der Theorie formulierten Gesetze erfüllt sind, aber sozusagen in ‚reiner Form'. Deshalb ist ein Modell immer ein konkretes Gebilde, das in einer bestimmten Form oder in einem bestimmten Grade anschaulich, endlich und der Betrachtung oder der praktischen Tätigkeit zugänglich ist."

71 Cf. Štoff 1969, 329. On the topic of (non-human) models in the context of art, one might, for example, beside Schelbert 2019 in the digital art history context, consult Horst Bredekamp, "Modelle der Kunst und der Evolution," in: *Modelle des Denkens: Streitgespräch in der Wissenschaftlichen Sitzung der Versammlung der Berlin-Brandenburgischen Akademie der Wissenschaften am 12. Dezember 2003* (BBAW-Debatte; vol. 2), ed. by Sonja Ginnow and Christiane Lahusen, Berlin: Berlin-Brandenburgische Akademie der Wissenschaften, 2005, 13–20, and Ludmilla Jordanova, "Material Models as Visual Culture," in: *Models: The Third Dimension of Science*, ed. by Soraya de Chadarevian and Nick Hopwood, Stanford: Stanford University Press, 2004, 443–451, as mentioned by Reinhard Wendler in his introduction of Mahr's *Replik* in Mahr 2015b.

72 For an appraisal, see Barbara E. Hof, "The Cybernetic "General Model Theory": Unifying Science or Epistemic Change?" in: *Perspectives on Science* 26/1 (2018), 76–96, online: <https://doi.org/10.1162/POSC_a_00268> [green open access version available under <https://doi.org/10.5167/uzh-150926>].

73 When there are references to Stachowiak in English-language literature on modelling, they are usually by Germans, such as in Bernhard Thalheim, "The Theory of Conceptual Models, the Theory of Conceptual Modelling and Foundations of Conceptual Modelling," in: *Handbook of Conceptual Modeling: Theory, Practice, and Research Challenges*, ed. by David W. Embley and Bernhard Thalheim, Berlin [et al.]: Springer, 2011, 543–577. That is, of course, to be expected since there are no English translations

to the body of output he produced on the topic, most importantly his *Allgemeine Modelltheorie* (1973).[74] Stachowiak was a proponent of 'neo-pragmatism'[75] and formulated a model theory centred around three features or characteristics of a model:

> (A) *Characteristic of mapping*. Models are always models of something, namely representations of certain 'originals' (or 'prototypes'), natural or artificial, which themselves can be models again. (B) *Characteristic of shortening* (reducing, abbreviation). Models do not generally map all the attributes of the original represented by them, but only those that are relevant for the modeller or model-user. [...] (C) *Characteristic of pragmatical model-function*. Models are not in themselves coordinated to their originals. They always fulfil their functions of substitution only for subjects with goal-dependent mental or factual operations within certain lapses of time.[76]

Here, we find abstraction and simplification supplemented by the pragmatic element of a *situatedness* of a model *usefulness* in its specific use in a specific context at a specific time. While this might seem obvious, explicitly stating it has the benefit of delimiting any universal *Geltungsanspruch* ('claim of applicability') either creators of models or their users might be inclined to entertain otherwise.

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of Stachowiak's main body of work. In another collected volume by Bernhard Thalheim, which is in German and notable for presenting the so-called *Kieler Modellbegriff* (model definition as developed by him and at his chair of computer science in Kiel), references to Stachowiak feature throughout, cf. Thalheim and Nissen eds. 2015. One of the few English-language publications of Stachowiak's work is Herbert Stachowiak, "Models," in: *Scientific Thought: Some Underlying Concepts, Methods and Procedures* (New Babylon; vol. 9), ed. by Unesco Division of Philosophy, Paris / The Hague: Mouton, 1972, 145–166, online: <https://unesdoc.unesco.org/ark:/48223/pf0000002251> (accessed 8 February 2023).

74 See Herbert Stachowiak, *Allgemeine Modelltheorie*, Wien [et al.]: Springer, 1973.

75 Cf. Stachowiak 1983 (viz. his section on "Erkenntnisstufen zum Systematischen Neopragmatismus und zur Allgemeinen Modelltheorie," 87–146).

76 Stachowiak 1972, 150.

Given the focus of our inquiry, it would appear sensible to end this section by summarizing the main findings as they pertain to the model-building that we will have to engage in (or anticipate engaging in):

(1) Models of most if not all kind would seem to share characteristics of abstraction, reduction or simplification, delineation, and, as McCarty would add as a differentiation between models and concepts, manipulability.[77]
(2) The difference between conceptual models and concepts as such is that conceptual models will have identified structures, i.e. elements and their relations, that can be clearly delineated and visualized.
(3) A model will never represent the entire 'original' (*Urbild* if we like, which can refer to a concept or otherwise ideational 'entity' or 'system of entities' as well as to a material or pictorial 'entity' or 'system of entities' as well as to other types of 'entities' and other models)[78] but we can purposefully choose those parts of the *Urbild* that are *useful* for a certain intent of study or activity.

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77 Cf. McCarty 2005, 26. This differentiation seems self-explanatory at first glance; however, it also begs a similar question as the issue of simulation in a humanities context, namely for which fields of study the manipulability of models would be a benefit in their methodological repertoire and for which it would, conversely, be in contradiction to their established scholarly ethics and *Erkenntnisstrategien* ('strategies for gaining insight'); and on that point it would, furthermore, beg the questions how exactly this would manifest and what could be done to countenance the 'manipulation' of elements in a model; whether there would have to be criteria according to which this is admissible in certain circumstances of correction or uncertainty or exploration ('what happens if...' would take it closer to issues of simulation, however, and with that closer to the issues discussed in this chapter before, which goes to show that each discipline would have to contend with these questions on their own and within the boundaries of their remit of scholarly argumentation). A model that maps (in the sense of *abbilden*) a state of knowledge about a body of evidence could be manipulated in contradiction to that evidence but then it would not represent that evidence or a state of knowledge about that evidence anymore; conversely, a single model could, through manipulation, represent different concurrent states of knowledges about (i.e. interpretations of) a body of evidence that would exist concurrently within scholarship with or without models and model manipulation. In any case, it would seem that there are still many debates to be had about this particular aspect of modelling.

78 I generally hesitate to use the term 'system' because that might necessitate a discussion of Niklas Luhmann or other system theorists, especially since mistranslations

(4) All models are both models-of and models-for, that is, *abbildend* and *vorbildend*, to some degree, but we can differentiate models along their *primary* function in this regard.

(5) In humanities computing, conceptual models that are universal more than they are case-specific, which is not to say that they are universal, will tend towards being *vorbildend*, in the sense that they purposefully await further implementation and specification in the form of another model, e.g. in the form of a case-specific data model.

(6) Consequently, in the context of this book, it would seem to be the case that we are developing a conceptual *vorbildendes* model *for* digital scholarly editions so that others may develop an editorial *abbildendes* model *of* certain specific materials; and since there is no methodical guideline for this, the following chapters, or at least those examining a variety of source materials, will focus on uncovering principles, identifying structures, and delineating terms of involved scholarship.

As a second to last point in this general part of the discussion, it should be noted that McCarty compares the term 'model' to related terms and concepts, namely analogy, representation, diagram, map, simulation, and experiment.[79] Even though this differentiation might, at first, seem complex, the discussion may be abbreviated in the following way: models are analogical but there are other types of analogies; models are representations but there are other types of representations; models are often depicted in the form of diagrams but the visualization of a model is not the same as the model since one model can be depicted in different diagrams – and a model can be represented in forms other than a diagram, such as in a physical three-dimensional model; maps are certain types of models

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between German and English have already caused much confusion among scholars in that regard, cf. Ervin Laszlo, "Foreword," in: Ludwig von Bertalanffy, *Perspectives on General System Theory: Scientific-Philosophical Studies*, ed. by Edgar Taschdjian, New York: George Braziller, 1975, 8–13. It is interesting, however, to note the intersection of the pioneering work of biologist Bertalanffy with that of cybernetic pioneers like Norbert Wiener.

79 Cf. McCarty 2005, 28–37.

but not every model is a map, although we might refer to the process of *abbilden* as mapping; models can be used for simulations when dynamic factors like time are added to the equation and elements are manipulated in their positioning and relationality; models can be experimental in the sense that they might be used for testing and visualizing a hypothesis that might be revealed to be flawed in the process of trying to model it – but there are other types of experiments that are more likely to satisfy standards applied to the procedures involved in an experiment, especially in the natural sciences, where an experiment will aim to uncover that which is unknown whereas a model, as noted before, may be an explorative inquiry into a subject matter and may uncover in its process something previously unknown but may not, however, depict that which is unknown unless the depiction of the known is treated as simultaneously being a depiction of that which is unknown (although a model will never depict everything that is already known and will therefore, through an absence of something in the model, not inevitably denote the absent as unknown).

As for the last point of this general part, let me emphasize that it stands to reason that while there are many more authors in many more languages and contexts that should be of interest to the modelling discourse in the digital humanities, the purpose of this section was merely to draw attention to that very fact and suggest venues for exploration. More work is to be done to recover directly relevant writings where they might help advance current positions in the sense that some of those contributions are several decades old and yet would seem to be ahead of current positions; progress can be made in ignorance of such literature, but one supposes that it can be made more so in knowledge of it. To that end, the digital humanities should seek to be aware of discourses at the edges of their disciplinary purview, which is to say, they should be aware of the discourses *touching* the purview of humanities computing, present and past, such as in the case of cybernetics as it fuelled discussions of modelling theory in the 1960s and 1970s.

D.
MODELS IN THE HUMANITIES

If it now seems as if this chapter has already served its purpose, that impression is deceptive. Moving from the general discussion of models in science to a slightly more specific discussion of models in the humanities serves to make a point about an epistemological core characteristic of the humanities that may complicate modelling concerns in the digital humanities and furthermore highlight why scholarly editing may be one of the few humanistic activities that already translate well and will presumably continue to translate well into a computational paradigm. Once we have established that, we can turn to digital scholarly editing and aspects specific to the modelling *environment* that we operate in and the modelling *parameters* that we might want to keep in mind when developing models for digital scholarly editions.

To start with, let us register another desideratum: Models in the humanities and modelling as a method in the humanities have hitherto not been particularly pronounced subjects of study; neither in the humanities as such nor in discussions of humanities computing – at least not with a broad view on models in the *humanities* rather than a view on models in specialized fields of humanistic study. While discussions of models in science can fill sizeable rows on bookshelves, as demonstrated in the previous sections, models in the humanities are usually not kept in mind, let alone addressed specifically.[80] This means that in the case of humanities computing, humanists and other researchers (such as computer scientists) alike are confronted with two issues of modelling: how to model something in the humanities at all and how to model something from the humanities computationally. These issues should not be confused but a lack of literature and consideration on the first

80 This is not an issue exclusive to the English language. Even though German publications on general matters of *Wissenschaftstheorie* would ostensibly seem to encompass the humanities, in practice this is often not the case, cf. Athena Panteos and Tim Rojek, "Einleitung," in: *Texte zur Theorie der Geisteswissenschaften*, ed. by Athena Panteos and Tim Rojek, Stuttgart: Reclam, 2016, 9–23, here esp. 11–12.

point necessarily leads to a conflation. The solution, at present, would therefore seem to be a consideration of models in the humanities as such.

All of the above is not to say that there have been no references to 'models' and 'modelling' *in* the humanities; quite the opposite. As Manfred Thaller has pointed out, the historian Geoffrey Rudolph Elton opposed the use of quantitative methods in historical studies (as well as other kinds of methods 'borrowed' from other disciplines) and yet nonetheless did not object to the term or concept of a 'model' itself, rather treating it as naturally belonging to the vocabulary of a historian.[81] Searching the literature produced in historical studies would likely unearth a multitude of uses of the term 'model' but little discussion *of* the term 'model'. In one of the few publications explicitly about models in historical studies, "Models Inherent in History" (1972), historian and hermeneuticist Gordon Leff described the resistance to a discourse about modelling in the following way:

> Historians as a profession are not given to constructing or employing models in any formal or explicit sense; where they do, it is mainly in areas bordering on other disciplines, especially economics and social studies. Most historians, if asked, would probably deny that models had anything to do with their subject. In that they would, I believe, be mistaken.[82]

He accurately identifies that the issue is not whether models and modelling play a role in scholarship but whether this is acknowledged and discussed. When asked what they would consider to be a model

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81 Cf. Manfred Thaller, "Von der Mißverständlichkeit des Selbstverständlichen: Beobachtungen zur Diskussion über die Nützlichkeit formaler Verfahren in der Geschichtswissenschaft," in: *Historical Social Research* suppl. 29 (2017), 221–242, here 228, online: <https://doi.org/10.12759/hsr.suppl.29.2017.221-242> [originally published in *Frühe Neuzeit – Frühe Moderne: Forschungen zur Vielschichtigkeit von Übergangsprozessen* (Veröffentlichungen des MPI zur Erforschung multireligiöser und multiethnischer Gesellschaften; vol. 104), ed. by Rudolf Vierhaus [et al.], Göttingen: Vandenhoeck & Ruprecht, 1992, 443–67].

82 Gordon Leff, "Models Inherent in History," in: *The Rules of the Game: Cross-Disciplinary Essays on Models in Scholarly Thought*, ed. by Teodor Shanin, London / New York: Routledge, 2001, 148–160, here 148 [reprint; originally published in Abingdon, Oxfordshire: Tavistock Publications, 1972].

in historiography, a colleague of mine answered: feudalism. But is feudalism not rather a concept which may be expressed in different models and at different stages of idealization, unless one were to equate 'feudalism' with a most schematic and abstract view on hierarchical socio-economic order? Such an extreme simplification would seem ill-suited for historical studies in an academic context.

We do, of course, find simplifications of the kind that is often adhered to even when there is criticism over its lack of nuance. Periodization is one such example and it is also one that Leff cites by referring to the "conception of an epoch."[83] Periodization, that is, the division of time into eras and epochs and ages, clustered around a purported unity of thought, societal, political, economic, or other factors, might be a useful "organizing principle"[84] for the study of history, but it might also suggest continuities and discontinuities where there are none, or at least not on the scale suggested, and it might also serve to lock assumptions, presuppositions, or even prejudices into place by virtue of association.[85] The reference to early medieval times as the 'dark ages' that one can sometimes still encounter in Anglophone literature on the topic, albeit nowadays supposedly referring to a lack of source material[86] rather than the pejorative meaning intended by the Humanist scholars who originated the notion,[87] is a good example for this.[88] Even the source material

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83 Ibid., 150.

84 Leff 1972/2001, 151.

85 On the topic of the periodization of history, see Lawrence Besserman (Ed.), *The Challenge of Periodization: Old Paradigms and New Perspectives*, London / New York: Routledge, 2013 [originally published in New York: Garland, 1996], and Johan Hendrik Jacob van der Pot, *Sinndeutung und Periodisierung der Geschichte: Eine systematische Übersicht der Theorien und Auffassungen*, Leiden [et al.]: Brill, 1999. To reiterate: If we consider discussions of periodization to be discussions about modelling in the humanities, then there have been many such discussions; but we will not find them under that banner.

86 This type of argumentation is usually connected to the so-called 'migration period' in British history and exemplified by the following: "In this migratory period things were rather less settled than in Roman times, and disruption made for only patchy source survival. It is indeed the Dark Age before around 800." (Helen M. Jewell, *Women in Dark Age and Early Medieval Europe c. 500–1200*, Basingstoke: Palgrave Macmillan, 2006, 2.)

87 Cf. Theodor E. Mommsen, "Petrarch's Conception of the 'Dark Ages'," in: *Speculum* 17/2 (1942), 226–242.

88 See on this topic as such and on the question why the term 'dark ages' has survived in the vocabulary of British historians (applied to the so-called 'Anglo-Saxon' period)

argument begs the question why such a term would not be applied to other, less well-documented times with greater frequency and where the line is drawn between 'dark ages' and suitably well-documented 'lighter' or, indeed, 'enlightened ages'. It is perhaps no coincidence that publications such as *The Bright Ages: A New History of Medieval Europe* (2021) have been embroiled in controversies of their own, cut from the same narrative cloth as the one they seek to shed.[89]

After discussing the issue of periodization, Leff goes on to argue that the study of history might be evidence-based but only "seemingly empirical"[90] in that its results are not reproducible and the researcher dependent on sources that survived arbitrarily or already in service of a narrative. Consequently, the study of history relies heavily on structured concepts within which the evidence can be framed, partitioned, and related to each other; in other words, models:

> History cannot be systematically studied or written unless the historian observes the criteria which are peculiar to it as a body of knowledge. For that a conceptual framework is necessary, which, however empirically founded, becomes intelligible only through following the same intellectual processes of definition and inference necessary to all conceptual knowledge. That framework is provided by the historian's models, which, as mental constructs imposed upon the evidence, make the facts speak in response to his prompting and not of themselves.[91]

We could find many examples for this but the most obvious might be the French *Annales* school: What is Fernand Braudel's methodical instrument of dividing history into *longue durée*, *moyenne durée*, and

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longer than elsewhere Janet L. Nelson, "The Dark Ages," in: *History Workshop Journal* 63/1 (2007), 191–201, online: <https://doi.org/10.1093/hwj/dbm006>.

89 See for the book in question Matthew Gabriele and David M. Perry, *The Bright Ages: A New History of Medieval Europe*, New York: HarperCollins, 2021. On the controversy that followed the release of the book, see Jennifer Schuessler, "Medieval Scholars Spar on a Modern Battlefield: Twitter," in: *New York Times* (6 May 2022), online: <https://www.nytimes.com/2022/05/06/arts/medieval-race-twitter.html> (accessed 9 February 2023).

90 Leff 1972/2001, 148.

91 Ibid., 149.

événement if not a model, a structural lens through which to study segmented stretches of time?[92] Lest we forget, he even published a monograph by the title *Le Modèle italien* (1989).[93]

Models occur and recur in other disciplines of the humanities as well, of course. Arnold Schönberg's definition of a *Satz* has been referred to as a 'model'[94] and there is a more general understanding of a *Satzmodell* in musicology (in this case denoting a general configuration or formula or schemata of musical elements characteristic for a certain composer or epoch)[95] which is quite obviously related to issues discussed here, not least of all because German researchers, in writing about this specific concept, have explicitly drawn on the model theory of Stachowiak.[96] As for philology, Lachmann's stemmatology has been mentioned before but belongs here as well since it is a prime example for modelling;[97] for literary studies, we could also cite Moretti – his monograph *Graphs, Maps, Trees* (2005) has the subtitle *Abstract Models for a Literary History* after all. We could refer to Max Weber's notion of an *Idealtypus* as an

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92 Cf. Fernand Braudel, "Histoire et Sciences sociales: La longue durée," in: *Annales: Économies, Sociétés, Civilisations* 13/4 (1958), 725–753.

93 See Fernand Braudel, *Le Modèle italien*, Paris: Arthaud, 1989.

94 For a discussion of 'model' and 'variant' in this context, see Oliver Schwab-Felisch, "Haydn, Schenker, Schönberg: Ein Beitrag zur Eklektizismusdebatte in der Musiktheorie," in: *Zeitschrift der Gesellschaft für Musiktheorie* 7 [special issue] (2010), 165–196, online: <https://doi.org/10.31751/568>. For Schönberg's writings, see Arnold Schönberg, *Fundamentals of Musical Composition*, ed. by Gerald Strang in collaboration with Leonard Stein, London: Faber, 1967. On the topic of 'modelling' in musicology which, as an *activity*, is usually used to refer to an act of musical imitation, see J. Peter Burkholder, 'Modelling,' in: *Grove Music Online* (2001), online: <https://doi.org/10.1093/gmo/9781561592630.article.53082> [published in print 20 January 2001, published online 2001].

95 It should be noted that the entire notion of a *Satz* and the notion of *Formenlehre* in general is not without its critics in musicology and would seem to be applied in a fairly broad way in the literature about this particular understanding of *Satzmodell*, as cited in the following fn. For an impression of the discussion about the *Formenlehre* and the issue of speaking of 'schemata', cf. Clemens Kühn, *Formenlehre der Musik*, Kassel [et al.]: Bärenreiter, 1987, 7–12.

96 Cf. Oliver Schwab-Felisch, "Umriss eines allgemeinen Begriffs des musikalischen Satzmodells," in: *Zeitschrift der Gesellschaft für Musiktheorie* 4/3 (2007), 291–304, online: <https://doi.org/10.31751/262>, and Ulrich Kaiser, "Vom Satzmodell zum Modell," in: *Zeitschrift der Gesellschaft für Musiktheorie* special issue 13 (2016), 135–153, online: <https://doi.org/10.31751/865>.

97 See Roelli ed. 2020.

attempt to model abstracted aspects of social reality[98] or Erwin Panofsky's iconographic method.[99]

Rens Bod – a proponent of the study of a 'history of the humanities'[100] – would seem to agree with these examples, given that he lists very similar ones, saying that

> [s]uch [modelling] practices are found not only in linguistics (e.g. De Saussure, Jakobson) but also in philology (Lachmann, Greg), musicology (Schenker, Lerdahl), literary theory (Propp, Todorov), art history (Wölfflin, Panofsky) and historiography (the *Annales* school), just to name a few.[101]

His article on 'modelling in the humanities' from 2018, which the quote is taken from and which, to date, may be the only one to address the topic of modelling in the humanities under that very same title, applies his argument about the history of the humanities as developed by him earlier[102] to models *ex post facto*: namely that the humanities are, at their core, about 'linking patterns to principles' and that that, when considered in the light of modelling, means that they are about modelling (or that modelling is about 'linking patterns to principles' by the same token).[103]

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98 See Max Weber, "Die ‚Objektivität' sozialwissenschaftlicher und sozialpolitischer Erkenntnis," in: *Archiv für Sozialwissenschaft und Sozialpolitik* 19/1 (1904), 22–87.

99 See Erwin Panofsky, "Iconography and Iconology: An Introduction to the Study of Renaissance Art," in: *Meaning in the Visual Arts: Papers in and on Art History by Erwin Panofsky*, New York: Doubleday Anchor Books, 1955, 26–54 [originally published as "Introductory," in: *Studies in Iconology: Humanistic Themes in the Art of the Renaissance*, New York: Oxford University Press, 1939, 3–31].

100 He is, for example, one of the founders of the journal *History of Humanities* (2016–) and author of the book *A New History of the Humanities* (2013). For the editorial of the first issue of the journal, see Rens Bod [et al.], "A New Field: History of Humanities," in: *History of Humanities* 1/1 (2016), 1–8, online: <https://doi.org/10.1086/685056>; for the monograph, see Bod 2013a.

101 Rens Bod, "Modelling in the Humanities: Linking Patterns to Principles," in: *Historical Social Research* suppl. 31 (2018), 78–95, here 85, online: <https://doi.org/10.12759/hsr.suppl.31.2018.78-95>.

102 Most prominently in Bod 2013a.

103 Cf. Bod 2018, *passim*. In Bod 2013a, we find discussion of the thesis but not in relation to models and modelling which I only point out to underline that his central thesis is not *a priori* wedded to the discourse about modelling. He does use the term throughout as one might and earlier publications of his show that the notion of creating a model has played a role in his own formulation of theories in and *about* science and

While this theory holds some weight, it is not without issues. Consider the simple fact that I arrived at some of the same examples for modelling in the humanities as he did: Would that not indicate that while modelling is a part of the humanities, it is, in fact, if viewed from a very particular perspective of pronounced and fairly explicit modelling, not as ubiquitous as one might assume and can be associated with and pinpointed to a select number of scholars representing certain structural or structuralist approaches within their respective disciplines without being actually representative of a *predominant* or in some cases even particularly widespread approach in any of them? It might be possible to develop a broad understanding of modelling in the humanities more akin to the ideas by Gordon Leff but equating modelling with a 'linking of patterns to principles' is reminiscent of Wilhelm Windelband's 19th century distinction between *idiographic* and *nomothetic* studies; ironically, perhaps, given that Bod takes a dim view of Windelband's approach.[104] He argues against Windelband's characterization of the humanities as being invested in "the singular and the unique"[105] (with the natural sciences said to be invested in uncovering laws)[106] by claiming that this was a matter of the humanities creating an identity for themselves, not a lived reality throughout most of their history.[107] Bod essentially reverses the idea, not

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the humanities; see, for example, Rens Bod, "Towards a General Model of Applying Science," in: *International Studies in the Philosophy of Science* 20/1 (2006), 5–25, online: <https://doi.org/10.1080/02698590600640950>, and Rens Bod, "A Unified Model of Structural Organization in Language and Music," in: *Journal of Artificial Intelligence Research* 17 (2002), 289–308, online: <https://doi.org/10.1613/jair.1076>.

104 Cf. Bod 2018, 85. For Windelband's programmatic text, see Wilhelm Windelband, *Geschichte und Naturwissenschaft*, Straßburg: J. H. Ed. Heitz, ³1904, online: <https://archive.org/details/geschichteundnat01wind> [printed version of his inauguration speech as rector of the University of Strasbourg in 1894]. For a translation of this speech, see Wilhelm Windelband, "Rectorial Address, Strasbourg, 1894," transl. by Guy Oakes, in: *History and Thought* 19/2 (1980), 169–185 [for an introduction by the translator, see Guy Oakes, "History and Natural Science," in the same issue, 165–168].

105 Windelband 1894/1980, 182.

106 Cf. "From this perspective, however, the distance between psychology and chemistry is hardly greater than the distance between mechanics and biology. [...] Although the phenomenon in question may be a motion of bodies, a transformation of matter, a development of organic life, or a process of imagination, emotion, and volition, the purpose of these disciplines is invariably the discovery of laws of phenomena." (Ibid., 174.)

107 Cf. "This vision turned out to be extremely influential as it gave the humanities a powerful identity [...]. This constitutive separation between the humanities and sciences,

in order to divide the humanities and the sciences but to unite them. By exclusively focusing on examples of stemmatology and the like, on the alleged search for *patterns* as the primary investigative role, he creates the impression that there are no examples for modelling in the humanities besides and indeed, he even states that "[w]hen Dilthey's and Windelband's visions were gaining ground – from the early twentieth century onwards – modelling practices in the humanities continued,"[108] making it seem as if they continued *in spite of* the fundamental elaborations on the nature of the humanities by figures like Windelband and Wilhelm Dilthey whom we will have to discuss in a moment's time – or, indeed, by a figure like Benedetto Croce whose writings are disposed of by Bod in conjunction with Windelband and Dilthey in one swift mention.[109] If we instead took Windelband's theory seriously on its own merits, we would find that he, in fact, makes a much greater case for modelling being a core activity in historical studies and by extension the humanities than Bod himself. For Windelband states:

> Natural science seeks laws; history seeks *structural forms*. In the natural sciences, thought moves from the confirmation of particulars to the comprehension of general relationships; in the historical sciences, it is devoted to the faithful *delineation* of the particulars.[110]

By speaking of *patterns* and continuing to speak of *patterns* after entering his thesis about the humanities into the modelling debate, Bod potentially overlooks the more fitting term: Even when the humanities are concerned with the singular, unique, and particular, they are concerned with *conceptualizing* it and *delineating* its parts and *relating* them to each other and there consequently need not be any *pattern* involved, only a

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however, did not correspond to actual practice in the humanities before the nineteenth century." (Bod 2018, 85.)

108 Bod 2018, 85.

109 Cf. "The fact that their [Windelband's and Dilthey's] work nonetheless appeared to represent the accepted view of the humanities is largely because, together with the work of Croce, at the beginning of the twentieth century it was virtually the only philosophical reflection concerning the humanities." (Bod 2013a, 260.)

110 Windelband 1894/1980, 178. Emphasis by myself.

structure, which may sound similar but is not the same since it need not involve any *recurrence* of elements or the search thereafter. The relationship between the singular and the general is much more complicated than that, of course, once we begin asking how something may be identified as unique – is it because it occurs within a framework of similarity, from which it deviates? The humanities are, at their heart, a comparative project. This also explains the need for scholarly editions. Variance cannot be understood without a sense of unity, unity cannot be distinguished without a sense of originality. Insofar as the search for patterns allows for the unexpected within the expected (and notions of similarity and dissimilarity are entirely more complicated still in the historical sciences), one might say that it forms part of the investigative toolkit that the humanities have at their disposal. If the humanities, however, primarily seek to delineate objects of study, thoughts, terms, events, expressions in art, and so on, in order to *name* and *understand* them in relation to each other (i.e. in order to find a language that makes sense of the evidence and that which it bears witness to), then the humanities are not primarily concerned with linking patterns to principles, unless one confuses patterns with structures, viz. delineations, and principles with meaning, viz. a communal meaningfulness. Framing the history of the humanities from antiquity to modernity under certain conceptual premises to order it into a sense-making narrative is, I might add as a side note, an exercise in modelling in itself and runs the risk of establishing links between very different practices of scholarship across very different times, countries, and cultures, all of which we might not want to subsume under a very generalized 'humanities' umbrella denoting not only what modern-day humanities may be said to encompass but a specific tradition of scientific inquiry – insofar as there even is such a tradition – that found continuation both in the sciences if deemed separate from the humanities and in the humanities if deemed part of the sciences, which we would account for by describing the 'linking of patterns to principles' as one of many objectives in the *Wissenschaften* as such.

Criticism of Rens Bod's position has been unusually sharp (prior to entering the modelling discourse, in the context of which I am not aware of a response). Joris van Zundert has drawn attention to a sociological aspect of this debate:

> In his recent history of the humanities, Rens Bod dedicates a mere two pages to the concept and history of hermeneutics, in a section titled "Hermeneutics and the anticipatory 'method'" (Bod, 2013:333–4). He disposes of the "method" as being based on guesswork and premonitions. This dismissal might be cast aside as anecdotal were it not for Bod's position as professor of computational and digital humanities, investigating the humanities from both a computational and a historical perspective.[111]

Andreas Fickers, arguably one of Bod's main detractors, has even gone so far as to state the following:

> Driven by a utilitarian logic and motivated by the ambition to create visibility in the 'economy of attention', Bod's provocative statements of 'the end of humanities 1.0' can be interpreted as a perfect embodiment of a specific state of mind within contemporary academia. A mindset that the Austrian Professor of Digital Methods in Architecture and Space Planning Georg Franck has aptly dubbed 'mental capitalism'.[112]

The tone of the debate (in phrases such as "[i]n paraphrasing Dilthey one could say that the veins of the 'reasoning subject' Rens Bod seem to be filled not with real blood, but with 'the diluted sap of rationality'"[113]) is startling in its severity. One of the primary points of contention or causes for offence would seem to be Bod's disregard for Dilthey and the hermeneutical project. Let us turn to Dilthey then and consider why his notion of the humanities might still be of relevance as well as what a

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111 Joris van Zundert, "Screwmeneutics and Hermenumericals: The Computationality of Hermeneutics," in: *A New Companion to Digital Humanities*, ed. by Susan Schreibman, Ray Siemens and John Unsworth, Hoboken: Wiley-Blackwell, 2016, 331–347, here 340f.

112 Andreas Fickers, "Veins filled with the Diluted Sap of Rationality: A Critical Reply to Rens Bod," in: *Low Countries Historical Review* 128/4 (2013), 155–163, here 156, online: <https://doi.org/10.18352/bmgn-lchr.9347>. Bod's response in return can be found in Rens Bod, "Who's Afraid of Patterns? The Particular versus the Universal and the Meaning of Humanities 3.0," in: *Low Countries Historical Review* 128/4 (2013), 171–180, online: <https://doi.org/10.18352/bmgn-lchr.9351> [hereafter Bod 2013b].

113 Fickers 2013, 160.

'model of model-being' – to speak with Bernd Mahr[114] – might have to take into account when it comes to the humanities and their capacity for gaining *Erkenntnis* ('insight'). This is going to be important for understanding what type of knowledge we can or cannot model.

E.
EMPATHY AND EVIDENCE

To state it outright: An element that we might have to be aware of is the element of *Einfühlung* ('feeling-into') or *Nachfühlung* ('re-feeling') which we might also call *empathy* although that term is misleading in English. Mentioning this can provoke a certain hostile response, evidenced by the criticism Dilthey was subjected to by Jürgen Habermas and Hans-Georg Gadamer,[115] but as we will see, this notion is far from arbitrary or sentimental.

First of all, what is meant here by *Einfühlung* is the cognitive ability of perspective-taking.[116] In that, it is not a notion unique to any particular theorist, let alone any particular German theorist. We might, for example, reach back to neo-Confucian scholar Zhu Xi (1130–1200) and his distinction between 'self-focused' and 'other-focused' empathy[117] or,

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114 Cf. the title of Mahr 2008.

115 Their superficial reading of Dilthey has in turn been criticized; cf. Austin Harrington, "Dilthey, Empathy and Verstehen: A Contemporary Reappraisal," in: *European Journal of Social Theory* 4/3 (2001), 311–329, here 312f., online: <https://doi.org/10.1177/13684310122225145>.

116 On this topic in general, see Karsten Stueber, *Rediscovering Empathy: Agency, Folk Psychology, and the Human Sciences*, Cambridge, Massachusetts / London: MIT Press, 2010 [paperback; hardcover published in 2006]. In this context, one could also discuss the somewhat related neuroscientific concept of a 'theory of mind', on the topic of which see Alvin I. Goldman, "Theory of Mind," in: *The Oxford Handbook of Philosophy of Cognitive Science*, ed. by Eric Margolis, Richard Samuels and Stephen P. Stich, Oxford [et al.]: Oxford University Press, 2012, 402–424, and Christopher D. Frith and Daniel M. Wolpert (Eds.), *The Neuroscience of Social Interaction: Decoding, Imitating, and Influencing the Actions of Others*, Oxford [et al.]: Oxford University Press, 2004.

117 See Justin Tiwald, "Zhu Xi on Self-Focused vs. Other-Focused Empathy," in: *Dao Companion to Zhu Xi's Philosophy*, ed. by Kai-Chiu Ng and Yong Huang, Dordrecht: Springer, 2020, 963–980. The difference here is the difference between reconstructing another person's perspective versus how oneself would feel if put in that position. On

for more recent times and with more regard for the role that the concept plays in scholarship, refer to the writings of French historians of the Romantic era[118] such as Augustin Thierry (1795–1856) or Jules Michelet (1789–1874) who held that empathy was a crucial tool for a historian; it has even been stated that "[e]mpathy was the great Romantic trick; Michelet turned it into a scholarly method."[119] That scholarly method was marked by an identification of the scholar with the subject they were writing about, meaning that the historian was supposed to inhabit the emotional landscape of its subject and actually "become, through a kind of imaginative empathy or compassion, the historical object and actor in the event."[120] In this kind of *sympathy*, this kind of "history as 'resurrection'"[121] Michelet's concept differed from the sense of the term we will be working towards. But it already indicates, *pace* Bod, that there are many different conceptions of humanistic scholarship, other than a desire to 'link patterns to principles', and that they cannot be relegated to the fringes when they were at the very heart of the humanities as they formed and re-formed in the 19th century, if we restrict ourselves to the most recent European intellectual history.[122] This is also expressed in Hayden White's characterization of Michelet:

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the topic of empathy in Confucianism, one could also reach back much further, such as to classic philosopher Mèng kē / Mencius (c. 370–290 BC) who "singled out sympathy-and-empathy ('the heart that cannot bear the suffering of others') as the unique and defining characteristic of our nature" (Tu Wei-Ming, *Centrality and Commonality: An Essay on Confucian Religiousness*, Albany: State University of New York Press, 1989, 118).

118 To recall the discussion of periodization: This use of a marker demonstrates why they are seen as useful, conveying a multitude of associations by proxy.

119 Eugen Weber, "Great Man at Work: Michelet Reconsidered," in: *The American Scholar* 60/1 (1991), 53–72, here 58.

120 Michèle Hannoosh, *Jules Michelet: Writing Art and History in Nineteenth-Century France*, University Park: Pennsylvania State University Press, 2019, 30. On Michelet, as far as Anglophone literature goes, one might, besides Hannoosh 2019, also read what Hayden White has written about him, cf. Hayden White, *Metahistory: The Historical Imagination in Nineteenth-Century Europe*, Baltimore: John Hopkins University Press, 2014, 135–162 [fortieth-anniversary edition; originally published in 1973] – and one might, for example, take note of the fact that Michelet himself "specifically denied that he was a Romantic" (ibid., 149).

121 White 2014, 152.

122 It should be noted that Bod's global thinking is a welcome aspect of his work and impressive in the breadth of time and space that it covers in his history of the humanities;

> Unlike Herder, who conceived history as a *gradual* transformation of humanity from one unique set of particulars to another, Michelet conceived it as a series of cataclysmic reversals caused by long-growing tensions which force humanity into *opposed* camps.[123]

Neither of those approaches would be adequately described by a 'search for patterns' although, one supposes, *pattern* is a flexible enough term to allow for an embrace of all kinds of relational observations, albeit losing its specificity in the process.[124]

Returning to the matter of *Einfühlung* and a German context, it should be remembered that the discourse about it was widespread in the 19th century across many different disciplines – be it art historian Robert Vischer, psychologist Theodor Lipps, or, indeed, art historian Heinrich Wölfflin, they were all drawn to the term, for reasons of aesthetics and psychology, among others.[125] It was not only the appeal of

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with the caveat that this is used to argue a globality and universality of a shared human project (the linking of patterns to principles) that re-inscribes different traditions into a narrative that is not overly concerned with their, one might be tempted to say, particularities.

123 White 2014, 155.

124 Bod's approach is based on a broad definition: "My concept of 'patterns' is in fact an umbrella that covers everything that can be found between inexact regularities and exact laws." (Bod 2013a, 9.) Similarly: "The notion of 'pattern' is thus an umbrella term that covers everything that can be found between inexact trends and exact laws." (Bod 2013b, 172.) In effect, this means that he justifies the inclusion of all kinds of historical 'humanistic' methods (in his explanation in the sense of being involved in the study of art, literature, music, and so on, cf. Bod 2013a, 2) that aim at an uncovering of principles or a representation of some kind of 'regularity', whether universal or local; he himself in his endeavour seeking such patterns without a clearly delineated point of comparison. One could, for example, advance a thesis that the humanities are concerned with a universal understanding of 'human situatedness in space and time' and in such a scenario, one would most likely find ample evidence throughout the ages and different world regions to suit such an argument; accumulating such evidence would not, however, prove the thesis right if it did not fairly consider evidence to the contrary; doing so would make it a difficult, in the sense of necessarily exhaustive and comprehensive, argument to make, but such is the evidentiary burden of broad claims.

125 For some literature on these figures and their relationship with *Einfühlung* as well as the general genealogy of the concept in the late 19th century, see Frank Büttner, "Das Paradigma ‚Einfühlung' bei Robert Vischer, Heinrich Wölfflin und Wilhelm Worringer: Die problematische Karriere einer kunsttheoretischen Fragestellung," in: *200 Jahre Kunstgeschichte in München: Positionen, Perspektiven, Polemik 1780-1980* (Münchner

the emotional, however, and we find echoes of this debate reverberate throughout the scholarship of the time. Even Leopold von Ranke, one of the 'founding fathers' of history as an academic discipline in Germany who is famous for his introduction of source-criticism and infamous for his oft-misunderstood dictum that historians should recount history "as it really was,"[126] "intended […] that the historian should try to put himself into the position of his object/subject of study in order to be able to understand the intentions and motives of historical actors [and] [b]y a rigid study of historical sources […] reveal the 'inner connection between historical events'."[127]

This was refined, under the additional influence of the writings of Friedrich Schleiermacher, by Johann Gustav Droysen who argued that the historian could not be a mere arbiter of facts as found in the sources but necessarily had to shape them through their own *Verstehen* ('understanding').[128] The concept of *Verstehen* was subsequently further refined

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Universitätsschriften des Instituts für Kunstgeschichte; vol. 2), ed. by Christian Drude and Hubertus Kohle, München: Deutscher Kunstverlag, 2003, 82–93; Tobias Wilke, "Einfühlung als Metapher," in: *Deutsche Vierteljahrsschrift für Literaturwissenschaft und Geistesgeschichte* 88/3 (2014), 321–344; Rainer Schützeichel, "Architecture as Bodily and Spatial Art: The Idea of Einfühlung in Early Theoretical Contributions by Heinrich Wölfflin and August Schmarsow," in: *Architectural Theory Review* 18/3 (2013), 293–309, online: <https://doi.org/10.1080/13264826.2014.890007>; and Robin Curtis, "An Introduction to Einfühlung," transl. by Richard George Elliott, in: *Art in Translation* 6/4 (2014), 353–376, online: <https://doi.org/10.1080/17561310.2014.11425535>.

126 Leopold von Ranke, *Geschichten der romanischen und germanischen Völker von 1494 bis 1514: Zur Kritik neuerer Geschichtsschreiber* (Sämmtliche Werke; vol. 33 and 34), Leipzig: Duncker & Humblot, 1874, VII: "Man hat der Historie das Amt, die Vergangenheit zu richten, die Mitwelt zum Nutzen zukünftiger Jahre zu belehren, beigemessen: so hoher Aemter unterwindet sich gegenwärtiger Versuch nicht: er will blos [sic!] zeigen, wie es eigentlich gewesen." On this topic, see furthermore Mario Wimmer, "Wie es eigentlich gewesen," in: *Enzyklopädie der Genauigkeit*, ed. by Markus Krajewski, Antonia von Schöning and Mario Wimmer, Konstanz: Konstanz University Press, 2021, 514–531.

127 Andreas Fickers, "Towards a New Digital Historicism? Doing History in The Age of Abundance," in: *Journal of European Television History and Culture* 1/1 (2012), 19–26, online: <http://doi.org/10.18146/2213-0969.2012.jethc004> [online without page numbers; in the PDF on page 2].

128 See Johann Gustav Droysen, *Grundriss der Historik*, Leipzig: Veit, 1868, online: <https://www.deutschestextarchiv.de/droysen_historik_1868> (accessed 11 February 2023).

by Wilhelm Dilthey, one of the central figures in hermeneutics. Dilthey in particular used *Verstehen* as a contrast to the concept of *Erklären* ('explaining') that he ascribed to natural sciences.[129] Unlike the scholarly embeddedness of empathy in the Romantic era, to use that example since we have already familiarized ourselves with it, albeit superficially, Dilthey's concept of *Verstehen* and *Nacherleben* ('re-experiencing') was not intended to mean that a historian should identify with their subject or project their self onto an other in a way that would elevate a cognitive form of comprehension to a biased and possibly naïve form of involvement; Dilthey, who, we may note *en passant*, was not primarily a historian but might be better described as a *Wissenschaftsphilosoph* ('philosopher of science'),[130] does not speak of *Einfühlen* ('feeling-into') so much as he does of *Nachfühlen* ('re-feeling' or 'feeling-towards' or 'feeling-backwards-into' after the fact, reminiscent of *nachspüren*, 'tracing') and *Nacherleben* ('re-experiencing') which clearly denotes a historical situatedness of the historical subject which is not supposed to be superimposed by the present, as has also been pointed out in some of the more recent re-evaluations of his work.[131] The inadequate understanding of this distinction and, indeed, a failure to understand something as simple as the fact that Ranke, for as much as he proclaimed otherwise,

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129 Cf. Karsten Stueber, "Understanding Versus Explanation? How to Think about the Distinction between the Human and the Natural Sciences," in: *Inquiry* 55/1 (2012), 17–34, online: <https://doi.org/10.1080/0020174X.2012.643621>.

130 Whose contributions to the philosophy of science were so manifold that a collected volume about them can apparently be assembled without containing any mention of the issue of empathy or *Einfühlung* or *Nachfühlung* at all; see Christian Damböck and Hans-Ulrich Lessing (Eds.), *Dilthey als Wissenschaftsphilosoph*, Freiburg / München: Karl Alber, 2016.

131 Cf. Shaun Gallagher, "Dilthey and Empathy," in: *Interpreting Dilthey: Critical Essays*, ed. by Eric S. Nelson, Cambridge: Cambridge University Press, 2019, 145–158, online: <https://doi.org/10.1017/9781316459447.008>. Rudolf Makkreel pointed out several decades ago that Dilthey is "often confused with Historical Idealists such as Croce and Collingwood" (Rudolf Makkreel, *Dilthey: Philosopher of the Human Studies*, Princeton: Princeton University Press, ^{3}1992, 5 [originally published in 1975]) in a supposed aversion to the "use of general laws" (ibid.). Harrington demonstrates that the differences between *Einfühlen*, *Nachfühlen,* and, indeed, *Mitfühlen* ('feeling-with' – *Mitgefühl* meaning 'sympathy,' 'compassion'), the latter of which was *not* supposed to be a feature in a scholar's work according to Dilthey, are of importance in this debate and inadequately captured by the vague English term 'empathy', cf. Harrington 2001, 318f. which is also affirmed in Gallagher 2019, *passim*.

was not devoid of a framework of mind that colours his work as much as any scholar's time and person colour their work, and that he and Michelet, for example, are set apart by the ductus and style of their scholarship more so than by their rigour or quest for truthful accounts,[132] was partly at the root of the disregard shown for the concept of empathy in the philosophy of science in the 20th century;[133] all the while the ability to mentally assume a different perspective other than one's own is the very foundation of depersonalizing one's work even if such a depersonalization does not automatically follow from it nor can be achieved in full; and even if one might employ other means of externalization as well. The relegation of these discourses to the annals of history themselves is regrettable insofar as we see this lack of engagement continue in the scholarship by prominent researchers such as Bod in the context of the digital humanities. One cannot, for example, adequately understand Karl Lachmann and the stemmatological method without also being aware of the kind of literary studies that scholarly editions were being used for or the arguments Jacob Grimm was making, in addition to and sometimes in contrast to him,[134] or, indeed, without considering the arguments by the *New Philology* movement that show how Lachmann's methodology cannot simply be equated with 'scientificity' and 'rigour' (and that stemmatology is, in fact, largely misattributed to him as a methodological invention);[135] and when one discusses the *Annales* school and the *histoire sérielle*,[136] one might also want to make mention of the contrasting notion of *microhistoire* as practiced, for example, by

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132 Cf. White 2014, 157f.

133 That disregard is comparable to the disregard shown for the concept of imagination: "Au même titre que l'imagination, l'empathie fut dédaignée par la philosophie tout au long du XXème siècle." (Emmanuelle Glon, 'Empathie,' in: *l'Encyclopédie philosophique* (academic version, July 2017), ed. by Maxime Kristanek, online: <http://encyclo-philo.fr/empathie-a/> (accessed 11 February 2023).)

134 Jacob Grimm only features in Bod's history with regard to his contributions to comparative linguistics, cf. Bod 2013a, 281–283.

135 Cf. Giovanni Palumbo, "Criticism and Controversy," in: *Handbook of Stemmatology: History, Methodology, Digital Approaches*, ed. by Philipp Roelli, Berlin / Boston: De Gruyter, 2020, 88–108.

136 For an example of which, see Fernand Braudel, "Pour une histoire sérielle: Séville et l'Atlantique (1504-1650)," in: *Annales: Économies, Sociétés, Civilisations* 18/3 (1963), 541–553. Bod discusses the *Annales* school in Bod 2013a, 258–260.

Carlo Ginzburg.[137] With regard to Dilthey and Ranke, Edith Stein may have stated the dilemma they were – and, we may extrapolate, most if not all humanists are – faced with most succinctly:

> We now see why Dilthey can rightfully claim: 'the capacity for understanding that is at work in the humanities is the whole human being': only one who experiences themselves as a person, as a meaningful whole, can understand other persons. And we understand just as well why Ranke wants to 'delete' his self in order to see the things 'as they were'. The 'self' is the individual structure of experience; in it, the great master of understanding identifies the source of fallacy which endangers us. If we regard it as a measuring standard, we lock ourselves in the prison of our peculiarity; the others become ciphers to us or, even worse, we re-model them in our image and thereby falsify the historical truth.[138]

It is very interesting that Edith Stein uses the word *modeln* ('model') here or rather even *ummodeln* ('re-model'), a direct link to the issue of modelling; more so, a direct link to modelling something *nach unserem*

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137 The most well-known example of which is Carlo Ginzburg, *Il formaggio e i vermi: Il cosmo di un mugnaio del '500*, Turin: Einaudi, 1976. See also Carlo Ginzburg, "Microstoria: Due o tre cose che so di lei," in: *Quaderni storici* 29/86 (1994), 511–539, and the German translation of a collection of his essays in Carlo Ginzburg, *Spurensicherung: Die Wissenschaft auf der Suche nach sich selbst* (Kleine kulturwissenschaftliche Bibliothek; vol. 50), transl. by Gisela Bonz and Karl F. Hauber, Berlin: Wagenbach, 1995.

138 Edith Stein, *Zum Problem der Einfühlung*, Halle: Buchdruckerei des Waisenhauses, 1917, 129 [originally submitted as part II/IV of her dissertation in 1916 under the title *Das Einfühlungsproblem in seiner historischen Entwicklung und in phänomenologischer Betrachtung;* supervised by Edmund Husserl], original: "Wir sehen jetzt, mit welchem Recht Dilthey sagen kann: ‚das auffassende Vermögen, welches in den Geisteswissenschaften wirkt, ist der ganze Mensch': nur wer sich selbst als Person, als sinnvolles Ganzes erlebt, kann andre Personen verstehen. Und wir verstehen ebensogut, warum Ranke sein Selbst ‚auslöschen' möchte, um die Dinge zu sehen, ‚wie sie gewesen sind'. Das ‚Selbst' ist die individuelle Erlebnisstruktur; in ihr erkennt der große Meister des Verstehens die Täuschungsquelle, von der uns Gefahr droht. Wenn wir sie als Maßstab nehmen, dann sperren wir uns ein ins Gefängnis unserer Eigenart; die andern werden uns zu Rätseln oder, was noch schlimmer ist, wir modeln sie um nach unserem Bilde und fälschen so die historische Wahrheit." On the topic of her empathy theory, see also Fredrik Svenaeus, "Edith Stein's Phenomenology of Sensual and Emotional Empathy," in: *Phenomenology and the Cognitive Sciences* 17 (2018), 741–760.

Bilde ('in our image'). Goethe's *Faust* (1808) comes to mind: "What you the Spirit of Ages call / Is nothing but the spirit of you all, / Wherein the ages are reflected."[139]

Another aspect that should not be forgotten is that the issue of *Einfühlung* and what it may or may not indicate for the processes in the humanities that produce knowledge (inspire knowledge, suggest knowledge, enable knowledge) is closely entangled with the issue of intersubjectivity, which is why we find Edmund Husserl deeply entrenched in those very same questions.[140] Discourses in the digital humanities will sometimes, if at all, reference Heidegger, but other pertinent philosophers are curiously neglected.[141] The question is perhaps not so much what makes the humanities unique – for that would assume that they are, a distinction entirely irrelevant – but rather what makes them as they are. If the digital humanities are a cause for discomfort about the nature of the humanities – if they entertain, for example, a "lure of objectivity"[142] by springing "pseudopositivist trap[s]"[143] – then they have to engage with the long histories of such debates. Intersubjectivity as an approximation of shared understanding that neither commits to a positivist universalism nor disappears into individualized relativism would

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139 Here in the translation by Bayard Taylor; Johann Wolfgang von Goethe, *Faust: A Tragedy*, transl. by Bayard Taylor, London [et al.]: Ward, Lock & Co., [3]1890, 18. Original German: "Was ihr den Geist der Zeiten heißt, / Das ist im Grund der Herren eigner Geist, / In dem die Zeiten sich bespiegeln." (*Johann Wolfgang Goethe: Faust. Historisch-kritische Edition*, ed. by Anne Bohnenkamp, Silke Henke and Fotis Jannidis [et al.], Frankfurt am Main [et al.], 2016–present; here *Der Tragödie Erster Theil*, 'Nacht,' lines 577–579, online: <http://www.faustedition.net/print/faust.4#l577> (accessed 11 February 2023).)

140 See Rudolf A. Makreel, "How is Empathy Related to Understanding?" in: *Issues in Husserl's Ideas II* (Contributions to Phenomenology; vol. 24), ed. by Thomas Nenon and Lester Embree, Dordrecht: Springer, 1996, 199–212.

141 See, for example, McCarty 2005, 41–43. McCarty does mention that there are "strains of phenomenology [that] contribute to a philosophy of modelling" and that they "include most notably [...] Edmund Husserl (1859–1938), Heidegger's teacher, and Maurice Merleau-Ponty (1908–61)" but he also acknowledges that he "passes over these in silence" (ibid., 43).

142 Augustine Farinola, "Hermeneutical Postphenomenology: Computational Tools and the Lure of Objectivity," in: *Digital Scholarship in the Humanities* 38/3 (2023), 1078–1087, here 1081, online: <https://doi.org/10.1093/llc/fqac074>.

143 Fafinski 2022, 100.

seem like a useful concept to discuss further, especially given the perspectivity and positionality of modelling.[144]

F.
THE SPECTRE OF INTERPRETATION

Until such a discussion is had by the field at large,[145] modelling concerns are forced into the narrow confines of the practices already at play:

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144 Elena Pierazzo expresses a similar sentiment when she states: "The concept of intersubjectivity was deeply influential in the development of modern epistemology, sociology and psychology, as well as linguistics, while in the digital humanities it seems that we are still lingering on a misconception of which epistemic virtues are at the basis of the scientific method." (Pierazzo 2018, 129.)

145 Since Bod reduces Dilthey's hermeneutics to an "anticipatory 'method'" (Bod 2013a, 333) and insinuates that it is "commit[ted] [...] to 'premonitions'" (ibid., 334) unlike the supposedly related post-structuralism which may be "often obscure" (Bod 2013a, 334) but at least not "outside the scope of our quest for methodical principles" (ibid.), we might note here, as far as the digital humanities discourse goes, that references to figures such as Dilthey or Schleiermacher can be found in discussions taking place in the *Humanist* mailing list / discussion group maintained by Willard McCarty, for example in the June 2018 thread "32.107 Fish'ing for fatal flaws," cf. <http://lists.digitalhumanities.org/pipermail/humanist/2018-June/015674.html> (accessed 26 June 2018; not accessible anymore 11 February 2023; see the archived version in the Internet Archive). Here, Francois Lachance mentions Schleiermacher by way of quoting Frank Kermode, *The Classic: Literary Images of Permanence and Change*, Cambridge, Massachusetts [et al.]: Harvard University Press, 1983, 77 [originally published in New York: Viking Press, 1975]. The wider context of the discussion is criticism levelled at the field of digital humanities by Stanley Fish (repeatedly over the years but in this case in Fish 2018). The discussion of the criticism soon revolves around "mathphobia" (cf. "32.103 Fish'ing for fatal flaws" <http://lists.digitalhumanities.org/pipermail/humanist/2018-June/015670.html> (accessed 26 June 2018; not accessible anymore 11 February 2023; see the archived version in the Internet Archive) and the subsequent replies to the thread). That Kermode himself relies on translations of and introductions to Dilthey and Schleiermacher (as he himself acknowledges in Kermode 1983, 76, fn. 1) is not mentioned in the *Humanist* discussion; neither is the very specific meaning of 'divination' in Schleiermacher's work that the quoted part of Kermode 1983, 77 emphasizes as the way to break the hermeneutical circle and further describes as "an act of interpretive genius" (ibid.). That Schleiermacher's use of *Divination* must be seen in the tradition of Schlegel and Kant and as a type of *Einbildungskraft* ('imagination' in a sense of cognitive capacity for perception) more so than what is commonly referred to as divination in English, namely *göttliche Eingebung* ('divine inspiration'), is not mentioned either. These omissions threaten to mischaracterize the methodological writings of both Schleiermacher and Dilthey and do little to penetrate the shallow type of evocations they are reduced to in a digital humanities context (and, perhaps, even beyond that). For an in-depth discussion

graphs, networks, maps, trees. Et cetera. It is, perhaps, no coincidence that the discourse about modelling in the humanities is dominated by the digital humanities; that they are entwined, even if just on the mundane level of the scholars involved in those discussions.[146] In Bod's case, it might be fair to say that his interest lies with all forms of pattern-search more so than the humanities as such.[147] It is, in that sense, reminiscent of interests in the field of artificial intelligence and recalls McCarty's verdict with regard to such inquiries:

> 'Perhaps there are some kinds of knowledge that cannot be expressed in logic', the author of *Knowledge Representation: Logical, Philosophical, and Computational Foundations* declares (Sowa 2000: 12). Perhaps indeed – but we hear no more about them under that roof.[148]

This evokes Hans Vaihinger's formulation that "our ideational construction of the world is an enormous web of fictions, full of logical contradictions."[149] One does not have to speak of 'contradictions' necessarily to recognize that modelling in science as well as in the humanities may have to be understood as a way of coherently structuring the world around

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of Schleiermacher and his use of the term *Divination*, see Andreas Arndt, "Hermeneutik und Einbildungskraft," in: *Friedrich Schleiermachers Hermeneutik: Interpretationen und Perspektiven*, ed. by Andreas Arndt and Jörg Dierken, Berlin / Boston: De Gruyter, 2016, 119–128.

146 I would like to borrow Mario Wimmer's term of 'epistemic surroundings' here even though he applied it to mean the level of influence that scholarship – or the scholarly curation of materials – has on other scholarship, i.e. "scholarly production as a process of intellectual labor with what is at hand" (Mario Wimmer, "The Afterlives of Scholarship: Warburg and Cassirer," in: *History of Humanities* 2/1 (2017), 245–270, here 248). The term could, however, also be useful in describing enclosed spheres of communication in diverse, interdisciplinary fields such as the digital humanities.

147 The publication Rens Bod, *World of Patterns: A Global History of Knowledge*, transl. by Leston Buell, Baltimore: Johns Hopkins University Press, 2022, could be seen as confirmation for this. For the Dutch original, see Rens Bod, *Een wereld vol patronen: De geschiedenis van kennis*, Amsterdam: Prometheus, 2019.

148 McCarty 2005, 30.

149 Vaihinger 1911, 90, original: "Unser Vorstellungsgebilde der Welt ist ein ungeheures Gewebe von Fiktionen, voll logischer Widersprüche." *Vorstellungsgebilde* is extremely difficult to translate here, potentially denoting imagination, perception, conceptualization, ideation, vision, mental image, understanding.

us; which is not the same as entirely *constructing* it in the sense of inventing it through language or conceptualization. If there were no material basis for our perceptions, no paintings, manuscripts, historical records, archaeological excavations, nothing to analyse and disagree on, nothing to *interpret* – and what use is an awareness of a pattern, computationally recognized or otherwise, if no one asks what it tells us? –, then what would be the purpose of the humanities? The naming of a thing does not make the thing come into existence; the naming follows from its existence and is a way to help us understand its existence. Models in the humanities are not 'make-believe'[150] so much as they are 'making-sense' and insofar as the humanities study products of the human mind and the conditions of their production throughout time and, in fact, the conditions of human thinking throughout time, they necessarily draw on the connective tissue that the capacity for human thinking accords us ourselves. A theologian might enter the notion of *souls* and the study of the *remnants* of ensouled beings into the debate,[151] but we do not need to resort to such opaque vocabulary: It is enough to acknowledge that "recognizing the thoughts of individual agents has to play some role in the interpretive project of the human sciences"[152] and that humanistic inquiry is not rooted in solipsistic study. It is rooted in questions such as: How did this come into being? Why did this come into being? What did it mean to someone who lived hundreds of years ago? What does it mean

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150 Which is one of the ways that models in a tradition of Vaihinger's fictionalism have been framed as; see Adam Toon, *Models as Make-Believe: Imagination, Fiction and Scientific Representation*, Basingstoke [et al.]: Palgrave Macmillan, 2012. See also Ronald N. Giere, "Why Scientific Models Should Not Be Regarded as Works of Fiction," in: *Fictions in Science: Philosophical Essays on Modeling and Idealization*, ed. by Mauricio Suárez, London: Routledge, 2009, 248–258.

151 Indeed, one does have not to be a theologian to do so, as the concept of that which is *fremdseelisch* ('of another soul') and our capacity for perceiving it plays an important role in German philosophical discourses about hermeneutics in the tradition of Dilthey and Husserl; cf. Verena Mayer, "Einfühlen und Verstehen: Husserls Beitrag zur Empathie-Debatte," in: *The Philosophy of Edmund Husserl* (Logical Analysis and History of Philosophy / Philosophiegeschichte und logische Analyse; vol. 16), ed. by Uwe Meixner and Rochus Sowa, Leiden: Brill, 2013, 220–243, here esp. 229–233, online: <https://doi.org/10.30965/9783897858596_013>.

152 Karsten Stueber, 'Empathy,' in: *The Stanford Encyclopedia of Philosophy* (Fall 2019 Edition), ed. by Edward N. Zalta, online: <https://plato.stanford.edu/archives/fall2019/entries/empathy/> (accessed 11 February 2023).

to a modern-day reader? What did it mean to the author? What does it mean to an audience, an observer, a listener, a painter, a composer, what do they mean to each other, what did they mean to each other? What does it mean to others? What *should* it mean to others? What meaning should others take from it (even if only asked from the perspective of a researcher publishing their research)? In a certain postmodern vein – although, as Manfred Frank notes, that term would seem to be favoured by "representatives of the 'pensiero debole'"[153] and "has the consistency of a pudding that one is supposed to nail to the wall"[154] –, some scholars might even be asking: Does it mean anything at all? (Alternatively: What does it mean to *me*?)

It is not – and this might not need saying but better to state it: It is not or should not be an expectation of the digital humanities that they are able or will be able to transmutate humanistic research in all of its dimensions into a digital environment; or that they will be able to enhance all of these dimensions, never mind what one deems the important dimensions, through computational ways of exploration or representation; one would think this self-evident but it might not be, otherwise we would see other types of fundamental discussions in the digital humanities. The spectre of 'interpretation' looms large. Where and when does meaning begin, and where and when does it enter into that which we model?

There is a lowest common denominator, and it is arguably the reason why the digital humanities are so document- and artefact-oriented. Instead of asking *what does it mean*, we may ask *what does it say*, *what does it depict*, *how can it be represented* and those are already difficult enough to answer but it could be that these are the only types of questions that we may legitimately ask in that context. This is where the evidence comes in: The wide range between the material tradition, the

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153 Frank 2011, 364, original: "[...] von den Vertretern des ‚pensiero debole' [...]." The *pensiero debole* is a specific Italian tradition of poststructuralist thinking that originated with the publication of Gianni Vattimo and Pier Aldo Rovatti (Eds.), *Il pensiero debole*, Milano: Feltrinelli, 1983.

154 Frank 2011, 364, original: "[...] der [...] etwa die Konsistenz eines Puddings hat, den man an die Wand nageln soll [...]."

information that can be gleaned from it, and all the ways in which we structure our theories about said corpus of knowledge. This corpus will often already contain more than is strictly evidentiary: We will identify named entities and disambiguate them and associate them with each other or with coordinates on a map or with dates on a timeline. In the realm of traditional scholarship in the humanities, as important as this is, many would perceive it to be a basic prerequisite for answering research questions, not meaningful in itself. But why, may I ask, do we not aim to represent the conceptualizations of our knowledge domains as such, rather than our conceptualizations of source materials? There is no rule saying that there can only be one model of something. In fact, there should not be because there cannot be. If our knowledge is an argument, and if an edition is an argument, there is nothing to suggest that a model could not be an argument – or rather, that the argument could not be a model. For that, the argument would have to consist of delineated parts that can be related to each other. That would seem to be in the realm of the achievable. Whether it is desirable is another question altogether. One has to wonder if models in the humanities were not widely discussed in explicit terms before the digital humanities came along because they are seen as overreaching into a domain of scholarly argumentation that they could not possibly satisfy.[155] There is another aspect to this: If there is, as Jim Mussell, a media historian, has observed for his own field, "a shift from documents to data,"[156] a question emerges as to how depleted the reserves of meaningful engagement are or are rather bound to become, unless a type of digital hermeneutics begins to take hold.[157]

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155 Aptly captured in the verdict that "there is a widespread sense that digital history has over-promised and under-delivered in terms of its interpretative contribution back to the discipline" (Stephen Robertson [et al.], "Digital History and Argument," white paper by the *Arguing with Digital History* working group, Roy Rosenzweig Center for History and New Media (13 November 2017), online: <https://rrchnm.org/portfolio-item/digital-history-argument-white-paper/> (accessed 11 February 2023)).

156 Jim Mussell, "Doing and Making: History as Digital Practice," in: *History in the Digital Age*, ed. by Toni Weller, London / New York: Routledge, 2013, 79–94, here 80.

157 Andreas Fickers has, thus far, been one of the strongest proponents of digital hermeneutics, in his sense mostly focused on tool criticism and the like; see Andreas Fickers, "Update für die Hermeneutik: Geschichtswissenschaft auf dem Weg zur digitalen Forensik?" in: *Zeithistorische Forschungen / Studies in Contemporary History* 17/1 (2020), 157–168, online: <https://doi.org/10.14765/zzf.dok-1765>. See also Andreas Fickers

Generally, it would seem to me that the modelling discourse in the (digital) humanities would do well – for the field going forward – to address, or address in more depth, the following desiderata (preliminary thoughts):

(1) *Abbild* and *Vorbild*. When is the primary function of a model in the digital humanities *abbildend*, when is it *vorbildend*, and how do both relate to the question of universal versus case-specific models?
(2) Semiotics. How is a model expressed or visualized and what does that say about that which can be modelled?[158]
(3) Process. What are the processes of modelling in the digital humanities? And how can we model these processes (not only as methods but also as practices)?
(4) Patterns and structures. What is our definition of a pattern, what is our definition of a structure, and how can we distinguish between the two? (And why does it matter?)
(5) Perspectivity. What types of knowledges and assumptions are embedded in our models and how can they be made explicit?
(6) Information. How do we distinguish between the factual, the extrafactual, and the counterfactual in our information representations?
(7) Simulation. Speaking of extrafactual, what is the relationship of modelling as a method in general and simulations as use cases in particular (i.e. between the static and the dynamic, between a state and a progression, between timelessness and time-boundedness)?[159]

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and Juliane Tatarinov (Eds.), *Digital History and Hermeneutics: Between Theory and Practice* (Studies in Digital History and Hermeneutics; vol. 2), Berlin / Boston: De Gruyter, 2022, online: <https://doi.org/10.1515/9783110723991>.

158 Ciula [et al.] eds. 2018 goes in that direction.

159 Simulative projects in the digital humanities typically involve a high degree of reconstruction. See, for example, the *Virtual Angkor* project, Monash University, 2018–present, <https://www.virtualangkor.com/> (accessed 13 February 2023), and the *Virtual Paul's Cross* project, NC State University, 2011–2021, <https://vpcross.chass.ncsu.edu/> (accessed 13 February 2023). On the latter, see also the discussion by Brent Nelson, "Virtual Paul's Cross Project: A Digital Recreation of John Donne's Gunpowder

(8) *Erkenntnis*. Speaking of simulation, what role, if any, should immersion play in these scenarios, e.g. should the modeller become part of the model and interact with the modelled in a way that is supposed to generate new insight, as the eTaRDiS project (2021–2023) is proposing?[160]

(9) 'Empathy machines.'[161] Speaking of virtual reality, how do projects that model the past in ways that can be experienced not only by researchers but also by society at large impact modelling concerns, both in terms of purpose and in terms of focus?

(10) A model of model-being. Could we find a way to classify models in the digital humanities? Would this be useful and if so, why?

I have begun thinking about such a model classification, similar to what Štoff had in mind. Intermittently, I have thought about it for years. It is not at a stage where I would want to put it forward; nor would it seem essential for the inquiry of this book to do so. For that, it is enough to know that the conceptual work of the following chapters will be engaged in the meta-methodological task of the *Vorbild* kind, generalizing structures (rather than patterns) of relation. However, there are a few aspects that we could note:

Earlier in this chapter, I suggested that the main distinction between models in the digital humanities might not be the material versus non-material distinction but rather one between visible (or visualized) models and those that are not. We could also think about a distinction

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Day Sermon," review, in: *Renaissance and Reformation / Renaissance et* Réforme 42/2 (2019), 189–194, online: <https://www.jstor.org/stable/26860676>, and the assessment: "*VPCP* does splendidly what a good model should: it gives shape to a body of data in a form that enables a new kind of interrogation [...]" (ibid., 193).

160 See *eTaRDiS – Exploration Temporaler und Räumlicher Daten in Immersiven Szenarien*, University of Bielefeld, 2021–2023, <https://digital-history.uni-bielefeld.de/etardis/> (accessed 13 February 2023).

161 On this phenomenon, see, for example, Chris Bevan [et al.], "Behind the Curtain of the 'Ultimate Empathy Machine': On the Composition of Virtual Reality Nonfiction Experiences," in: *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*, ed. by Stephen Brewster and Geraldine Fitzpatrick, New York: Association for Computing Machinery, 2019, [1–12], online: <https://doi.org/10.1145/3290605.3300736>.

along the lines of the primary *Abbild* / *Vorbild* function. The simplest distinction would be to differentiate between computational and non-computational models, first and foremost. This would not necessarily be a distinction between computational and conceptual models; although it could be, depending on how narrowly or broadly we were to define 'conceptual' (viz. closer to unrealized mental models or domain models in the data modelling vein). Computer science has borrowed so many terms from philosophy, it might be time to borrow some of them back. But that is, of course, not for the digital humanities to decide. In this disciplinary context, we might want to think further about what Štoff wrote regarding mathematically and spatially similar models. While not the only examples, some of the most relevant modelling practices in the digital humanities revolve around statistical methods from computer linguistics – or what we might refer to as the 'calculation of language' (e.g. with probabilistic language models, topic models)[162] – and the '(re-) creation of objects and spaces' (e.g. 3D reconstructions).[163] If we add the simulative aspect, we might speak of the 'study of complex systems'. We could also add the 'visualization of networks' (over time). None of this is particularly formalized or subsumed but it might indicate where such considerations could go. We could find categories for that which is modelled, how it is modelled, the dimensions in which it is modelled. The purpose for which it is modelled, the context in which it is modelled. We could define primary (secondary, tertiary...) functions, attributes, and qualities that could be attached to any given model within a given

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162 For a reflection on language models in the context of NLP, see, to start with, Emily M. Bender [et al.], "On the Dangers of Stochastic Parrots: Can Language Models Be Too Big?" in: *FAccT '21: Proceedings of the 2021 ACM Conference on Fairness, Accountability, and Transparency*, New York: Association for Computing Machinery, 2021, 610–623, online: <https://doi.org/10.1145/3442188.3445922>.

163 On this topic, see, for example, Piotr Kuroczyński, "Neuer Forschungsraum für die Kunstgeschichte: Virtuelle Forschungsumgebungen für digitale 3D-Rekonstruktionen," in: *Computing Art Reader: Einführung in die digitale Kunstgeschichte* (Computing in Art and Architecture; vol. 1), ed. by Piotr Kuroczyński, Peter Bell and Lisa Dieckmann, Heidelberg: arthistoricum.net, 2018, 160–181, online: <https://doi.org/10.11588/arthistoricum.413.c582>, and Piotr Kuroczyński, Mieke Pfarr-Harfst and Sander Münster (Eds.), *Der Modelle Tugend 2.0: Digitale 3D-Rekonstruktion als virtueller Raum der architekturhistorischen Forschung* (Computing in Art and Architecture; vol. 2), Heidelberg: arthistoricum.net, 2019.

category. No such system would ever be complete or normative; it would, as any other model of anything, communicate a point of view in order to facilitate an understanding of self – in the case of *Wissenschaft*, perhaps most importantly, a methodological understanding of self.

This would still leave a major issue unattended, namely the issue what role models and modelling play in the chain of reasoning within the (digital) humanities. I have posed the question whether we could model our arguments beyond that which we can express in relatively unambiguous terms about source materials (source units, language, music, mathematically, generally; witnesses of culture manifested materially, historically) and the relation of basic entities. If we could do so – if we were to do so –, it would necessitate a reflection on the partial nature of these representations, which is also to say, the partial nature of the argument. We could, if we were inclined to do so, find indications for this in the hermeneutics of Schleiermacher and Dilthey or, indeed, August Boeckh and his famous dictum of the *Erkenntnis des Erkannten* ('coming to know that which was already known' or 'finding that which has been found' or 'realizing the realized') where the humanities make sense of that which is already sense-imbued. This is not a "linear uncovering of a meaning that can always be presumed to be unambiguous but rather a drawing-near to determined-undetermined structures of meaning that are approached simultaneously from multiple directions [...] in a circular motion."[164]

While this may sound obscure, I cannot help but be struck by the "principle of a productive impenetrability"[165] (*Unergründlichkeit* in a sense of unknowability) in the humanities which may only ever produce "findings which remain *approximative*"[166] and I suspect that this

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164 Frithjof Rodi, *Erkenntnis des Erkannten: Zur Hermeneutik des 19. und 20. Jahrhunderts*, Frankfurt am Main: Suhrkamp, 1990, 87f., original (full sentence): "‚Erkenntnis des Erkannten', das Wort in einem auch mit Diltheys Position zu vereinbarenden Sinn genommen, ist nicht einliniges Aufdecken eines stets als eindeutig vorauszusetzenden Sinnes, sondern ein von vielen Seiten her gleichzeitig vorgehendes, in wechselseitiger Formierung der Ansätze zirkulär verfahrendes Sich-annähern an bestimmt-unbestimmte Sinnstrukturen, in deren approximative Artikulation auch das einzubringen ist, was oben (S. 68) als Erlebnis-Ausdruck bezeichnet wurde."

165 Ibid., 97, original: "Prinzip der produktiven Unergründlichkeit."

166 Rodi 1990, 97, original: "durch die Betonung [...] ihrer immer nur *approximativ* bleibenden Ergebnisse." (Emphasis in the original.)

traditional philosophy of the humanities – in the German tradition, at the very least – would pair well with modelling as a method, if conscious of the fact that understanding, insofar as it requires a familiarity with the objects of study, the methods of study, and the conclusions that may be drawn from the chosen approach, is not and may never be contingent on a single data point any more than a single mind. It is here that we can see what is truly at stake in the digital humanities: not the simplification of models but the delegation of simplification.