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Review of *Modelwork: The Material Culture of Making and Knowing*

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Modelwork: The Material Culture of Making and Knowing.
Edited by Martin Brückner, Sandy Eisenstadt, and Sarah Wasserman
University of Minnesota Press, 2021
281 pp.

What do we mean when we talk about models? We mean simulacra, miniatures, objects which serve as *physical abstractions* in order to make a point or test a theory. More broadly speaking, models are mental or physical objects that belong to the vaguely uncanny category of representation; they depict, they simulate, and they generate thought.

Modelwork, a recent book from the University of Minnesota edited by Martin Brückner, Sandy Eisenstadt, and Sarah Wasserman, is unique in making the center of attention the liminality of the model, which lies between the physical and the theoretical, between imagination and matter. As we form models, this volume suggests, they have in turn formed us.

Bruno Latour, as is often the case when it comes to studies concerning science and the technical, has pondered this subject and its interstitial nature. He famously describes his body of work concerning the nature of knowledge and its creation as examining the sites where truth is produced, seeing those sites as the loci of civilization and that they represent science, law, technology and other formalized modes and sites of knowledge generation. But Latour is interested, as well, in “tangled objects” (Luckhurst 2006), new assemblages of knowledge in which the production of truth involves hybrid structures which cut across the boundaries of objects, moving between categories in new and unfamiliar ways.

The example for this given by Latour is science fiction, which Latour sees as a “strange hybrid” of science and fiction, able to give new insights not possible in either science or fiction by itself. In the same manner, models represent a “tangled object”; an engagement between linguistic representations of a concept and mechanical representations thereof, generally in miniature. As Brückner and Eisenstadt suggest in the introduction to *Modelwork*, models are hybrids, “amalgamating knowledge, both certain and indefinite, and practice, both critical and habitual,” as well as serving as material and conceptual manifestations of knowledge. The model can codify knowledge, or serve as the working-out of theory, or both; or it can (like Antonio da Sangallo’s model for an unbuilt St. Peter’s Basilica with a vast ambulatory, an Ionic second level, and a huge price) show us what might have been but never was; the same holds for Michelangelo’s model, with its symmetrical, neo-Classical approach (Bianchini, Ippolito, and Senatore 2019). In comparing these models to one another, and to the current basilica (Carlo Maderno’s modification of Michelangelo’s plans with a much extended nave and a façade designed for Papal blessings from a huge balcony that blocks views of the dome and drum of the building) (Hibbard 1971), one can sense both the attempts to work through difficult practical and aesthetic difficulties on a complex site.

The Working Model

At the start, like the authors in this volume, we do well to acknowledge that creating a model

is a template of sorts for the processes of human mentation. Humans examine a realm of stimuli, from which they deduce the existence of objects. These objects are classified by the human mind into a sort of proto-ontology, which is refined and codified through knowledge of already-existing linguistic systems. Through this interaction the system of commonly-held symbols and their linkages, a semiotic symbolic system is both used and transformed; it is within this system in which values, as well as meanings, reside. Thus, in brief, we might describe the “linguistic turn” of the modern philosophical venture, as Richard Rorty suggests. This shift, beginning with Frege, moved the main thrust of Western philosophy away from idealism toward a linguistically-oriented nominalism (Rorty 1967).

The argument can be made, then, that humans and their culture consist of nothing but models—that the entire edifice of human knowledge consists of these abstractions—models—which enable the mental operations which define and separate the human realms. But *Modelwork* takes a narrower, and valuable, approach to the question of models. As Brückner and Eisenstadt suggest in the introduction to the volume, the models in which this book deals are material models—physical objects created to serve as abstractions of other physical realities. Daston and Galison (1992, 85) call such items “working objects,” artifacts whose materiality gives them an additional overlay of meaning beyond that of the representation of the physical structure, process or invention. In the material nature of their representation, such models can provide information about the society of which they are a part, or the practices and procedures of some subset of that society. Such models are semiotic agents that, as Annabel Jane Wharton suggests in “Defining Models” (the first chapter of this volume), not only refer in some manner to a referent, but differ in some significant way, whether scale or material or function; models thus require that the user be familiar with the hermeneutic conventions within which the model was intended to be used as an epistemic operator, and hence models are agents of discourse—and like all agents of discourse, act politically.

The Farish Models in the Philosopher’s Table

A case in point are the modeling mechanisms used by William Farish in his tenure at Cambridge University. As a teacher of natural philosophy, Farish used a scaffold of wood, to which various simple mechanical contrivances could be attached. By assembling these units (pulleys, levers, wheels, and the like) to form machines, Farish was able to model the design and implementation of a broad range of mechanical devices for students in his classes in the then emerging realm of industrial design. Farish also created isometric, parallel projection drawings of the items he created using his system. The drawings enable the viewer to exactly understand the nature of the model, serving as a sort of “mental model,” while the model itself demonstrated how complex machines (in one 1822 article, for example, a device for grinding optical glass) could be constructed from elementary mechanical parts.

As described in a chapter by Hilary Brian, Robert Willis, the successor to Farish, published a book entitled *Principles of Mechanism*, which served as the endpoint of a long process of modeling in which the idea of standardized assemblies (the pulley, the screw and worm, for example) was deployed on modeling components of what came to be called a “philosophical table,” a wooden base within a fixed scaffold upon which models of “machines,” as such devices came to be called, could be constructed. *Principles of Mechanism*, Willis’s study of engineering, which was based by dint of models upon a mathematical analysis of motions,

came to supercede earlier approaches based on functionality of motion. As such, Willis was able to decompose mechanical implements, whether natural or man-made, into essential items which could then be modeled and manipulated (via mental or physical modeling) into novel items (Buchanan 2013). For his part, Farish, developed isometry as a representational strategy in order to model the models he had created, making the argument that such a representation most closely mimicked the manner in which human thought represented objects, since it lacked the distance-based continuation of scale found in true perspective drawing (Cocozza 2017). In these cases, what the models are about in some sense are *learning how to see*.

Modeling: How to See

As another essay, by Christopher Lukasik (chapter four in this volume), similarly suggest, 18th and 19th century drawing books, intended to teach individuals how to draw, also understood that they had to teach the emerging visual artist help to see, and in so doing, inculcated a whole set of socio-cultural understandings along with what would seem to be the neutral acts of artistic rendering. The notion of drawing, and the resultant art, as a “universal language,” permitted the cultural freighting of the images and their valuations in terms of “beauty” and “rectitude” and “propriety” to be elided. In a particularly telling example, Lukasik demonstrates how pseudosciences like “racial science” and phrenology interposed themselves, at the recommendation of art instruction manuals, between objects to be depicted and those who sought to depict them, a sort of “default Occidentalism” that Martin Scherzinger, in another article in this volume, argues is present in software involving the study of musical perception, as well as in algorithms as a whole.

Epistemic Models

The examples presented in *Modelwork* can serve the useful function or inspiring those in a variety of domains to question some of the assumptions underlying the models which have served as foundational in their respective fields. Consider, for example, the Gettier problem. There are numerous logical formulations of the problem, but almost every discussion of the matter comes to focus on one or another of the verbal models of the conundrum. Some of the models are—like the material models and model work—exemplars from a Gedanken experiment, rather than items or events one might encounter in one’s quotidian experience. No one ever said, “either Jones owns a Ford, or Jones is in Barcelona”; it is difficult to imagine a circumstance in which the horns of an intellectual dilemma would be either one’s brands choice in an automobile or the place where one is located when has when encountered, as Chisholm’s 1966 example suggests, a dog disguised as a sheep?

Try as one might, it is difficult to imagine who would dress up a dog to look like a sheep, or to what end. Were someone to do so in order to deceive passing strangers, or in order to create Gettier situations and thus undermine the whole enterprise of knowledge formation, they would be perverse individuals indeed. The same is true of Goldman’s (1976) fake barns example, in which a poor wayfarer is, unbeknownst to them, traveling in a region in which fake barns are the norm. He or she sees a real barn, and believes that he or she has indeed seen a real barn, thus having justified true belief. But in this land of fake barns this individual

would have thought the same had he or she seen a fake barn. Is it then true that this justified belief our Zayd, Umar, Khalid and Bakr have regarding barns ‘knowledge’?¹ Or can we— from a standpoint of greater knowledge regarding the prevalence of fake barns in the domain in question—criticize their method of justification as insufficient? Or might we argue that, at some point, the whole model of the Gettier problem has, like the model of the spheres contained in the Ptolemaic system, become too complex and unwieldy to use, thereby become untenable by virtue of Ockham’s principal? Or might we argue that these models of the Gettier problem are pointing to an underlying fault at the heart at the notion of a binary conceptualization of justification?

Learning How to See Epistemically

Clearly, arguments regarding the likelihood of a ‘land of fake barns’ are like arguments that the miniature model of a lens-grinding machine that Farish constructed from idealized components on a philosophical table would make lenses too small for any real use; they miss the point of a model. The Gettier examples are meant to capture a crucial problem about our notion of justified true belief, in the same piecemeal abstraction mode that the models by Farish are meant to capture the idea that all machines for manufacturing good can ultimately be built up from a stock set of mechanical primitives.

The Gettier models, as Hetherington (1996) suggests, all have two traits in common—luck and fallibility. It is the bad luck of the victim in the Gettier models to find themselves in a place where fake barns are the norm, or where dogs besport themselves by dressing as sheep. Arising from such bad luck is the notion of fallibility; one may, through bad luck, find one’s normally reliable program of justification of facts inadequate. Our normal program for justification of ‘barn-ness’, say, is to look at an object and see if it resembles the barns we have seen in the past. The maker of fake barns would know of this, and would model the fake barn on a real barn; what might be required would be to exit our auto or train and to look around the sides of the facade to see that the fake barn had neither sides nor back.

But what do we do if we are yet more luckless? What, for example, do we do if the dog who imitates a sheep goes so far to engage in transplants of fur and cosmetic surgery? Clearly, such a dog is supremely unlikely, and hence such bad luck is *almost* beyond imagining; but *having* been imagined cannot be discounted. What would be required to determine whether or not we were looking at an absurdly determined dog or a sheep would be a DNA test; and no one among us would go that far in their effort to obtain justified true belief unless (as in a matter of inheritance, say) a great deal of money were involved.

The point of this *reductio ad ridiculum* (Dorolle 1918) is to come to Zagzebski’s point; it is not that Gettier cases are omnipresent so much that to assert that in any specific instance we have not been ‘Gettiered’ is to assert that we have been lucky. And to base knowledge, even in part, on luck, certainly seems counterintuitive. We might state the same assertion in a

¹ The “Tom, Dick and Harry” of Moses Maimonides’ *Guide to the Perplexed*; equivalent to the “Reuben and Simeon” of the Talmud or the “Smith and Jones” of Gettier. In the particular case in Chapter 52 of the first book of the *Guide*, Maimonides is using these singular terms to make the point that relational attributes can be ascribed to entities without making any positive statement about the essence of those entities. As such, Zayd and companions take their place with Smith and Jones as exemplaria in the realm of epistemic placeholders.

different manner, however. What is the prevalence of dogs who elect to imitate sheep? We cannot, by right, say that it is zero, since we can't rule out that possibility that some number of the purported sheep that we have seen in our lives might have been dogs bent on imitating sheep. But we can surely say that the number of such dog-sheep is *approaching zero*. (As the Yiddish joke has it regarding the possibility of being murdered by a bunny rabbit, the odds are vanishingly small, but never zero).

The conclusion we might draw from our consideration of the Gettier models is that justification is somehow a matter of probability. We *might* be plagued by barns created by determined jokesters as we drive through the countryside; but it is probably—very probably—not the case. It is sufficiently probable that when we look into our back yard to see if our child is there that we do not see a child who looks like our child but is not ours, we do not investigate further. In our daily lives, we count on likelihood to make our justificatory processes for knowledge sufficient. It is only in the most important cases (purchasing a home, say) that we demand binding proof of fact-claims (legal proof of land ownership back a century, in the example of purchases of a home and land).

Marshall McLuhan, the media theorist, conceived of his notions of media inquiry as “probes,” (McLuhan 1969) heuristic devices structured as questions. In the same manner, the Gettier models ultimately serve as “probes” in the sense McLuhan describes, or as models in the sense of *Modelwork*; they are functional if unreal items which we can mentally handle, picking them up and turning them around, looking at them from different angles, attempting to approach the items in new ways. The model itself is an inert entity made from stock elements; but if the artificer has enough skill or art, and the student is willing enough, the result may be that the model can interact with the student, the scholar, the engineer, the artist in ways that enable the production of new knowledge.

And the result of the Gettier examples, or as I would have it, models, has been substantial; so substantial that Harvey Siegel (1997, p. 164) argues that “we are all fallibilists now.” At least in part due to Gettier, as Siegel argues, all claims are seen as fallible, none certain, and that justification is hence fallible; Zagzebski's understanding of Gettier problems as “inescapable” (1994) has led, by way of such fallibilism, to a probabilistic conception of justification in which the primary question is the threshold problem—at what point of epistemic probability is one justified in accepting evidence is sufficient, a matter discussed by Chisholm (1966).²

In sum, then, epistemology has been profoundly affected by models; much of the movement toward fallibilism, I would suggest, was motivated by the use of the Gettier models, and the increasing understanding that problems with the traditional understanding of justified true

² Chisholm is careful to differentiate the epistemic sense of “probable” from the statistical sense of “probable” as “frequency of occurrence”. In the epistemic sense, a quasi-probabilistic relationship applies to a new belief and its relation to extant beliefs that individuals hold; rather than being expressed numerically, the relationship between beliefs is expressed as “more probable” or “less probable. See Chisholm 1977, 56. Also, see Reed (2012) for a more extensive discussion of the increasing prevalence of fallibilism amongst epistemologists; Turri (2012) offers a comprehensive view of the fallibilist and other responses to the challenge of Gettier to the traditional “justified true belief” standard for knowledge.

belief as the constituent assembly of knowledge those models revealed were, as Zagzebski suggested, inescapable.

Conclusion

We can hope, then, for excellent models to stimulate our work as we move forward in our endeavors; Gettier's claim in epistemology, like Sangallo's in architecture or Farish's in engineering, is to have provided such.

Modelwork, as a book, serves the same purpose. One of the delights of reviewing books is to come upon a volume that one does not have any particular expectations toward, and to find instead that that book inspires pleasant and fruitful thought; this book is just such a volume. I would say that there would be few who could read of Farish and Willis without finding themselves interested, or who could consider the idea of bias within musical algorithms without giving serious consideration to how their own idea of what is, and what is not, musical may reflect deep-seated biases.

Modelwork is a provocative book, not so much in the sense of making bold claims but in the sense of providing information and ideas that cannot help but stimulate and provoke thought. The individual selections in this volume serve as a set of pieces whose joint impact is to serve as a meditation on the role that models, most particularly physical models, play in the creative process, to be sure; but the deftly-assembled volume as a whole serves as a refreshing stimulant for thought and creativity.

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