Part III Introduction

Experience, Translation, and the Norms of Science

Jamie Cohen-Cole

What were the rules, norms, and expectations by which people in the premodern world conducted themselves as they translated experience onto paper, generating and preserving experience within the bodies of scientific knowledge available to them? As this volume demonstrates, such translation was no simple matter. Aristotelian rules of method took experience to be mutable and therefore an unreliable a source of knowledge. They set a high bar, informing experience's relation to the governing rules, norms, and expectations of science. The norms demanded that, first, sense perceptions be collated and, second, these collated experiences be translated onto parchment and paper, before they could count as experience. Only through skilled practices—applying the proper types of reasoning to sense perceptions, inferring from perceptions, images, and memories, and associating different epistemic or even ontological realms—could experiences be constructed as *scientific*, and from there be made into potential candidates for true and certain knowledge. Such were the towering norms of Aristotelian science.

The norms of authentic scientific experience policed most strictly those topics that strayed farthest from what could be demonstrated by syllogisms or proven by mathematics. This means we moderns can find characteristic candidates for scientific knowledge not only in prototypical instances, but also, and even more clearly, in cases where our predecessors sought to negotiate which topics and methods were inside, which outside proper scientific knowledge. Those cases can be found especially at the fringes of the body of Aristotelian science.[1]

As Julia Reed shows (Chapter 8), normative conventions in early modern England become apparent when medical ontologies designed to help us understand sickness and health are translated into more than one language of mathematics: geometric (following the model of Newton) or numeric. Norms of translation from physical to textual or mathematical form shed light on the scientist's, physician's, and philosopher's personae.[2] The practice of careful measurement, for example, might be taken to indicate the scientist's moral and intellectual virtues.[3]

DOI: 10.4324/9781003258704-12

But the practices of mathematics cannot simply be taken for granted. Far from expanding everywhere monotonically, numeric measurement and the method of its application to the sciences has depended on cultural contexts.[4] Even the choice of which kind of mathematics—numeric, algebraic, geometric—is most appropriate to use in print and to model the world is part of a system of cultural values that embed disciplinary practices and norms of personal conduct.[5] In both the cases Reed discusses, adopting mathematical forms involved a gain in prestige, through affiliation with either the high status of astronomy or the promise of becoming able to measure otherwise inaccessible indicators of bodily condition. At the same time, both gains involved a loss: the loss of reference to classical ontologies of the humors as transmitted from Galenic medicine. Medical practitioners could nevertheless gain by mathematical translation because each form offered to raise their epistemic status as physicians. Translating medical experiences into the language of mathematics thus marked a potential path to certain knowledge in early modern England, emulating the Aristotelian ideal of certainty.

Yehuda Halper focuses on medieval Hebrew and Arabic philosophy to show how within that same broad context of Aristotelian certainty, experience was filtered by norms of syllogistic reasoning (Chapter 7). Halper figures Moses Maimonides as translating Aristotle for his readers in both a linguistic and an epistemic sense. Four settings for the discussion of experience in Maimonides's *Treatise on the Art of Logic* illustrate a range of norms of evidence and reasoning (inductive, inferential, deductive, syllogistic) that would make observations taken from medicine into candidates for experience and possibly knowledge.[6] One context for the *Treatise* was Maimonides's own work, the *Medical Aphorisms*; the others emerge in three separate translations of the *Treatise* into Hebrew. Halper explains that medieval readers' familiarity with—and perhaps their experience of—very specific contexts, whether of a particular reading and interpretive tradition or of medical cases they had experienced themselves, would have invited specific interpretations of whether and how observations of bodies could achieve the status of certain knowledge.[7] These settings demonstrate that there was a mutable set of formal rules for collecting empirical evidence and translating it into certain knowledge, rules that were in flower well before Francis Bacon outlined his own rules for translating observations into knowledge in the *New Organon* of 1620.

Norms for making experience into knowledge extended beyond rules of inference or the application of geometry and measurement. Hannah Erlwein's and Tommaso Alpina's chapters consider the norms that regulated translation from a given observable instance to a similar unobservable case, at least unobservable to the naked eye. In formal terms, these would be the rules of inference and observation for establishing similarity sets, analogies, and models. Erlwein (Chapter 6) shows that *kalām* theologians debated which forms of analogy would establish a proper translation between the world of everyday experience and that of the eternal. These debates set norms that governed just how experiences of, for instance, writing could be translated into knowledge about that which is inaccessible to the senses, for instance whether and how the world is eternal.[8]

Alpina (Chapter 5) describes how Avicenna's norms for experience conditioned the making of knowledge about animal sensations. Avicenna spelled out which kinds of human observations could count as experiential knowledge about the sensory experiences of aquatic creatures. Direct observation of fish and dolphin anatomy being impossible, Avicenna set normative conditions for making observations of invisible morphology and drawing conclusions from it: when people had prolonged and repeated experience of animal behavior, they could draw valid scientific inferences about animals' sensory or cognitive capacities, in this case their faculty of hearing.

Together, the chapters in this section suggest that the use of experience and observation, even of those things not directly accessible by direct sense impression, did not need to wait for the sixteenth century, as has sometimes been assumed.[9] Centuries before, there were already both specified activities and precise norms governing the use of experience in the making of scientific knowledge—only there was yet not a unified scientific method. This lack of unity marks the premodern period not as unique, but as entirely continuous with scientific study ever since.[10] Further, the premodern scientific studies that made experience both a topic of investigation and a meta-scientific tool have echoes in the work of some twentieth-century cognitive psychologists, who took perception and observation to depend on memory, reason, judgment, inference, classification, and a range of social factors. The cognitive psychologist Jerome Bruner contended that

> the organism is always set or tuned or expectant; he is, in short, ready for certain classes of stimulus events to occur. The tuning of the organism, and we shall discuss its determinants presently, we shall call an hypothesis ... . The data of the scientist are not the raw cues of stimulation, but the perceptions of the scientist which occur when those cues confirm perceptual hypotheses which he has acquired. In this important sense, then, the scientist's data are not found, but created.[11]

As Lorraine Daston and Elisabeth Lunbeck have noted, until recently historians of science have missed the role of the intellect in observation because they read psychologists as being only interested in perception.[12] Perhaps this tradition of fashioning historiographic tools by reading psychologists selectively was a product of historians focusing their attention primarily on prototypical, paradigmatic sciences. If so, then broadening the history of science's scope to ask how non-canonical fields—medicine, theology, the human sciences—have studied perception, reason, observation, and experience offers us the chance to go beyond views of the premodern period as prescientific and take it on its own terms.

Notes

1 Parallels can be found with modern instances that question whether the social sciences are actually science. See Gieryn, "U.S. Congress"; Gieryn, "Boundary-Work."
2 Daston and Sibum, "Scientific Personae."
3 Schaffer, "Astronomers"; Schaffer, "Late Victorian Metrology."
4 Wise, "How Do Sums Count?"
5 For accounts that show dramatically different virtues attached to geometric representation, see Galison, "Suppressed Drawing"; Wise, "What's in a Line."
6 "Candidates for knowledge" is inspired by Ian Hacking's analysis of candidates for truth and falsehood in "Language, Truth and Reason."
7 The effects of different forms of reading on the interpretation of a single text are discussed in Warwick, "Cambridge Mathematics." Warwick drew on the field of reader response to underline his claim that texts are interpreted preconsciously according to the norms of specific reading communities. See especially Fish, *Is There a Text in This Class?*, 318.
8 This observation offers a useful corrective to previous studies of such rules, which suggest that analogical reasoning emerged in the early modern period and with a move away from the kind of thinking characteristic of alchemical study. See Gentner and Jeziorski, "Shift from Metaphor to Analogy."
9 For instance, Grant, *Nature of Natural Philosophy*, ch. 8; Cohen, *Scientific Revolution*.
10 Galison and Stump, *Disunity*.
11 "Cognition and the Limits of Scientific Inquiry." Paper read at the Institute for the Unity of Science at the American Academy of Arts and Sciences, 1951. Jerome S. Bruner Papers, Harvard University Archives, HUG 4242.28. This argument appeared in a number of places, including Bruner, "On Perceptual Readiness." For broader discussion of Bruner's work and the role of scientific reason in shaping observation, see Cohen-Cole, "Reflexivity."
12 Daston and Lunbeck, "Introduction," 5.

Bibliography

Bruner, Jerome S. "On Perceptual Readiness." *Psychological Review* 64 (1957): 123–52.

Cohen, H. Floris. *The Scientific Revolution: A Historiographical Inquiry*. Chicago: University of Chicago Press, 1994.

Cohen-Cole, Jamie. "The Reflexivity of Cognitive Science: The Scientist as Model of Human Nature." *History of the Human Sciences* 18, no. 4 (2005): 107–39.

Daston, Lorraine, and Elisabeth Lunbeck. "Introduction: Observation Observed." In *Histories of Scientific Observation*, edited by Lorraine Daston and Elizabeth Lunbeck, 1–9. Chicago: University of Chicago Press, 2011.

Daston, Lorraine, and H. Otto Sibum. "Introduction: Scientific Personae and Their Histories." *Science in Context* 16, nos. 1–2 (2003): 1–8.

Fish, Stanley. *Is There a Text in This Class? The Authority of Interpretive Communities*. Cambridge: Harvard University Press, 1980.

Galison, Peter. "The Suppressed Drawing: Paul Dirac's Hidden Geometry." *Representations* 72 (2000): 146–66.

Galison, Peter, and David J. Stump, eds. *The Disunity of Science: Boundaries, Contexts, and Power*. Stanford: Stanford University Press, 1996.

Gentner, Dedre, and Michael Jeziorski. "The Shift from Metaphor to Analogy in Western Science." In *Metaphor and Thought*, edited by Andrew Ortony, 2nd ed., 447–80. Cambridge: Cambridge University Press, 1993.

Gieryn, Thomas. "Boundary-Work and the Demarcation of Science from Non-Science: Strains and Interests in Professional Ideologies of Scientists." *American Sociological Review* 48 (1983): 781–95.

Gieryn, Thomas. "The U.S. Congress Demarcates Natural Science and Social Science (Twice)." In *Cultural Boundaries of Science: Credibility on the Line*, 65–114. Chicago: University of Chicago Press, 1999.

Grant, Edward. *The Nature of Natural Philosophy in the Late Middle Ages*. Washington, DC: Catholic University of America Press, 2012.

Hacking, Ian. "Language, Truth and Reason." In *Rationality and Relativism*, edited by Martin Hollis and Steven Lukes, 48–66. Cambridge, MA: MIT Press, 1982.

Schaffer, Simon. "Astronomers Mark Time: Discipline and the Personal Equation," *Science in Context* 2, no. 1 (1988): 115–45.

Schaffer, Simon. "Late Victorian Metrology and Its Instrumentation: A Manufactory of Ohms." In *Invisible Connections: Instruments, Institutions, and Science*, edited by Robert Bud and Susan E. Cozzens, 23–56. Bellingham, WA: SPIE Optical Engineering Press, 1992.

Warwick, Andrew. "Cambridge Mathematics and Cavendish Physics: Cunningham, Campbell and Einstein's Relativity 1905–1911, Part I: The Uses of Theory." *Studies in History and Philosophy of Science Part A* 23, no. 4 (1992): 625–56.

Warwick, Andrew. "Cambridge Mathematics and Cavendish Physics: Cunningham, Campbell and Einstein's Relativity 1905–1911, Part II: Comparing Traditions in Cambridge Physics," *Studies in History and Philosophy of Science Part A* 24, no. 1 (1993): 1–25.

Wise, M. Norton. "How Do Sums Count? On the Cultural Origins of Statistical Causality." In *The Probabilistic Revolution*, *1: Ideas in History*, edited by Lorenz Krüger, Lorraine J. Daston, and Michael Heidelberger, 395–426. Cambridge, MA: MIT Press, 1987.

Wise, M. Norton. "What's in a Line?" In *Aesthetics, Industry, and Science: Hermann von Helmholtz and the Berlin Physical Society*, 148–94. Chicago: University of Chicago Press, 2018.