

History of Science and History of Philologies

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Abstract: While both the sciences and the humanities, as currently defined, may be too heterogeneous to be encompassed within a unified historical framework, there is good reason to believe that the history of science and the history of philologies both have much to gain by joining forces. This collaboration has already yielded striking results in the case of the history of science and humanist learning in early modern Europe. This essay argues that first, philology and at least some of the sciences (e.g., astronomy) remained intertwined in consequential ways well into the modern period in Western cultures; and second, widening the scope of inquiry to include other philological traditions in non-Western cultures offers rich possibilities for a comparative history of learned practices. The focus on practices is key; by shifting the emphasis from what is studied to how it is studied, deep commonalities emerge among disciplines—and intellectual traditions—now classified as disparate.

In August 1820, Carl Friedrich Gauss, professor of astronomy and director of the observatory at the University of Göttingen, sent his friend and fellow astronomer the Bremen physician Heinrich Wilhelm Olbers a table comparing Gauss's own observed values for the position of five zenith stars with those of other celebrated astronomers, both past and present. Gauss attempted to explain the discrepancies among them: "The [observations of the] first four stars harmonize beautifully, as you see, . . . but how it happened that [the value of the star] Capella is 18" less, I cannot, lacking the original details, explain."¹

Comparing discrepant astronomical observations and attempting to eliminate variability was a leitmotif of the decades-long correspondence between Gauss and Olbers. They obsessed over such issues as whether the cross hairs of sighting instruments should be made of spider or cocoon silk in order to eliminate sag; the maddening tendency of observatory clocks to lose or gain time; individual differences among even trained observers using the same instruments in the same place to measure the same position; and even whether disparities in the width of various observers' pupils and irises might lead to divergences.² Gauss famously proposed and

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¹ C. F. Gauss to H. W. Olbers, Göttingen, 23 August 1820, in Carl Friedrich Gauss, *Werke, Ergänzungsreihe IV: Briefwechsel C. F. Gauss–H. W. M. F. Olbers*, ed. C. Schilling (1909; Hildesheim/New York: Georg Olms Verlag, 1976), Vol. 2, no. 390, p. 28.

² *Ibid.*, Vol. 2, no. 384, pp. 7–8; no. 386, p. 15; no. 391, p. 33; and no. 395, p. 43.

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justified a mathematical treatment, the method of least squares, to estimate and thereby tame random observational errors by assuming that they were probabilistically and symmetrically distributed around the true value. But he repeatedly emphasized that recourse to judgment was indispensable in separating the gold from the dross among variable observations: in distinguishing between “constant” and “random” errors; in choosing the function for the error distribution (*pro arbitrio*); in assigning a weight to particular observational errors; and in deciding to throw out outlying observations that could not be squared with the astronomer’s expert understanding of the phenomenon in question.³

As Gauss wrote to Olbers, who had begged him for prescriptive rules (*Vorschriften*) on how to handle the outlier problem, the application of probability theory to observations required “the most comprehensive specialist knowledge possible”; here “mathematical rigor and certainty” were unattainable.⁴ No mathematical formula could supplant unwavering attentiveness and painstaking care on the part of the observer. When Olbers reported that Friedrich Wilhelm Bessel, director of the Königsberg Observatory, had discovered a systematic discrepancy of one second between his own and his assistant Walbeck’s observations of the same ten stars over five days (a discrepancy later known as the individual and ineradicable personal equation of each and every observer), Gauss responded: “between us, Walbeck (whom I consider to be otherwise quite intelligent) seems to me still somewhat unpracticed in observation.”⁵

At just about the same time, in Göttingen as in other German universities, professors of Classical philology were wrestling with their own intractable problems of errors and variations.⁶ If it was the difficulty of determining the exact positions of the stars above that worried the astronomers, it was discovering the exact texts of Homer, Virgil, and other authors—the stars of the cultural pantheon of the Western tradition—that kept the Classicists up at night. Twenty centuries or more separated the Greek and Roman authors from the nineteenth-century scholars who so admired them; for most of that period, the ancient works of poetry and prose had been transmitted by being copied by hand, either by a single scribe’s inspection of some manuscript or by a group of scribes to whom a reader dictated. Either procedure was guaranteed to generate all kinds of discrepancies, including visual and aural mistakes, the effects of distraction or boredom, of ignorance or misinformation, or of scorn or reverence.

³ Carl Friedrich Gauss, *Theoria combinationes observationum erroribus minimis obnoxiae* (Pars prior, 1821; Pars posterior, 1823), Pars prior, sec. 6, in Gauss, *Werke*, ed. Königliche Gesellschaft der Wissenschaften zu Göttingen (1873; Hildesheim: Georg Olms, 1981), Vol. 4, pp. 1–108, 6–7. Adrien-Marie Legendre and Pierre-Simon Laplace had published the method of least squares earlier, albeit with different mathematical functions and justifications. On the priority dispute with Gauss see Stephen M. Stigler, “Gauss and the Invention of Least Squares,” *Annals of Statistics*, 1981, 9:465–474.

⁴ C. F. Gauss to H. W. Olbers, Göttingen, 3 May 1827, in Gauss, *Werke, Ergänzungsreihe IV* (cit. n. 1), Vol. 2, no. 613, p. 480. On attempts to deal with outliers see Zeno G. Swijtink, “The Objectification of Observation: Measurement and Statistical Methods in the Nineteenth Century,” in *The Probabilistic Revolution*, Vol. 1: *Ideas in History*, ed. Lorenz Krüger, Lorraine Daston, and Michael Heidelberger (Cambridge, Mass.: MIT Press, 1987), pp. 261–286.

⁵ C. F. Gauss to H. W. Olbers, Göttingen, 3 May 1827, in Gauss, *Werke* (cit. n. 4), Vol. 2, no. 414, p. 92. On the tension between the personal equation and the conscientiousness of the observer see Simon Schaffer, “Astronomers Mark Time: Discipline and the Personal Equation,” *Science in Context*, 1988, 2:115–145; and Jimena Canales, “Sensational Differences: The Case of the Transit of Venus,” *Cahiers François Viète*, 2007, 11–12:15–40.

⁶ By “philology” we mean, in the present context, the rational, disciplined, and institutionalized form of interpersonal research, testing, and communication, directed to (above all, written) texts; and by “Classical philology” we mean this activity when it is directed to the surviving written texts of ancient Greece and Rome. We take “Classical scholarship” in a broader sense—essentially that of Friedrich August Wolf and August Boeckh—to include all the disciplines that try to cast light upon the whole of Greek and Roman antiquity, including history, linguistics, numismatics, epigraphy, papyrology, history of institutions, religion, and so forth.

And as copies were copied over and over from ever more copies, the distance from the *Urtext* expanded and new readings (depending on one's point of view, either errors or innovations) proliferated geometrically.

Since antiquity, scholars had developed a number of procedures for trying to determine the best reading where manuscripts diverged or a better reading where they all transmitted the same one. The procedures included various modes of collation; linguistic, stylistic, and historical investigations; *emendatio ope codicum* (emendation by comparison with other manuscripts) and *emendatio ope ingenii* (emendation by the scholar's own wit).⁷ But it was only in the early nineteenth century that Classicists, especially in Germany, began to express the need for more rigorous procedures that would enable them to both reduce the number of variants to choose from and make that choice without having to have recourse to personal taste and intelligence. Friedrich August Wolf opened his foundational *Prolegomena to Homer* of 1795 with a programmatic call for a truly critical method of edition that would examine all the extant manuscripts, establish the familial relations among them, and choose readings not for their attractiveness but for their genuineness.⁸ But Wolf himself never fulfilled the program he adumbrated, and it was left to his followers to try to work out a more scientific method. Above all, it was Karl Lachmann (who had studied at Göttingen, as had Wolf) who heard Wolf's call. Already in 1818, as a young, freshly appointed *Ausserordentlicher Professor* at Königsberg, he took to task one of the doyens of the profession, Gottfried Hermann, for having neglected adequately to examine the manuscripts of Sophocles's *Ajax* for his own edition and for having chosen readings purely on the basis of his own stylistic sense. As Lachmann wrote in his review, laziness masquerading as tolerance for the judgment of others amounted to "criminal leniency," and textual critics must be wary of those "who do not strive above all for a documentary text and who venture to get to work all too quickly, without having severely interrogated all the witnesses."⁹ The young scholar went on to develop procedures for textual edition that came to be so closely identified with him that they are still called "Lachmann's method."¹⁰ His procedures included establishing genealogical relations among manuscripts, disregarding manuscripts copied directly from other surviving ones, and choosing among variants as far as possible according to stemmatic and statistical principles.

These two campaigns to minimize errors through systematic methods, one in astronomy and the other in Classical philology, both from early nineteenth-century Germany, exhibit obvious disanalogies. Both appealed to statistical intuitions about the likelihood of error, but Gauss's method invoked a mathematical distribution of the probabilities; Lachmann's was guided by everyday assumptions about likelihood. The errors in one case were due to diverse and unreliable instruments, choppy air, and individual perceptual differences; in the other, errors were the result of long chains of scribal transmission, the loss of manuscripts through the depredations of time and circumstance, and individual linguistic differences. Yet there are

⁷ Rudolf Pfeiffer, *History of Classical Scholarship from the Beginnings to the End of the Hellenistic Age* (Oxford: Clarendon Press, 1968); Pfeiffer, *History of Classical Scholarship from 1300 to 1850* (Oxford: Clarendon Press, 1976); and L. D. Reynolds and N. G. Wilson, *Scribes and Scholars: A Guide to the Transmission of Greek and Latin Literature*, 4th ed. (Oxford: Oxford Univ. Press, 2013).

⁸ Friedrich August Wolf, *Prolegomena to Homer 1795*, trans. Anthony Grafton, Glenn W. Most, and James E. G. Zetzel (Princeton: Princeton Univ. Press, 1985), pp. 43–45.

⁹ Karl Lachmann, *Kleinere Schriften zur Classischen Philologie*, ed. von J. Vahlen (Berlin: G. Reimer, 1876), pp. 1–17, 2 (quotations).

¹⁰ Sebastiano Timpanaro, *The Genesis of Lachmann's Method*, ed. and trans. Glenn W. Most (Chicago/London: Univ. Chicago Press, 2005).

also striking analogies. In both cases, it is assumed that (1) a unique true value (the position of a star, the original text of an ancient author) has been obscured by variability introduced by a cloud of witnesses, be they multiple observations or transcriptions; (2) these errors can be classified as either systematic (e.g., an irregular clock, but also a habitually inattentive observer or copyist) or random (e.g., reversed digits of a transcribed stellar position or the reversed letters of a transcribed Greek word); and (3) the most counterintuitive and consequential of all, even the random errors exhibit certain regularities that systematic methods can diagnose and exploit so as to approximate more closely to either the true position of a heavenly body or the *Urtex*t of a work from Greco-Roman antiquity. In both cases, there is also an acute consciousness that method, though indispensable, will not alone suffice; judgment informed by deep knowledge of the subject matter remains essential—whether to decide to discard an outlying observation or to emend a specious reading.

What these parallels point to is not necessarily influence in one direction or the other but, rather, a common context in which similar problems (in this case, how to deal with variability interpreted as error) are framed in similar ways and attacked with similar methods. This was done by savants who encountered one another regularly in the streets of their small university towns, the meeting rooms of local academies, the pages of journals like the *Göttingische Gelehrte Anzeigen*, and sometimes in the bosom of their own families. (Gauss's son-in-law, the orientalist Heinrich August Ewald, also a professor at Göttingen, applied text-critical methods to the Hebrew Bible to reduce apparent random usage to rules.¹¹) The philologists and the astronomers were both participating in an emergent learned culture that emphasized, among other things, advanced specialist training in the recently founded research seminars (pioneered by the philologists but soon imitated by the physicists and other professors); publication of original research in specialized journals; expertise over erudition; and self-consciously critical methods alert to every possible source of error. This was, in short, a culture of *Wissenschaftlichkeit* as opposed to *Gelehrsamkeit*.¹² Our point is not simply that the philologists and the astronomers were all *Wissenschaftler*; rather, together they were defining the very meaning of *Wissenschaft* in the same place at the same time along similar lines—and in ways that remain significant for the modern understanding of science, rigor, and expertise.

We offer this early nineteenth-century example because it suggests that the histories of at least astronomy and philology, if not those of all the sciences and humanities, continued to be entangled long past well-attested cases from the early modern period.¹³ Interactions occurred at multiple levels, not only in institutions like the seminar but also in key practices like error analysis. Our larger point is that current ways of conceptualizing both the history of science and the history of the humanities have imposed anachronistic divisions among the great regions of knowledge and thereby obscured commonalities that are deeper, broader, and more enduring than this or that case study about specific instances of interaction, influence,

¹¹ Heinrich August Ewald, *Die Komposition der Genesis kritisch untersucht* (Braunschweig: Ludwig Lucius, 1823), p. 7.

¹² R. Steven Turner, "Historicism, Kritik, and the Prussian Professoriate, 1790–1840," in *Philologie et herméneutique au 19e siècle*, ed. M. Bollaek and H. Wismann (Göttingen: Vanderhoeck & Ruprecht, 1983), pp. 450–489; William Clark, *Academic Charisma and the Origins of the Research University* (Chicago: Univ. Chicago Press, 2006), pp. 173–179, 219–227; and Kathryn Olesko, *Physics as a Calling: Discipline and Practice in the Königsberg Seminar for Physics* (Ithaca, N.Y.: Cornell Univ. Press, 1991).

¹³ See, for example, Anthony Grafton, "Humanism and Science in Renaissance Prague: Kepler in Context," in Grafton, *Defenders of the Text: The Traditions of Scholarship in an Age of Science, 1450–1800* (Cambridge, Mass.: Harvard Univ. Press, 1991), pp. 178–203; and Jed Z. Buchwald and Mordechai Feingold, *Newton and the Origin of Civilization* (Princeton: Princeton Univ. Press, 2013).

or borrowing would suggest. As a historian of science (LJD) and as a classicist and historian of philologies (GWM), we would like to set out some reasons why our fields have much to gain by joining forces.

THE VIEW FROM THE HISTORY OF SCIENCE

For some time now, historians of science have been rethinking their subject matter. First came the challenges from the heartland; contextualized studies of what by anyone's definition were key episodes in the history of science—the achievements of Copernicus, Kepler, Newton, Darwin—blurred the line between science proper and what most historians (and especially philosophers) of science then deemed science improper, including astrology, alchemy, political economy, and, heaven forbid, theology. These discomfiting associations could be, and at first were, dismissed as the growing pains of embryonic science. Then, however, careful studies of undeniably modern, mature sciences revealed that context mattered there as well—and that no single method of inquiry or form of explanation could embrace all the disciplines grouped under even the narrower modern rubric: the disunity of science.¹⁴ Investigations of the emergence of seminal scientific practices, such as experimentation and observation, widened the scope of the sites and practitioners of science to include not only the laboratory and the observatory but also the household, the ship, the marketplace, the court, the coffee house, and the workshop; and not only the university professor of natural philosophy, mathematics, or medicine, but also the engineer, the artisan, the merchant, the apothecary, or the gardener.¹⁵ Explorations of knowledge traditions in non-European cultures have exerted further pressure on conventional distinctions between science and—take your pick—technology, erudition, state administration, art, medicine, and lay empiricism.¹⁶ Finally, all historians of premodern science (a peculiar category that encompasses, depending on whom one asks, everything before 1700, 1800, or 1900 and is in all cases defined solely by contradistinction to the equally murky and miscellaneous category of modern science) are acutely aware that the projection of classifications of knowledge as currently institutionalized in academic disciplines onto earlier periods risks seriously distorting both content and context. Is it any wonder that historians of science fret about exactly what it is we are historians of?¹⁷

And now, on top of all this, comes the history of the humanities. Even historians of science who dismiss attempts to draw a sharp line between science and other kinds of knowledge (e.g., the Popperian demarcation criterion or the Two Cultures opposition) as relics of musty polemics may well balk at this latest addition. For one thing, the humanities are even more amorphous than the sciences. Even within anglophone traditions, reasonable people (and university faculties) may differ as to whether, for example, history belongs to the humanities or the social sciences. Pragmatists may understandably decide to take whatever currently

¹⁴ Peter Galison and David J. Stump, eds., *The Disunity of Science: Boundaries, Contexts, and Power* (Redwood City, Calif.: Stanford Univ. Press, 1996).

¹⁵ For an overview of this literature see Katharine Park and Lorraine Daston, eds., *The Cambridge History of Science*, Vol. 3: *Early Modern Science* (Cambridge: Cambridge Univ. Press, 2008).

¹⁶ See, for example, Kapil Raj, *Relocating Modern Science: Circulation and the Construction of Knowledge in South Asia and Europe, 1650–1900* (New York: Palgrave Macmillan, 2007); G. E. R. Lloyd, *Disciplines in the Making: Cross-Cultural Perspectives on Elites, Disciplines, and Knowledge* (Oxford: Oxford Univ. Press, 2009); and Dagmar Schäfer, *The Crafting of Ten Thousand Things: Knowledge and Technology in Seventeenth-Century China* (Chicago: Univ. Chicago Press, 2011).

¹⁷ Jan Golinski, "Is It Time to Forget Science? Reflections on Singular Science and Its History," in *Clio Meets Science: The Challenge of History*, ed. Robert E. Kohler and Kathryn M. Olesko, *Osiris*, 2012, N.S., 27:19–36; and Peter Dear, "Science Is Dead, Long Live Science," *ibid.*, pp. 37–55.

counts as the humanities as the starting point for historical inquiry, but historians of science who have only recently begun to extricate themselves from the tangle of misunderstandings this strategy created when applied to physics or biology in earlier periods will be rightly wary.¹⁸ Moreover, since at least the eighteenth century, the ontologies of the natural and human realms have been conceived in yin-yang opposition, as the regularity of nature versus the variability of all things human. Surely the humanities deserve their own history (or, rather, histories) as much as any other branch of human endeavor, but is there anything to be gained by gathering them up into the folds of the history of science?

Despite these misgivings, there are good grounds to believe that broadening the subject matter of the history of science to include at least some of the history of some of the humanities (the reasons for these qualifications will be clear from what follows) is both inevitable and potentially transformative. First, the inevitable: The integration of some parts of the history of the humanities within the history of science is already a *fait accompli* for certain epochs and disciplines. The history of philosophy and natural philosophy can be only artificially distinguished prior to the eighteenth century, and science and philosophy continue to interpenetrate in the modern period, despite institutionalized disciplinary divides. Classical erudition and medicine (and, via *materia medica*, natural history) interacted strongly from the Renaissance through the Enlightenment, as humanist recoveries of ancient texts stimulated empirical inquiry, *historia* encompassing both pursuits.¹⁹ The recent efflorescence of studies on the history of early modern learning has traced the deep affinities between the humanist practices of excerpting, note-taking, collating, and indexing and the practices of naturalists as they ordered their collections and synthesized old and new knowledge of organic forms, which in turn resembled the practices of physicians, as they gathered and shared observations in formats soon copied by the first scientific journals.²⁰

Striking as these examples of the seamless integration of the history of science and some branches of the humanities are, they remain piecemeal. In certain historical contexts, certain aspects of what we now call the humanities and the sciences were in prolonged and intense dialogue with one another or were even pursued by the same people using similar or identical practices. This would make the case-by-case integration of the histories of the humanities and the sciences inevitable, but hardly transformative. Can anything more systematic be claimed?

For the humanities (or *Geisteswissenschaften* or *sciences humaines*) as a whole, and as currently constituted, probably not. If, however, we narrow our focus to a particular branch of the contemporary humanities, namely philological traditions (not just Greek and Latin but also Arabic, Chinese, Persian, Sanskrit, and other long-lived intellectual chains of transmission and analysis of canonical texts), the situation changes. First, until well into the twentieth

¹⁸ Given the heterogeneity of the modern humanities and the complexity of the historical antecedents of its components, it is understandable that some otherwise excellent studies have either overstated the case for the predominance of one discipline, as does James Turner in *Philology: The Forgotten Origins of the Humanities* (Princeton, N.J.: Princeton Univ. Press, 2014), or taken the current composition of the humanities as the working definition, as does Rens Bod in *A New History of the Humanities: The Search for Principles and Patterns from Antiquity to the Present* (Oxford: Oxford Univ. Press, 2013).

¹⁹ Gianna Pomata and Nancy G. Siraisi, eds., *Historia: Empiricism and Erudition in Early Modern Europe* (Cambridge, Mass.: MIT Press, 2005). On the emergence of humanities divisions in twentieth-century anglophone universities see Turner, *Philology* (cit. n. 18), pp. 382–386.

²⁰ Ann Blair, “Humanist Methods in Natural Philosophy: The Commonplace Book,” *Journal of the History of Ideas*, 1992, 53:541–551; Blair, *Too Much to Know: Managing Scholarly Information before the Modern Age* (New Haven, Conn.: Yale Univ. Press, 2010); Staffan Müller-Wille and Isabelle Charmantier, “Lists as Research Technologies,” *Isis*, 2012, 103:743–752; and Fabian Krämer, *Ein Zentaur in London: Lektüre und Beobachtung in der frühneuzeitlichen Naturforschung* (Aalfalterbach: Didymos-Verlag, 2014).

century, these studies formed the educational core for all intellectual elites, including those who later went on to concentrate on mathematical and natural inquiry. Historians of science have recognized this fact in their studies of conservative resistance to the introduction of more instruction in mathematics and natural science at the expense of the classics in secondary and tertiary education, but they have seldom registered its significance in the formation of cognitive habits instilled early and reinforced often.

Second, philological practices of grammatical analysis, collation and comparison of texts, glosses and commentaries, indices and tabulations, and, perhaps most significant of all, detection and correction of all manner of inconsistencies in form and substance, were (and in some cases, still are) the foundation for many scientific practices, especially in medicine and natural history.²¹ The first regularities to which the analogy “law” was applied in the late Middle Ages were those of astronomy—and grammar.²² Early modernists have provided highly suggestive examples of textual inquiry transferred to natural inquiry; for example, the close comparison of variant texts and the close comparison of plant species and genera.²³

Third, until well into the nineteenth century in Europe—indeed, especially in the nineteenth century—philology not only counted as *a* science; it was *the* science, the model of the highest form of knowledge. The discoveries of the philologists, whether concerning the authorship of the *Iliad*, the decipherment of hieroglyphics, or the ancestry of modern languages, counted alongside those of the chemists and the physicists as among the most spectacular of the age and their methods as among the most rigorous. Big Science (including the phrase) began not with the science-based industries of coal tar derivatives or optical glass but with the grand projects of the philologists, such as Theodor Mommsen’s *Corpus Inscriptionum Latinarum*.²⁴ The sheer scale of state funding for philological research (including archaeological excavations that enriched the collections of the British Museum, the Louvre, and the Berlin Museum Insel) cries out for comparison with the coeval expenditures for laboratories and observatories. These comparisons were made at the time by the natural scientists themselves, who often felt themselves to be at a disadvantage vis-à-vis their philologist colleagues.²⁵ Even if their schooling had not drummed into them knowledge of, and reverence for, Classical philology, there was good reason for even the most successful nineteenth-century scientists to be looking nervously over their shoulders at the achievements and prestige of the philologists.

Finally, most pervasive yet most elusive, philology modeled the life of the mind for many centuries, in many cultures. For millennia, to be learned was synonymous with achieving mastery of a textual tradition and was displayed in prodigious feats not only of memory and erudition but also of perspicacity and analytic acuity. Epistemic virtues such as impartiality,

²¹ Ann Blair, “The Rise of Note-Taking in Early Modern Europe,” *Intellectual History Review*, 2010, 20:303–316; Gianna Pomata, “Sharing Cases: The Observations in Early Modern Medicine,” *Early Science and Medicine*, 2010, 15:193–236; and Staffan Müller-Wille and Isabelle Charmantier, “Natural History and Information Overload: The Case of Linnaeus,” *Studies in the History and Philosophy of Science, Part C*, 2012, 43:4–15.

²² Jane E. Ruby, “The Origins of Scientific ‘Law,’” *Journal of the History of Ideas*, 1986, 47:341–359.

²³ Brian W. Ogilvie, *The Science of Describing: Natural History in Renaissance Europe* (Chicago: Univ. Chicago Press, 2006), pp. 87–138.

²⁴ Rüdiger vom Bruch, “Mommsen und Harnack: Die Geburt von Big Science aus den Geisteswissenschaften,” in *Theodor Mommsen: Wissenschaft und Politik im 19. Jahrhundert*, ed. Alexander Demandt et al. (Berlin: Walter de Gruyter, 2005), pp. 121–141.

²⁵ In the Prussian Academy of Science in Berlin, for example, the Physical-Mathematical Class frankly envied the success of the projects in the Historical-Philological Section; see Conrad Grau, *Die Preußische Akademie der Wissenschaften zu Berlin* (Berlin: Spektrum Verlag, 1993), p. 195.

certainty, and precision pervade and perhaps originate in the older traditions of history and philology as well as in the sciences.²⁶

The history of learning in classical traditions worldwide has so far been conceived as a supplement to the history of science, intersecting with and enriching the latter's familiar narratives at key points but not fundamentally changing them. The transformative potential lies in taking the history of practices to its logical conclusion. Historians of science have understandably begun their inquiries with practices that nowadays count as quintessentially scientific, such as laboratory experimentation, precision measurement, and systematic observation. These led down unexpected alleys, into kitchens and forges, into monasteries and farmers' fields, the bureaus of royal administrators, and the counting houses of merchants—and, in the case of note-taking, collecting, and compiling, into the humanist's study. Yet even these investigations began with a familiar terminus point of departure: not note-taking and compiling per se, but note-taking and compiling in the service of botanical classification or weather prediction. What we lack is a history of practices unfiltered either implicitly or explicitly by anachronistic criteria as to what counts as scientific. Because of the prominence of philology in so many cultures for so many centuries, the history of its practices is the single most promising candidate for such a truly historicized account of how scientists—and not just natural scientists—came to do what they do.

THE VIEW FROM THE HISTORY OF PHILOGIES

We can ask not only how adding the history of the humanities to the palette of the history of science might be advantageous to the history of science, but also how it might be advantageous to the history of the humanities, particularly the history of philologies (the reasons for the plural will be explained below). After all, the history of the humanities has been researched for many years—indeed, for centuries in some cases. And if it's not broke, why fix it?

The history of Classical philology and of Classical scholarship, at least in terms of the lives of the scholars who have performed it, has been studied at least since Roman Imperial times. Suetonius's biographies of famous Roman grammarians and rhetoricians are still extant (the former seems to be transmitted in its entirety) and doubtless were modeled upon lost Greek works, while surviving Greek treatises like Diogenes Laertius's *Lives and Opinions of the Famous Philosophers* and Philostratus's *Lives of the Sophists* can give us at least some idea of what ancient Greek biographical studies of the life and scholarship of philologists might have looked like.²⁷ The biographical model for the history of scholarship continued to produce works of enormous intelligence and significance throughout post-Classical times and indeed has remained vigorous to the present day; and what is more, especially in the past decades numerous important nonbiographical studies of various humanistic disciplines, institutions, and techniques have been published.²⁸ So what, if anything, is to be gained by starting to do the history of Classical scholarship, as one of the humanities, within the history of science?

²⁶ Lorraine Daston, "Objectivity and Impartiality: Epistemic Virtues in the Humanities," in *The Making of the Humanities*, Vol. 3: *The Modern Humanities*, ed. Rens Bod, Jaap Maat, and Thijs Weststeijn (Amsterdam: Univ. Amsterdam Press, 2014), pp. 27–42.

²⁷ Suetonius, *De grammaticis et rhetoribus*, ed. and trans. Robert A. Kaster (Oxford: Clarendon Press, 1995); Diogenes Laertius, *Lives of Eminent Philosophers*, trans. R. D. Hicks (Cambridge, Mass./London: Harvard Univ. Press, Heinemann, 1931); and Philostratus and Eunapius, *The Lives of the Sophists*, trans. Wilmer Cave Wright (Cambridge, Mass.: Harvard Univ. Press, 1989).

²⁸ For example see Hans Aarsleff, *The Study of Language in England, 1780–1860* (Princeton: Princeton Univ. Press, 1967);

The immediate answer to this sensible question is that disciplinary history is pursued by experts trained within that discipline, writing for the most part for their disciplinary colleagues and students—a situation all too familiar to historians of science and medicine. This state of affairs has the undoubted advantage that authors writing about the history of a discipline, as well as their readers, will in all likelihood possess to a sufficient degree the professional expertise needed to understand—and to criticize—the usually technical, and often rebarbative, works of their predecessors. But the success of the history of the natural sciences over the past centuries has demonstrated that, while of course it is indispensable that the historian have a sufficient training to be able to follow technical disciplinary discussions at a high level of competence, s/he does not have to be a practicing researcher in that particular discipline to be able to publish important contributions to the understanding of its history. There is also a positive side of the coin to this negative argument: one cannot attempt to understand past science (or any other past phenomenon) on its own terms—or even understand what such an attempt would mean and would involve—without having the detailed historical and linguistic training that many scientists lack. And the perhaps ineradicable disciplinary habit of measuring the value of past science by present standards turns this kind of history of science into either a history of progress culminating in the present or a history of error leading nowhere.

There are further disadvantages to disciplinary history of the humanities (again, ones all too familiar to historians of science). Disciplinary history written from within that discipline tends to be not only teleological but also parochial and hagiographical. Most importantly, disciplinary history written from within that discipline tends to be unprofessional, in the sense that it is written by scholars who have been trained in the discipline that they are studying but not in the discipline of history or the history of science. Because the history of science has since its origins wrestled with the problem of disciplinary history, it offers concepts, techniques, questions, research strategies, and standards for achieving a broader historical perspective. This is precisely the perspective that might make the history of philologies (or of other disciplines in the humanities) not only more interesting for readers outside of the discipline but also better able to come to grips with some of the disciplinary quandaries that might otherwise be unanswerable, or undecidable, or, worst of all, simply invisible.

What might the history of science be able to offer as an antidote to these disciplinary histories of the humanities in general and of Classical philology and scholarship in particular? Over the past decades, the history of science has increasingly moved away from an object-based definition of its field and instead has focused ever more upon scientific practices and techniques and institutional and other forms of social contexts. From this perspective, the humanities and the natural sciences are far closer to one another than they might appear to those who look only to their objects. If we understand a science as a rational, disciplined, and institutionalized form of interpersonal research, testing, and communication, then the history of the humanities has much to contribute to understanding the history of science and to broadening usefully its understanding of its own fundamental practices.

Indeed, to limit the history of science to the natural sciences is to project onto the past a very recent restriction of the meaning of the term “science” and to project onto other cultures

Grafton, *Defenders of the Text* (cit. n. 13); Anthony Grafton and Lisa Jardine, *From Humanism to the Humanities: Education and the Liberal Arts in Fifteenth- and Sixteenth-Century Europe* (Cambridge, Mass.: Harvard Univ. Press, 1986); George W. Houston, *Inside Roman Libraries: Book Collections and Their Management in Antiquity* (Chapel Hill, N.C.: Univ. North Carolina Press, 2014); E. J. Kenney, *The Classical Text: Aspects of Editing in the Age of the Printed Book* (Oakland: Univ. California Press, 1974); and Anna Morpurgo Davies, *Nineteenth-Century Linguistics*, in *History of Linguistics*, Vol. 4, ed. Giulio Lepschy (London: Longman, 1998).

a restriction that is far more severe in English than in any other language. When we consider the usages of the term “*epistêmê*” in ancient Greek or of “*scientia*” in Classical or post-Classical Latin, it becomes evident that what we today call the natural sciences represents only a very narrow selection out of the broad spectrum of activities that those words once designated. And “*science*” in French and “*scienza*” in Italian, like “*Wissenschaft*” in German, are applied to many professional activities that do not fall within the domain of the natural sciences as defined in American and British universities. Think only of *les sciences humaines*, of *le scienze umane*, or of *Geisteswissenschaften*. The situation rapidly becomes still more complicated if other knowledge traditions or other cultural traditions are granted equal status. If the modern history of Western science wishes truly to examine critically its own historical and cultural position, then broadening its subject matter would be an important first step.

It seems prudent to begin with philology. After all, it is one of the humanistic disciplines that bear the greatest analogies with the natural sciences in its rigorous methodology, its strict procedures of professionalization, its cumulative advances, and its often team-based organization of research, which is sometimes on a vast scale.²⁹ Moreover, it is the most widespread geographically and temporally, so that it provides ample material for methodological and historical reflection and for comparison among different cultures and periods. What might such a cross-cultural study of philologies from the perspective of the history of science look like?³⁰

One example is the project on “Learned Practices of Canonical Texts,” a comparative study of philological techniques in a variety of cultural traditions.³¹ This project began from the observation that those cultural traditions that have assigned a preeminent importance to a small body of canonical texts—religious, philosophical, literary, legal, observational, and other kinds—have historically faced a perplexing set of problems. The central role that these texts have played in their institutions has meant that they usually had to be reproduced over and over again—not only because any material bearer was liable to damage over time, but also because empires expanded, institutions proliferated, and users multiplied. But in premodern times, and indeed until the invention of purely mechanical modes of light-based reproduction in the latter half of the nineteenth century, the only way to reproduce texts was by copying them by hand. And copying by hand, as we saw earlier, inevitably introduced new readings into the new exemplar. So the cultures involved (Mesopotamian, Egyptian, Hebrew, Greek, Latin, Arabic, Vedic, Chinese, Tibetan, Japanese, and some others) had to deal with a fundamental and potentially deeply unsettling problem: the texts that were central to many of their most important activities were available to them only in copies that diverged from one another in at least some passages. Moreover, the older the originals were, and the more often they had been copied, the more discrepancies were likely to exist among them.

The history and the methodology of attempts to deal with this difficulty in the Greco-

²⁹ Music theory, until at least the eighteenth century, was classified as part of mixed mathematics and was often taught as part of the quadrivium; it provides another intriguing example of a humanities discipline with strong analogies to the natural sciences. See H. Floris Cohen, *Quantifying Music: The Science of Music at the First Stage of the Scientific Revolution* (Dordrecht: Kluwer, 1984); and Bod, *New History of the Humanities* (cit. n. 18), pp. 198–210.

³⁰ For excellent recent examples see Sarah C. Humphreys, ed., *Cultures of Scholarship* (Ann Arbor: Univ. Michigan Press, 1997); Humphreys and Rudolf C. Wagner, eds., *Modernity's Classics* (Berlin/New York: Springer, 2013); and now Sheldon Pollock, Benjamin A. Elman, and Ku-ming Kevin Chang, eds., *World Philology* (Cambridge, Mass.: Harvard Univ. Press, 2015).

³¹ Anthony T. Grafton and Glenn W. Most, eds., *Canonical Texts and Scholarly Practices: A Global Comparative Approach* (Cambridge: Cambridge Univ. Press, in press, 2015). Subsequent examples are drawn from this volume, which resulted from a research group directed by Grafton and Most at the Max Planck Institute for the History of Science in Berlin in 2012.

Roman tradition have been studied for centuries, and there is a vast and profoundly learned bibliography of secondary scholarship on this subject.³² To a lesser extent, and by and large more recently, this phenomenon has also been studied in other cultures. But surprisingly little attention has been paid to investigating its history comparatively among different cultures. The project on “Learned Practices of Canonical Texts” aimed to address these questions on the basis of examples drawn from ancient Greece and Rome; Byzantium and medieval Latin; the ancient Near East; Coptic, Hebrew, and Arabic; Sanskrit and Chinese; early modern Europe; and the Ottoman Empire.³³ Comparison reveals that all or almost all cultures of which we have records have developed some of the same techniques and institutions for minimizing the probability of this problem or for dealing with its deleterious consequences when they have occurred. Royal libraries and official copies of important texts are found invariably in such cultures; so too are scribal schools, with rigorous professional procedures for training and testing scribes. Methods of copying manuscripts, orally and visually, one by one or in groups, and practices of collating manuscripts have tended to be astonishingly invariant throughout the world and over centuries, at least until recently.

Yet cultures can also differ from one another in their attitude and approach to the problems posed by manuscript variance. The Vedic tradition puts a unique premium upon the ability to precisely memorize extraordinarily extensive classical texts in Sanskrit, thereby in effect reducing the likelihood of textual variation arising and proliferating because of the copying of written exemplars. But it is the ancient Greek tradition that seems to have felt the strongest anxiety about divergent copies of texts and to have developed the earliest and most systematic methods for dealing with these. Over and over again during the course of antiquity, Greek political leaders established standard collections of important texts—perhaps already in the late sixth century B.C.E. with the Athenian tyrant Pisistratus for the epics of Homer, certainly in the latter fourth century B.C.E. with the Athenian statesman Lycurgus for the texts of the three great Athenian tragedians, and certainly also starting in the early third century B.C.E. with the Ptolemaic kings in Hellenistic Alexandria for all the preceding works of Greek literature thought worth preserving. Such Ptolemaic institutions as the library (the “Mou-seion,” a temple of the Muses), the head librarian, the library catalogue, the critical edition, the commentary, and the monograph went on to become models first for later Greek culture, then for ancient Rome, and then, through the mediation of Rome and Latin, for post-Classical Europe. Within this millennial Western tradition, there seems to be little decisive change in methods and techniques until the nineteenth century. Even printing, which has attracted so much attention, did not transform the activity of philologists as profoundly as some have suggested. It is only in the nineteenth century that the situation in Europe was altered decisively by a series of innovations, such as ease of travel and communications, the pacification and reclamation of parts of Italy and the Eastern Mediterranean, the expansion of the scholarly community, the reorganization of the university and of scientific research, the establishment of the Big Science model for the organization of large-scale industrialized research into antiquity, and the invention of processes for copying texts mechanically.

The philological procedures of Western Classical scholars and the institutional contexts within which they flourished from antiquity until modern times have long been an object of study, but hitherto largely for and by the Classical philologists themselves, as a means of

³² See, to begin with, the works listed in note 7, above; see also Bod, *New History of the Humanities* (cit. n. 18), pp. 143–160, 272–280.

³³ See http://www.mpiwg-berlin.mpg.de/en/research/projects/DeptII_GraftonMost_Canonical.

professionalization for their students. This should, and doubtless will, continue. But setting these procedures within a larger comparative horizon together with other cultures and languages, and viewing them from a history of science perspective for which practices and institutions are no less interesting than discoveries and concepts, should make it possible to engage experts in the Western Classical tradition in a fruitful dialogue with their colleagues from other disciplines, countries, and languages. It should then also be possible to anchor the history of the philologies within the history of science and to help the history of science understand more profoundly its object and its own place within the world of research.

CONCLUSION: TAKING A BROADER VIEW

Both the history of science and the history of Classical philology have widened their angle of vision in the past decade, and in both cases a focus on practices rather than current disciplinary structures has served to enlarge the scope of inquiry. Historians of science have queried anachronistic definitions of what is a science and who is a scientist; historians of philology have pluralized their subject matter. Yet both face a challenge that originates with their own origins: for different reasons, both the history of science and the history of Classical philology have all too often been militantly Western-centric, albeit with a few great, good exceptions.³⁴ Since the Renaissance, Classics has been the discipline that defined the Western tradition in opposition to allegedly distinct (indeed, often allegedly inferior) cultural lineages; since the Enlightenment, the history of science has been enlisted to explain why the West is modern (and the rest are not). These two narratives oddly reinforce each other, despite the fact that they pull in opposite directions; the one looks backward to ancient Greece and Rome, while the other looks forward to unlimited future progress. This Janus-faced alliance of the Ancients and the Moderns has proved remarkably resilient, in the teeth of abundant countervailing evidence. Other cultures were, and are, repeatedly measured and found wanting, whether the criterion is having had a democracy like Athens's or a Scientific Revolution like Europe's. Although most historians of science and most Classical philologists would now disavow the ancestral narratives that enthrone the West, they have not managed to unseat them (not even among fellow academics), much less to offer compelling alternatives.

Ironically, a new alliance might finally prove the undoing of the old one. So far, most attempts to include non-Western knowledge traditions within the history of science have dwelt on reception, circulation, and interaction in cultural encounters or have treated such knowledge as somehow supplemental to the sciences (note the telling slippage of language from "science" to "knowledge") as they developed in Europe and related cultures.³⁵ For their part, historians of Classical philology, just because they have seen themselves as the foremost guardians of their intellectual traditions, have insisted on the uniqueness, if not the supremacy, of the texts and techniques entrusted to their keeping. What is lacking in both cases is a genuinely comparative framework that would examine the history of diverse intellectual traditions on an equal footing.

³⁴ See for example Nathan Sivin and G. E. R. Lloyd, *The Way and the Word: Science and Medicine in Early China and Greece* (New Haven: Yale Univ. Press, 2002); and Lloyd, *Disciplines in the Making: Cross-cultural Perspectives on Elites, Learning, and Innovation* (Oxford: Oxford Univ. Press, 2009). But see also the depressingly accurate remarks on the outdated state of the bibliography for science in ancient China and medieval Islam (to say nothing of other cultural traditions) in H. Floris Cohen, *How Modern Science Came into the World: Four Civilizations, One Seventeenth-Century Breakthrough* (Amsterdam: Amsterdam Univ. Press, 2010).

³⁵ To be fair, the technical barriers to the mastery of diverse languages and histories, not to mention the content of the diverse intellectual traditions, are high: collaborative work (see n. 33) seems to be the obvious answer.

A strategic cooperation between historians of science and historians of philologies (now emphatically in the plural), one centered on practices, might be a first step toward developing such a framework. The focus on practices is essential for three reasons; the first two are familiar to historians of science, but the third is key to comparative studies. First, it directs attention to what practitioners actually do; second, the origins of practices often connect different disciplines with a common context, as in the case of the astronomers and philologists with which we began; and third, practices endure while classifications of knowledge vary over epochs and among cultures. It is important to be clear about the limits of such a research program; it encompasses neither the whole of the modern humanities (nor of the modern sciences) nor all cultures. It also does not encompass the whole of the history of knowledge. Among those cultures that have sustained philologies, like those that have cultivated the sciences, such pursuits are the purview of a small, highly educated elite. Yet just because these pursuits, dissimilar though they are in many other respects, often represent the kind of knowledge most prized in particular historical and cultural milieux, a comparative study has much to tell us about not only the shifting classifications but also the shifting meanings of the sciences, human and natural.