Reassessing Humanism and Science

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The notion that "humanism" and "science" are inevitably opposed to one another in their content, methods, and goals, has multiple origins which reinforce its currency. While one can trace the fear that "scientism" would undermine traditional morality and mythology back to the Athens of Aristophanes,[1] the more relevant source for the twentieth-century sense of a gulf between the notorious "two cultures"[2] lies no doubt, as Owen Hannaway argues below, in the segregation in the European educational system since the nineteenth century between classical studies and scientific and technical training. The cultural biases engendered by this split made it easy for historians like George Sarton or Lynn Thorndike to conclude that Renaissance humanism, with its concern for elegant style and ancient books, was inevitably antithetical to the skills of observation, experiment, and mathematization on which modern science was built. The role of humanism was further diminished by the spate of works from Pierre Duhem and Anneliese Maier to Alistair Crombie which emphasized the continuity between late medieval developments in methodology, the science of motion, and other fields and Galileo's "modern" formulations.[3] On this view, the humanist interlude of the fifteenth and sixteenth centuries was at best a holding ground for the medieval seeds of the Scientific Revolution; at worst it actually threatened to sterilize them.

In reviling the humanists for their bookish attention to philology historians merely took their cues from the "founders of modern science" themselves, those self-styled prophets of a new intellectual order and

[1] Richard Olson, *Science Deified and Science Defied* (Berkeley, 1982), ch. 3.

[2] C. P. Snow, *The Two Cultures* (Cambridge, 1959).

[3] For more recent approaches to medieval science see *Science in the Middle Ages*, ed. David Lindberg (Chicago, 1978).

disinterested disciples of truth. Bacon, Descartes, and even Galileo mocked the traditional methods of natural philosophy, which culminated in Renaissance humanism, of gathering ancient testimony and discussing previous opinions.[4] In 1607 Tommaso Campanella explained how he differed from earlier scholars like Pico:

> I learn more from the anatomy of an ant or a grass (not to mention the miraculous anatomy of the world as a whole) than from all the books written from the beginning of time to the present, since I learned to do philosophy and to read God's book. I use his exemplar to correct the books of men, which have been badly and arbitrarily copied . . .[5]

Such self-descriptions should leave us skeptical, however: just as the humanists proclaimed their scorn for and independence from the scholastics while drawing on many of their methods and beliefs, so too the "novatores" of the seventeenth century owe more to Renaissance humanism than their claims to bold originality suggest.

These four papers propose close analyses of specific cases of the interaction between Renaissance humanism and science. They do not reach a simple over-arching conclusion but support more general arguments for the impact of humanism on "science" recently advanced elsewhere.[6] Under scrutiny "humanism" reveals multiple, sometimes divergent strands: not only well known subcategories like Southern and Northern, earlier and later, in which Lynn Joy detects a new shift in the perceived relation between language and philosophical commitment, but also differing attitudes toward allegoresis or the genealogy of astronomy, for example, which Anthony Grafton introduces but which have yet to be fully identified and named. Furthermore these papers consider not the anachronistic category of "science" in general but a range of specific Renaissance disci-

[4] Anthony Grafton, *Defenders of the Text: the Traditions of Scholarship in an Age of Science 1450-1800* (Cambridge, Mass., 1991), introduction: "The Humanists Reassessed."

[5] "Ecco dunque il diverso filosofar mio da quel di Pico; ed io imparo piú dell'anatomia d'una formica o d'una erba (lascio quella del mondo mirabilissima) che non da tutti li libri che sono scritti dal principio di secoli sin a mo', dopo ch'imparai a filosofare e legger il libro di Dio: al cui esemplare correggo i libri umani malamente copiati ad a capriccio, e non secondo sta nell'universo libro originale." Tommaso Campanella, *Lettere*, ed. V. Spampanato (Bari, 1927), 134.

[6] See for example Eric Cochrane, "Science and Humanism in the Italian Renaissance," *American Historical Review*, 81 (1976), 1037-59; Michel-Pierre Lerner, "L'humanisme a-t-il sécrété des difficultés au développement de la science au XVIe siècle?" *Revue de synthèse* 93-4 (1979), 48-72; Cesare Vasoli, "The Contribution of Humanism to the Birth of Modern Science," *Renaissance and Reformation* 3 (1979), 1-15; Barbara Shapiro, "History and Natural History in Sixteenth- and Seventeenth-Century England: An Essay on the Relationship between Humanism and Science," in Barbara Shapiro and Robert G. Frank, Jr., *English Scientific Virtuosi in the Sixteenth and Seventeenth Centuries* (Los Angeles, 1979), 3-55; and "Early Modern Intellectual Life: Humanism, Religion and Science in Seventeenth Century England," *History of Science*, 29 (1991), 45-71.

plines in their interaction with certain aspects of humanism—notably philosophy, astronomy, metallurgy (*res metallica*), and natural philosophy, that wide-ranging speculative investigation of the causes of phenomena involving the natural body.

These papers may serve as small samples of a rich body of recent research on the role of ancient texts in the origins of modern science. The humanists did not anticipate Galileo's telescope or Kepler's ellipses, but their influence was pervasive nonetheless, for the classical texts recovered during the Renaissance offered rich rewards to scientists and philosophers as well as historians and moralists. Ample evidence disproves the old assumption that humanists concerned only with style and philology neglected the contents of the works they made available. The Greek works that the humanists brought to light, many of them written in the Hellenistic and Imperial periods, offered models of rigorous physical science and sharp medical debate which had been known only in part, and largely through translations, in the Middle Ages.[7] These texts proved literally fundamental to the science of the sixteenth century, which developed from the materials and hints contained in classical and medieval texts rather than from an effort to reject them entirely.[8] The new astronomy of Copernicus rested on Regiomontanus's meticulous epitome of Ptolemy's *Almagest*; in fact, Copernicus's *De revolutionibus*, as Otto Neugebauer pointed out long ago, actually replicated the *Almagest* both in basic structure and in hundreds of technical details.[9] The new medicine of the sixteenth century relied for methods and data on the texts of the Hippocratic corpus and of Galen, which a raft of humanists and doctors of humanistic bent edited, translated and explicated.[10] Even in fields like natural history, where no single ancient writer ranked quite as high as Ptolemy or Galen, the classical texts remained basic sources of ideas as well as facts until deep in the sixteenth century. Pliny, for example, seemed to offer an

[7] For the extraordinary impact of the revival of Greek mathematics, for example, see the fascinating remarks of Regiomontanus, in his *Oratio habita Patavii in praelectione Alfragani*, reprinted in his *Opera collectanea*, ed. F. Schmeidler (Osnabrück, 1972), and Melanchthon, in his reply to Pico della Mirandola's letter to Barbaro in defense of scholasticism: *Corpus reformatorum IX*, 687-703, translated in Q. Breen, *Christianity and Humanism* (Grand Rapids, 1968), 52-68, at p. 66. Cf. the standard account by P. L. Rose, *The Italian Renaissance of Mathematics* (Geneva, 1977).

[8] For an elegant study of a case in point, see W. Hartner, "Tycho Brahe et Albumasar. La question de l'autorité scientifique au début de la recherche libre en astronomie," in *La science au seizième siècle* (Paris, 1960), 135-46.

[9] See most recently O. Neugebauer and N. Swerdlow, *Mathematical Astronomy in Copernicus's De Revolutionibus* (New York, 1984). On Regiomontanus see also A. Gerl, *Trigonometrisch-Astronomisches Rechnen kurz vor Copernicus: der Briefwechsel Regiomontanus-Bianchini* (Stuttgart, 1989).

[10] See V. Nutton, *John Caius and the Eton Galen* (Cambridge, 1987).

attractive model for a non-Aristotelian natural science in the early decades of the sixteenth century.[11]

The recovery of classical texts shaped larger attitudes as well as technical practices. The Italian scholars of the fifteenth century (not all of them humanists) who revived the works of Plato, read them as basically consonant with Christianity and revived along with them a vast range of Neo-Platonic treatises and commentaries.[12] They bequeathed both their agenda and their favorite texts to the later Renaissance. Kepler, as Judith Field has shown, long believed that one should read the *Timaeus* as a commentary on Genesis and found in Proclus's commentary on Euclid a major inspiration for his assumptions about aesthetics and mathematics. The quotation from Proclus on the title page of the *Harmonice mundi* was meant as far more than a classical decoration.[13] Other newly available classics stimulated speculations about the dignity of man, the plurality of inhabited worlds, and the theory of matter—all of which helped to bring about the slow death of classical astrology and the slow birth of a new cosmology. Lively debate still rages on many topics: for example, the actual effects on natural philosophy and science of the rich but strange collection of Greek texts of the first three centuries AD now known as the Hermetic Corpus.[14] But the pervasive impact of the ancient texts is clear. The New Science grew not only from the shock of the new worlds laid open by explorers and observers, but also from the shock of the old books recovered and explicated by scholars working patiently in their studies.

From the 1470s on, moreover, intellectuals grasped both the good and the harm that the printing press could do to the classics of ancient science. Regiomontanus settled in Nuremberg in order to found a press which could issue new translations of Ptolemy's *Geography* and *Almagest*, the *Hypotyposis* of Proclus, and the commentaries of Theon, and a raft of other texts. He managed only to produce a text of Manilius and some modern technical works, but the enterprise and the broadside in which he described it became famous.[15] True, the printers sometimes seemed to do more harm than good. Ermolao Barbaro lamented, as he issued his great textual commentary on Pliny, that "books are printed everywhere

[11] See *ibid.*, and C. Nauert, "C. Plinius Secundus (*Naturalis Historia*)," in *Catalogus translationum et commentariorum*, ed. F. E. Cranz, P. O. Kristeller, and V. Brown, III (Washington, D.C., 1980), 297-422.

[12] See in general P. O. Kristeller, *Renaissance Thought and its Sources*, ed. M. Mooney (New York, 1979), chs. 3, 7-8; J. Hankins, *Plato in the Italian Renaissance* (Leiden, 1990).

[13] J. V. Field, *Kepler's Geometrical Cosmology* (Chicago, 1988).

[14] See most recently *Occult and Scientific Mentalities in the Renaissance*, ed. B. Vickers (Cambridge, 1984); P. Rossi, *La scienza e la filosofia dei moderni* (Turin, 1989), ch. 1; P. Zambelli, *L'ambigua natura della magia* (Milan, 1991); and B. P. Copenhaver's translation of and introduction to the *Corpus* (Cambridge, 1992). The most important recent study of the Hermetic texts in their context is G. Fowden, *The Egyptian Hermes* (Cambridge, 1986).

[15] Text reprinted in Regiomontanus, *Opera*, ed. Schmeidler, 533.

nowadays, but the printed texts are rife with errors."[16] But gradually printing made available texts, however imperfect, of Ptolemy and Galen, Hippocrates and Archimedes, which secured the basic gains of humanist scholarship and proved fundamental to the New Science.

Humanism affected scientific practice, finally, through its methods, which Owen Hannaway urges us to consider more closely. The precise attention to textual detail required in humanist reading and editing could be brought to bear on astronomical data, as in the work of Kepler, belying any necessary opposition of humanism to quantification and numeracy. The commonplace book developed as a pedagogical tool in humanist schools can illustrate, as Ann Blair argues, the process of selection and recombination of bookish facts characteristic not only of the cycle of traditional natural philosophy to the mid-seventeenth century but also of many aspects of the Baconian method. The humanists' skills in elegant and accessible presentation helped to spread scientific material to a wider public of readers and patrons, thanks to the use of the dialogue form, carefully crafted narratives and vernacular translations.[17] Finally, the humanist emphasis on arguing from evidence rather than from first principles may help account for the increased references to direct observation, especially novel when they are drawn from the practical arts which until the Renaissance were always considered divorced from the pursuit of *scientia*.[18]

We do not seek to deny the contributions of medieval scholasticism to the development of modern science nor the revolutionary character of the proposals of the "novatores" of the seventeenth century. Galileo's mathematical abstraction from real experience, Bacon's call for the systematic gathering and confrontation of facts, Descartes's construction of a philosophy from first principles, and the claims of all three to stand at the beginning of a new age all have genuinely novel elements—as well as a shared and older element of rhetoric. Instead, taking to heart Paul Kristeller's injunction not "to play up humanism against scholasticism, or scholasticism against humanism, or modern science against both of them,"[19] we have tried to appreciate the specific ways in which humanist

[16] E. Barbaro, *Castigationes Plinianae et in Pomponium Melam*, ed. G. Pozzi et al. (Padua, 1973-79), I, 4: "Nunc libri passim imprimuntur, sed impressi scatent erroribus."

[17] Cf. the works of Agricola, Bodin, and Kepler as considered here. For other examples see Nancy Siraisi, "Girolamo Cardano and the Art of Medical Narrative," *JHI*, 52 (1991), 581-602; Robert Westman, "Proof, poetics, and patronage: Copernicus's preface to *De Revolutionibus*," in *Reappraisals of the Scientific Revolution*, ed. David Lindberg and Robert Westman (Cambridge, 1990), 167-205.

[18] Cf. here Agricola, Bodin, and Kepler. Guillaume Budé and Pierre de la Ramée most famously boast of their research into artisanal practice. For the concurrent rise in status of the practical arts during this period see Paolo Rossi, *Philosophy, Technology and the Arts in the Early Modern Era* (New York, 1970).

[19] Kristeller, *Renaissance Thought*, ch. 5, 119.

beliefs and methods shaped the practice of science in the Renaissance. In doing so we bring out the similarities linking figures whom the history of science has treated very differently: from Kepler the canonical "scientist," to Agricola the early "technologist," to Gassendi and Bodin, bookish authors of philosophy and natural philosophy, who are less easily canonized by the standards of modern science but who are equally representative of the historical context that these writers all share.[20]

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[20] We are grateful to Peter Dear for chairing the session at the History of Science Society Meeting of October 1991, at the University of Wisconsin, Madison, at which these papers were presented, and to Nicholas Jardine, for helpful comments.