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Isis, Vol. 82, No. 3. (Sep., 1991), pp. 522-531.

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A SECOND LOOK

History of Science in an Elegiac Mode

E. A. Burtt's *Metaphysical Foundations of Modern Physical Science* Revisited

By Lorraine Daston*

The tone of some of the most enduring works on the history of early modern science, works that still speak to us decades after their first publication, is elegiac, and E. A. Burtt's *Metaphysical Foundations of Modern Physical Science* (first published 1924; rev. ed. 1932) is no exception.¹ Although Burtt admired the achievements of "modern science" (by which he meant essentially Newton-to-now), he balked at what he believed to be their metaphysical price tag: namely, the replacement of "a deep and persistent assurance that man, with his hopes and ideals, was the all-important, even controlling fact in the universe" (p. 18) with an equally firm conviction that "man [was] a puny, irrelevant spectator . . . of the vast mathematical system whose regular motions according to mechanical principles constituted the world of nature" (p. 283).² Burtt's thesis was, in a nutshell, that it was the primary/secondary quality distinction that had brought us to this regrettable pass, and that seventeenth-century thinkers such as Kepler, Galileo, Descartes, Boyle, and Newton had swallowed this unsavory doctrine in order to make the world safe for mathematized science. Moreover, he accused generations of philosophers, bedazzled by the triumphs of modern science, of overlooking "the big problems involved in the new doctrine of causality, and the inherent ambiguities in the tentative, compromising and rationally inconstruable form of the Cartesian dualism that had been dragged along like a tribal deity in the course

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This essay was written at the Center for Advanced Study in the Behavioral Sciences; the research was also partially supported by NSF Grant DIR-8911169. I am grateful for both hospitality and support. I would also like to thank Peter Galison for several clarifying conversations, and an anonymous reviewer for helpful suggestions.

¹ See, e.g., Alexandre Koyré, *From the Closed World to the Infinite Universe* (Baltimore: Johns Hopkins Press, 1957), esp. the essay "The Newtonian Synthesis"; or Alfred North Whitehead, *Science and the Modern World* (1925; New York: Free Press, 1967), esp. the chapter "Science and Philosophy."

² Throughout this essay, page numbers in parentheses refer to Edwin Arthur Burtt, *The Metaphysical Foundations of Modern Physical Science* (Garden City, N.Y.: Doubleday Anchor, 1954).

of the campaign. For the claim of absolute and irrefutable demonstration in Newton's name had swept over Europe, and almost everyone had succumbed to its authoritative sway" (p. 301).

It is well beyond the compass of this brief essay to canvass the vast literature published between 1924 and 1991 that bears on all or part of Burtt's paired thesis and accusation. Instead of offering such a comprehensive survey, I propose to take up, in order, the following themes concerning the place of Burtt's subject and approach in current history and philosophy of science: the meaning of "metaphysics"; the emphasis upon historical context, and what context encompasses; the persistent confusion of the mechanical and the mathematical; and why we still resonate to elegies such as Burtt's.

Although most currently practicing historians of science prescribe and were themselves prescribed Burtt's book as an antidote to logical positivism (in the Anglo-American idiom, but with a strong Viennese accent), the positivists who provided the backdrop for Burtt himself were those of the 1890s, not the 1950s and 1960s or even the 1920s. Burtt's selected bibliography of secondary sources includes Ernst Cassirer, Pierre Duhem, Eugen Dühring, Harald Höffding, and a bevy of turn-of-the-century German historians of philosophy, but it is clearly Ernst Mach whom Burtt was at once refuting and emulating: refuting, in that Burtt upheld the inevitability of metaphysics in science and rejected what he saw as Mach's "relativism" (see Burtt's analysis of the Newton/Mach thought experiment of the whirling bucket, pp. 251–255); emulating, in that Mach's careful, critical examination of classical mechanics was the model for Burtt's own examination of seventeenth-century science. Burtt could turn the weapons of Machian positivism to antipositivist ends because he was, in the final analysis, hostile toward the particular metaphysics he had chosen to study, though not toward metaphysics in general. Hence, the revelatory, "unmasking" quality of Machian analyses, in which scientific dogmas are shown to have no clothes, was entirely suited to Burtt's aims.

However, Burtt adopted more from Mach than a debunking mien and the tools of close textual criticism to go with it. His understanding of what constituted metaphysics was also surprisingly Machian—surprising, because Burtt was trained as a historian of philosophy, with more than a glancing acquaintance with medieval sources. Nonetheless, he ordinarily used "metaphysics" in a postpositivist sense, as the presuppositions (often unexamined) that inform a scientist's work, which may be of either epistemological or ontological import (pp. 227–228).³ This sort of metaphysics is essentially a residual category, directly descended from Hume's notorious advice on how to make room on one's bookshelves: if a work is neither about mathematical/logical relationships nor about matters of fact, then it is about "metaphysics" and should be consigned to the flames. On this view, metaphysics is what is left over once the mathematical and empirical content have been subtracted, with the further implication that this residue cannot be defended by rational argument, only affirmed or denied.

³ I owe this point to Gary Hatfield's essay, "Metaphysics and the New Science," in *Reappraisals of the Scientific Revolution*, ed. David Lindberg and Robert S. Westman (Cambridge/New York: Cambridge Univ. Press, 1990), pp. 93–166. I am grateful to Professor Hatfield for allowing me to read a prepublication version of his essay, one of the most important analyses of Burtt's thesis and of seventeenth-century metaphysics to appear in recent years.

Of course, this is hardly the way in which metaphysics has been understood throughout most of its long history, during which its meanings have been several and varied, and it was emphatically not the way in which seventeenth-century thinkers understood the term. Far from quarantining metaphysics off from rational argument, they acknowledged metaphysics to be the pinnacle of such argument. This is why even the most militant empiricists ranked “metaphysical certainty” on a par with (and sometimes even above) “mathematical certainty,” and considered both of these a firmer warrant for rational belief than mere “physical certainty” based upon observation and experiment, not to mention the still shakier “moral certainty” of human affairs. Seventeenth-century metaphysics was about arguments, often elaborate and thickly armored ones, not covert assumptions. However interesting and revealing the latter may be, they cannot be expected to pass muster as arguments, though they may bolster the plausibility of arguments and supply their premises.

Burt's niggardly view of metaphysics not only led him into anachronism with regard to what he judged to be seventeenth-century exemplars thereof; it also robbed him of most means to defend the alternative, “teleological” metaphysics he preferred. He could criticize metaphysics he abhorred by pointing (in customary positivist fashion) to its lack of empirical support or to its internal incoherence, but the ground for electing another metaphysics could be neither empirical nor logical. Ultimately, Burt's residual notion of metaphysics—neither logical nor empirical and therefore not rational at all—obliged him to resort to emotive appeals. Perhaps this is why his complaint against what he took to be the seventeenth-century scientific legacy at times rises to a high, keening wail:

The gloriously romantic universe of Dante and Milton, that set no bounds to the imagination of man as it played over space and time, had now been swept away. . . . The world that people had thought themselves living in—a world rich with colour and sound, redolent with fragrance, filled with gladness, love and beauty, speaking everywhere of purposive harmony and creative ideals—was crowded now into minute corners in the brains of scattered organic beings. (pp. 238–239)

I shall address Burt's regrets and their lasting reverberations below; for the moment, it is enough to note the consequences of his truncated definition of metaphysics both for his treatment of the seventeenth century and for his own philosophical program. He deprived the one of some of its best representatives (Spinoza and Leibniz merit barely a passing mention), and the other of some of its best supports.

A metaphysics of presuppositions does not in principle preclude a contextual treatment: after all, whence the presuppositions? However, in practice Burt was singularly unconcerned with even the intellectual context of his chosen thinkers. Aside from a few feints in the direction of Renaissance Neoplatonism and Arian heresies, what context Burt supplied is incidental, biographical, and pointedly nonrational—Descartes's “ecstatic illumination” of 10 November 1619, or the personal piety of Boyle and Newton. In part, this neglect is due to a lingering psychologism admixed with positivist prejudices: presuppositions can be accepted or rejected only on faith, and thus predispositions (private, ineffable, idiosyncratic) are paramount. In part, it is due to an implicit view of history, or at least of the history of philosophy, as having the forward momentum of a hurtling

locomotive; ideas develop along certain lines because they must do so. Because this is as much a matter of intrinsic flaws as internal logic, there is room for unintended but not unpredictable consequences—so, for example, that Hobbes's materialism should follow hard on the heels of Descartes's dualism was inevitable, despite Descartes's own very different intentions (pp. 122–123); similarly, Newton's quaint voluntarist theology “was rapidly peeled off by all the competent hands that could get at him,” for no better fate could be expected for such “cosmic plumbery” (pp. 298–299). Writ large, this view of intellectual history is a kind of conceptual preformationism: all the possibilities of an intellectual movement are curled up inside from the very beginning inexorably unfolding over generations to come. Thus, Burtt collapsed all that is metaphysically significant about pre-Einsteinian science into the few decades that separate Kepler from Newton, for these were the decades that stamped “modern science” with its distinctive character (p. 30). By implication, none of the transformations of eighteenth- and nineteenth-century science were more than embellishments upon these dominant seventeenth-century themes.

Burtt, of course, cannot be blamed for not attending to a historiography of science that did not yet exist when he wrote his book, one that shows how fertile and formative the intervening centuries between the seventeenth and the twentieth were for all he understood under “modern science.” Nor can he be justly reproached for ignoring the impact of the revival of skepticism on seventeenth-century philosophy, or the numerous and suggestive studies that show the intellectual import not just of personal piety but of theological doctrine and speculation in the development of seventeenth-century natural philosophy. Nor were coeval political and social theory hermetically sealed off from those developments. However, it is unclear whether Burtt's historiographic views would have made room for such studies even if they had been available to him. Persuaded that the sources of the presuppositions that passed as metaphysics were personal and therefore inscrutable, and that the subsequent history of those presuppositions was predestined, Burtt had little motive for enlisting context to illuminate and to explain. Note that this was as true for intellectual as for social contexts, for philosophical ruminations as for political interests. The truth was in the texts, and only in a select few of those.

As a result, Burtt's *explications de texte*, penetrating and wide-ranging though they often are, have an oddly rootless quality. He wrote of an intellectual earthquake that purportedly shook Western views of nature and humanity to their foundations, but it was an earthquake that apparently came from nowhere. Why should Kepler, Galileo, Descartes, Boyle, Newton, and a host of lesser lights have embraced a mathematized view of nature, committing them to what Burtt held to be a “world hard, cold, colourless, silent, and dead,” and to a nonsensical epistemology to boot? Why should they have risked epistemological shoals at all, given that, as Burtt rightly remarked, the problem of knowledge had vexed few medieval minds? Burtt's answer was that the new science required it, but this claim does not carry conviction: there were too many versions of the new science, with and without mathematics; too many versions of mathematized nature, with or without the mechanical philosophy; and too many versions of why nature should be mathematized to warrant any straightforward connection. Nor would a vague gesture in the direction of Neoplatonism or Pythagoreanism help matters

much, for few of the important thinkers hewed to these positions with any consistency (Kepler yes, Descartes decidedly not). In any case, such a gesture simply re-poses the question, Why would seventeenth-century thinkers have succumbed to those features of Neoplatonism that would have made the mathematization of nature seem attainable and (particularly puzzling to Burt) desirable above all else? Why, in short, do certain kinds of explanations succeed when and where they do?

It is not clear that the mountain range of literature on the Scientific Revolution that has pushed upward and outward since the *Metaphysical Foundations* first appeared can answer this question with any succinctness. We know enormously more about the key figures Burt investigated, and of the considerable importance of those he did not, such as Huygens, Hooke, and Leibniz. We know considerably more, though still not enough, about the theological currents that buoyed up the likes of Descartes, Boyle, and Newton, so that their beliefs now appear less a matter of private devotion and more a matter of public intellectual engagement. We also know more about the chameleon forms of Neoplatonism and, probably more to the point, about the early modern transmission history of Archimedes's works. We even know something of the political milieu of seventeenth-century science, both the small politics of patronage and institutions and the great politics of factions and nations. We are in a position to correct quite a number of Burt's claims: so, for example, it is not true that there was no direct influence of Bacon upon Boyle (p. 125); it is not true that Galileo believed that every aspect of nature was susceptible of mathematical treatment (p. 214); it is not true that Newtonian natural theology quickly disappeared from the scientific scene (p. 299).

But after some seventy-five years, such amendments hardly bring down shame upon a work that has otherwise weathered the decades so well. Instead of listing piecemeal corrections, we must ask, Are we in a position to answer Burt's central questions, or at least to explain the phenomenon he described? Perhaps not, but we are in a position to make several critical distinctions that may lead us to reframe those questions and to redescribe the phenomenon. First, the phenomenon must now be termed the phenomena: the mathematization of nature (and not just nature) that began in the seventeenth century and is still ongoing displays a myriad of forms, motives, and underlying assumptions. This is the case even if we confine our gaze to the seventeenth century.⁴ Second, the relationship between the primary/secondary quality distinction (which Burt took to be our fall from metaphysical grace) and the mathematization of nature was by no means a necessary one.

This second claim requires some elaboration. Although Burt was aware that the primary/secondary quality distinction took several forms and was justified by several arguments (contrast, e.g., those of Galileo and Locke), he took the ubiquity of the distinction to be evidence for its centrality to seventeenth-century scientific thought, without dwelling upon those distinctions. Moreover, he understood the distinction to be a necessary and sufficient condition for applying mathematics to nature. The policy of lumping rather than splitting masked important differences in how the distinction was understood and applied, differences that might have undermined the rigidity of that alleged if-and-only-if connection.

⁴ On varieties of mathematization see *ibid.*

More specifically, Burtt regularly conflated the mechanical philosophy with mathematization, because advocates of both at one time or another invoked the primary/secondary quality distinction. The entire Archimedean tradition, not to mention mathematical astronomy since Ptolemy, shows that there can be mathematization in blissful innocence of the primary/secondary quality distinction. There are also plenty of examples of the mechanical philosophy without mathematics, including Descartes's *Principia philosophiae* (1644) and most of Boyle's speculations on the subject. To claim that the *in se* properties of things are shape, size, and motion does not give one the means to measure or even mathematically model those properties. Descartes's most successful efforts in mathematization were the essays on dioptrics and meteorology appended to the *Discours de la méthode* (1637), and these owed more to classical optics than to the mechanical philosophy. His mechanical magnum opus, the *Principia*, is remarkably free of numbers, and the figures of microscopic mechanisms cannot be termed properly geometrical. In Descartes's case, the failure to transform the mechanical into the mathematical may be reasonably read as a failed hope, but in Boyle's case there is some evidence that he actively distrusted what he perceived to be the overly abstract and "conjectural" character of mathematics.⁵ That is, even had the means been available to convert the microscopic screws and wedges of the mechanical philosophy into mathematical form, Boyle might have scrupled to do so. The primary/secondary quality distinction was by no means as inextricably bound to the mathematization of nature as Burtt supposed.

Burtt resented the primary/secondary quality distinction because he interpreted it as a cruel sentence of exile, "that banishing of man from the great world of nature" (p. 89), and a warrant for grinding determinism: "With man eliminated from the real world, the latter appeared bound by mechanical necessity" (p. 96). Both of these supposed implications of the primary/secondary distinction might be disputed on philosophical grounds. "Exile" seems too strong a term for a relationship between perceptions and the external world, for the former quite faithfully represent (and sometimes, in the case of the primary qualities, even resemble) the latter. A certain configuration of corpuscular sizes, shapes, and motions regularly triggers the sensation yellow in the normal observer; we are by no means severed from contact with nature, and the contacts we have are reliable and decipherable, if not immediately transparent. The claim that the elimination of humans from nature inevitably dooms the latter to "mechanical necessity" is at least as dubious, for it suggests that a deterministic account of nature *cum* humans is somehow unthinkable.

But it is possible that Burtt meant his claims historically rather than philosophically: although it might conceivably have turned out otherwise, in fact the primary/secondary quality distinction cast an epistemological and spiritual pall over Western intellectual life from which we have never fully recovered. In contrast to a time when "the whole universe was a small, finite place, and it was man's place" (p. 19), the post-seventeenth-century thinker "is but the chance and temporary product of a blind and purposeless nature, an irrelevant spectator of

⁵ See Steven Shapin, "Robert Boyle and Mathematics: Reality, Representation, and Experimental Practice," *Science in Context*, 1988, 2:23–58.

her doings, almost an alien intruder on her domain” (p. 24). Burttt was hardly alone in sighing over the world we have lost to modernity—Max Weber’s poignant passages on the “disenchantment” of the world mix melancholy and resignation in almost identical proportions, and we still have no end of writers pining for some highly romanticized premodern period (exactly which varies according to author). However, it is important to ask whether the seventeenth-century witnesses of this process were similarly dispirited, since the contrast between the new ideas and all they had to lose would have been even more acute. More specifically, did they understand the primary/secondary quality distinction as the flaming sword routing them, if not from Eden, at least from that oyster shell of a cosmos described by Dante?

It is very difficult to find evidence that they did. The new natural philosophy (better, philosophies) of the seventeenth century did not lack for opponents, many of them vehement that the new ontologies and cosmologies would bring time-honored beliefs and values crashing down around their ears. Most natural philosophers were exquisitely sensitive to the religious and, occasionally, moral implications of their work and addressed these at considerable length. However, it is exceedingly rare to find a figure, pre-Berkeley, who takes aim at the primary/secondary quality distinction. There are writers aplenty in the wake of Hobbes to fret about materialism, and some of these, such as Henry More and Joseph Glanvill, vigorously defend the existence and extent of spirit. Others, such as Boyle, take the opposite tack of belittling matter: There isn’t all that much of it, and what there is is so stupid that it could hardly account by itself for the admirable arrangement of nature. But these were voices raised against the threat of atheism, of God (not humanity) banished from the world. Not surprisingly, they made little reference to the epistemological quandaries raised by the primary/secondary quality distinction, for these bore at best obliquely on the materialist menace.

If otherwise anxious seventeenth-century observers were not alarmed by the new epistemology, why was Burttt? Because of his rapturous glosses on Dante’s *Paradiso*, we might suspect religious motives, for he was clearly moved by the medieval Christian vision. However, these suspicions fall wide of the mark. Although Burttt attributed seventeenth-century dissent from what he viewed as the inexorable march of mechanistic materialism—for example, Boyle’s penchant for teleology, or Newton’s interventionist God—to religious scruples, he was not himself a religious apologist. Nor was he a sworn enemy of science and technology. In a book on the conflict between science and religion written a few years after *Metaphysical Foundations*, Burttt insisted that religion must reform itself in the moral image of science: “The ideal of science is that of intellectual honesty and social verifiability, pursued in an atmosphere of complete tentativeness and mutual co-operation. The ideal of religion has been that of personal salvation, attained by the inflexible loyalty to some revered leader, institution, or doctrine.” Although he admitted the “grandeur” of past religions that had pandered to our “loneliness and cosmic weakness,” Burttt came down on the side of a cerebral religion that would emulate scientific tolerance and worship only the moral good.⁶

⁶ E. A. Burttt, *Religion in an Age of Science* (New York: Frederick A. Stokes, 1929), pp. 123–124.

Burt's metaphysical yearnings sprang from an altogether different source from religion, namely, the luxuriant early twentieth-century growth of new philosophies that took the contents of mind seriously. These are the radical empiricisms of Henri Bergson, William James, and (despite Burt's avowed antipositivism) Ernst Mach. This careful attention to lived mental experience was all that the philosophers Burt listed as his intellectual forebears had in common, despite his own implausible claim that "Berkeley, Hume, Kant, Fichte, Hegel, James, Bergson—all are united in one earnest attempt, the attempt to reinstate man with his high spiritual claims in a place of importance in the cosmic scheme" (p. 25). Like many of his contemporaries, Burt thrilled to the strains of a new philosophy of mind and dimly hoped that the new physics might also rehabilitate teleology in science. Certainly his own book was an attempt to assess the errors of the past from the vantage point of a new era, for since the owl of Minerva flies only at darkness, the flaws of Newtonian physics could be clearly discerned only after the advent of Einstein. Similarly, the positivism Burt loathed, despite all of his allusions to the positivist tenor of the seventeenth century, was that of the late nineteenth century. Indeed, it was hardly positivism at all, being crassly materialistic rather than agnostic about causation. It was rather the scientific naturalism that denied the existence of free will by citing the conservation of energy, and that belittled the importance of consciousness by citing the subjective privacy of its data.

Given that Burt's book was written in the greenhouse atmosphere of early twentieth-century philosophy, which produced the orchidaceous works of Bergson and of less well-known authors of the same mauve tint that are barely readable today, why has the *Metaphysical Foundations* cast such an enduring spell over historians of science? Why does it (and other classics in the same elegiac mode, most notably those of Alexandre Koyré and Alfred North Whitehead) still speak to us with such apposite directness? It should be underscored that Burt's own contemporaries apparently received this book (though not his later works, such as *Man Seeks the Divine* [1957] or *In Search of Philosophical Understanding* [1966]) with something akin to indifference. I have been able to locate only one review of the first edition, which reported Burt's theses so laconically and uninvitingly ("It is to be presumed that Mr. Burt will, in some later work, develop in detail the solution based upon this hypothesis")⁷ that readers can hardly have stampeded the bookstores.

The most thorough and thoughtful response to Burt came a dozen years later, in the form of Edward W. Strong's *Procedures and Metaphysics* (1936), but again couched in terms more dismissive than receptive. Strong had taken the trouble to read the Neoplatonists, both ancient and Renaissance, to whom Burt had appealed, and judged their intricate number symbolism and mystic rejection of the material world to be "non-homogeneous" with the speculative and practical mathematics of Niccolò Tartaglia, Girolamo Cardano, and Galileo. Probably still more damning for Burt's approach was Strong's new-style positivism, redolent of Mach and still more of Mach's Viennese successors, which distinguished

⁷ H. R. Smart, "Review of E. A. Burt, *The Metaphysical Foundations of Modern Physical Science*," *Philosophical Review*, 1926, 35:589–590.

sharply between possible metaphysical implications and metaphysical foundations of science. In Strong's view, the former existed but were the province of philosophers, not scientists; the latter were, at least in the case of the giants of the seventeenth century, illusory. Strong's conclusions insisted on the self-sufficiency of science: "Mechanical knowledge marches by method, not metaphysics. . . . The meaning of concepts employed by mathematicians and scientists in their work was found to be established in the limited operations and subject-matter constituting the science."⁸ These sentiments, so sweetly in tune with the promethodological, antimetaphysical stance of the logical empiricists, must have been tantamount to a funeral oration pronounced over Burt's book in the 1930s and 1940s.

Yet the book made a lasting impression on most historians of science of my generation (many with whom I have spoken recall it as a lodestone that drew them into the field), and it continues to appear on reading lists for introductory courses.⁹ Part of the answer is a tribute to Burt's methods: whatever he may have lacked in contextual interests, he was an admirably close reader of texts, and his book still serves to introduce students not only to a selection of fascinating texts but also to a probing, analytic way of reading them. Part of the answer also lies in Burt's resolutely critical stance: while unstinting in his praise for the achievements of seventeenth-century natural philosophers, he was keenly aware that they made intellectual choices, and was persuaded that they had sometimes made the wrong ones. That is, he rendered "modern science" problematic, showing it to be a considerably more complicated and contingent enterprise even at the loftiest conceptual level than the caricatures of a science driven by "methods" of discovery and "logics" of confirmation made it out to be. The presuppositions he examined may not have deserved the title "metaphysics," but they still opened up a third dimension for historians otherwise confined to the flatland of theories and empirical findings.

But it cannot be denied that part of the answer lies in Burt's elegiac tone. Although few of the more recent readers of the *Metaphysical Foundations* would have cultivated philosophies of introspection à la Bergson and James, and still fewer would have stormed at the scientific naturalism of the late nineteenth century, many shared Burt's romantic longing for a closer integration of nature and humanity. These yearnings no longer find vent in tracts so fiery and single-minded as Theodore Roszak's *Making of a Counter Culture* (1969), which in eerily Burtian accents attacked ideals of scientific objectivity as cruel and denatured. However, they do persist as faint sighs in a body of scholarly literature critical of modernity. Here, political right and left meet in an idealized vision of a world made whole (usually situated in the high Middle Ages), where humans nestled in a womblike nature before a rude birth into an indifferent universe. This vision could as easily come from a cultural conservative as from a radical femi-

⁸ Edward W. Strong, *Procedures and Metaphysics: A Study in the Philosophy of Mathematical-Physical Science in the Sixteenth and Seventeenth Centuries* (Berkeley: Univ. California Press, 1936), pp. 8, 10.

⁹ I tried without success to obtain publication figures from Doubleday & Company, which published the book from 1954 until very recently. I must therefore rely on impressions and anecdotes concerning the book's influence.

nist, and both might find sustenance and succor in Burtt.¹⁰ It is a form of anti-modern cultural nostalgia that cuts across decades and political lines. This is the key to the enduring appeal of Burtt and other historians in the elegiac mode. Saturation in the seventeenth-century texts and contexts that Burtt only grazed does not seem to have cured us of our hankering for the premodern; it will take a demystified Middle Ages to make us grateful for modernity.

¹⁰ Cf., e.g., C. S. Lewis, *The Discarded Image* (Cambridge: Cambridge Univ. Press, 1964); and Susan Bordo, *The Flight to Objectivity: Essays on Cartesianism and Culture* (Albany: State Univ. New York Press, 1987), on the nurturing Middle Ages.