

INTRODUCTION

E.A. Burtt brought a pair of insoluble ideas into collision--metaphysics and science--beginning with the curious word juxtaposition in the title of *The Metaphysical Foundations of Modern Physical Science*. The work has a majestic strangeness, owing to the penetrating elegance with which Burtt poked into Newton's authority. Originally, *The Metaphysical Foundations* was Burtt's Ph.D. dissertation, written at Columbia University, which was the seat of American pragmatism and naturalism in the 1920s. It was titled *The Metaphysics of Sir Isaac Newton: An Essay on the Metaphysical Foundations of Modern Science*.¹

For one thing, the work is a glimpse into a short, but exciting period in American intellectual history, a period noted for radical skepticism as well as progressive optimism. For another it is a barbed polemic against logical positivism and the new realism of Bertrand Russell, Alfred N. Whitehead, and the American New Realists, led by F.J.E. Woodbridge.² Most important and most enduring, if only enduringly controversial, it is philosophy of science, based on historical inquiry. While Burtt strikes some readers as "elegiac", others find him post-modern.³ What is remarkable is that today at the end of the century, Burtt, both in and out of step with the times, is still refreshing.

Like it or not, *The Metaphysical Foundations of Modern Physical Science* continues to be read by undergraduates in colleges and universities everywhere. Burtt continues to have an effect on the intellectual lives of educated persons, whether they have come under his spell directly by reading *The Metaphysical Foundations* or indirectly by way of their professors and teachers who have saved a place, at least in their private speculations, for the kind of questions Burtt raised. Since 1924 when *The Metaphysical Foundations of Modern Physical Science* first appeared in England Americans have continued to flirt with its perspective, usually without being aware of the American Pragmatic tradition from which it sprung.

E. A. Burtt lived to be nearly one hundred years old, and he continued to write well into his nineties. Throughout his life, the core of his thinking remained unchanged, although he modified his methods and his interests ranged widely and shifted emphasis. Given the scope and impact of Burtt's thought, it is only natural to ask: Who might have shaped his thinking? Whom did he admire? With whom did he study? Who joined him in his free hours and what did they discuss? What forces shaped E. A. Burtt's thinking during the genesis of *The Metaphysical Foundations of Modern Physical*

Science and how did those influences wax and wane over the course of his life as a philosopher?

What were the radical ideas filling the air in New York City around Columbia University, City College, and Union Theological Seminary when Edwin Arthur Burt came there to study in 1915? What were the unique interests of American philosophers in those days and what special tensions shaped that fitful era, just before the first Great War?

Among the many bold assertions Burt made concerning early modern science the key to all of them was his demonstration that the principle of universal order, upon which the whole edifice of science knowledge is based, is metaphysical.

Burt's research for his dissertation involved the careful study all of Newton's writing. Unlike any previous historian, he accepted the large volume of religious expositions right along with the scientific. Even in 1924, there was plenty of evidence to suggest that Newton had theological interests. Other historians had simply not found them important to their research questions or worse, had found them embarrassing to Newton's reputation as a scientist and intentionally ignored them. Burt studied Newton's theology right along with his science and reached the revolutionary conclusion that Isaac Newton "agreed with [Henry] More on the extension of God...and he certainly believed in extended ethereal spirits."⁴ This is the "metaphysical foundation" upon which Newton's science rests, and it is the only foundation we have for our belief in universal order.

What is more, for Newton, the connection between the knowing agency locked in the brain and the material world to be known was bridged by "a spiritual continuity connecting all the links in the infinite scene" and it was "supplied in God." The problems of knowledge, which Newton resolved by invoking the presence of God, evolved and changed as Newton's philosophy was popularized by Voltaire and the other Enlightenment thinkers. While Newton had evaded some philosophical problems by appeal to God, Hume, Locke and Kant pried off the Deity, leaving the situation with logical inconsistencies. No questions were raised, however, since the whole thing rested on the unquestioned authority of Newton, which had replaced God in the mind of modern man. For Burt, it is one of the ironies of history that although it was not philosophically consistent with Newton's own beliefs, the "general picture of the universe and of man's place in it which went forth under his name was essentially the one [worked out by Galileo and Descartes] in its most ambiguous and least construable form."⁵

Burt argued that since the principle of universal order, upon which modern physical science is based, is a metaphysical principle it is not necessarily a structural principle of the universe itself. According to Burt the

scientific world-view which has pervaded our common sense understanding of ourselves in the universe is nothing more than a transient episode in the history of man. In the 1932 revised edition to *The Metaphysical Foundations* he suggested with much modesty the need for a new epistemology and a new world-view, but he laid no claim to such a system himself. What he recommended was the critical historical analysis of the basic presuppositions of the world's major idea systems, including modern science, the various schools of modern philosophy, and world religions, as a necessary first step.

Although he denied as much in his unassuming questioning, the fact is that E.A. Burt was working on a new epistemology of his own. It is known only from a brief manuscript, *The Genesis of Hypothesis*, which was abandoned sometime after 1935. This manuscript makes a better understanding of *The Metaphysical Foundations* possible.

Burt had been profoundly influenced by John Dewey. One of his early teaching assignments at Columbia University had been a course in *Reflective Thinking*, which was an analysis of the process of problem solving, based almost entirely on Dewey's reconstruction in philosophy. Dewey's logic diverged widely from accepted doctrine since he rejected the truth-falsity categorizations of propositions, and held instead that propositions were simple tools in the process of inquiry, no more true or false than a hammer or screwdriver is true or false.

While Burt acquired the essentials of Dewey's thinking through teaching the Deweyan methods of inquiry at Columbia, he displayed a tremendously creative freedom in using those methods to examine the history of science from a new perspective. Obviously if scientific propositions are neither true nor false, but only tools in the process of inquiry, the notion that science is a cumulative enterprise heading toward certain correspondence with one, true physical reality is undermined and important questions about scientific truth can be raised.

There are parallels between this type of reflection on the progress of science and Thomas Kuhn's historical basis for rejecting the strict empiricists' interpretations of the logic of science. Kuhn, however, recalls that he did not read Burt's *Metaphysical Foundations* as philosophy of science, finding it useful simply as history.⁶ The inspirations Kuhn does acknowledge are Herbert Butterfield and Alexandre Koyré.

Even so, ideas parallel to Burt's are liberally threaded through the work of Herbert Butterfield and Alexandre Koyré as well as through that of Thomas Kuhn. Henry Guerlac, professor of the history of science at Cornell during Burt's time there, has written that Alexandre Koyré, in personal conversation with him "once remarked that his reading of E.A. Burt's remarkable book, the *Metaphysical Foundations of Modern Physical Science*, played an essential role "in leading Koyré to what he has characterized as his

'conversion' from the history of religion to the history of science."⁷ In addition, Pietro Redondi, in the preface to *Alexandre Koyré, De la mystique à la science*, has cited Koyré and written:

Koyré confirmera dans les Etudes galiléennes son adhésion à ce grand livre: "C'est M. Burt qui nous paraît avoir le mieux compris la substructure métaphysique-mathématisation platonisante - de la science classique."

Redondi has substantiated Burt's influence on Koyré several times.⁸ Butterfield and Kuhn were both influenced by A. Koyré⁹ and since Koyré's work has a debt to Burt, Kuhn has built on Burt's shoulders whether or not consciously.

For example, Burt's speculations in the conclusion to the 1932 edition of *The Metaphysical Foundations* parallel ideas Kuhn has advanced.

How to construe a rational structure out of...nature is the great difficulty of contemporary cosmology...[The] difficulties suggest that perhaps we need to be much more radical in the explanatory hypotheses considered than we have allowed ourselves to be heretofore. Possibly the world of external facts is much more fertile and plastic than we have ventured to suppose; it may be that all these cosmologies and many more analyses and classifications are genuine ways of arranging what nature offers to our understanding, and that the main condition determining our selection between them is something in us rather than something in the external world. This possibility might be enormously clarified by historical studies aiming to ferret out the fundamental motives and other human factors involved in each of these characteristic analyses as it appeared and to make what headway seemed feasible at evaluating them, discovering which are of more enduring significance and why.¹⁰

Kuhn's thought has raised no small amount of controversy, with Kuhn himself adding to the fray by advancing and then retracting ideas. One way to pass over the confusion is to accept Kuhn's thought through the eyes of Paul Hoyningen-Huene. Paul Hoyningen-Huene spent a year at MIT with Kuhn in preparation for his own exegesis of Kuhn's philosophy of science. The outcome of Hoyningen-Huene's year is his book, *Reconstructing Scientific Revolutions*. Kuhn, as interpreted by Hoyningen-Huene, was concerned with questions raised by Burt. Ideas put forward in the chapter titled, *The Constitution of a Phenomenal World*, compare substantially to Burt's examination of *something in us rather than something in the external world*. Hoyningen-Huene wrote, "The suggestion that perception in general might be influenced by subject-sided factors...becomes plausible, along with the

corollary that the subject-sided factors might be systematically different in different cultures, being the product of systematically different learning processes. It follows that the phenomenal worlds of two different cultures can be different, in which case the empirical concepts characteristic of one will find no precise counterparts in the other."¹¹

Hoyningen-Huene, standing in for Kuhn, confronts the fundamental question. Can we know the real world, the world as it is in itself? And how could we ever know that we know it, since we can have no objective model with which to compare our understanding. Given that humans know only the "phenomenal worlds" how can universality be claimed for any one of those?

How might we show that the general analysis of the constitution of phenomenal worlds actually generates results which hold for *all* phenomenal worlds? The most appealing strategy involves confirming the analysis in concrete individual cases. But even if this confirmation is successful for all past phenomenal worlds known to the historian, no real claim to universality can be asserted, for nothing ensures that the discovered factors in the constitution of this class of phenomenal worlds really apply to all phenomenal worlds. It might be that phenomenal worlds in the examined class were all constructed in comparable ways because they all belong to a common, more or less narrow tradition....

An approach that takes the anthropological basis of world constitution into account appears to offer the only prospect for a more rigorous justification of claims to universality. This approach requires that we know which capacities needed for the constitution of a phenomenal world humans come equipped with and which are developed over the course of interaction with the environment. If our knowledge of the anthropological foundations of world constitution is solid enough, we will presumably be able to make universal claims about the processes and structures which must necessarily participate in world constitution.¹²

Paul Hoyningen-Huene's interpretation of Kuhn, if not Kuhn's own thinking, echoes Burt's quest for a new philosophy of mind, taking critical historical analysis into account in order to arrive at as clear a picture of physical reality as it is possible for humankind to achieve.¹³

The fact that *The Metaphysical Foundations of Modern Physical Science: A Historical and Critical Essay* has proved to be a title with enduring appeal turns out to be no mystery. Indeed, it is a book which has led countless readers to question the foundations of scientific knowledge and has opened doors to new ways of thinking about science, philosophy, and what we can hope to know about objective reality in the present age. The book is a classic because it brings us back to unanswered questions.

E.A. Burtt, Historian and Philosopher

A Study of the author of The Metaphysical Foundations
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