

COMMENTARY ON THEOLOGICAL RESOURCES FROM THE PHYSICAL SCIENCES

by *F. S. C. Northrop*

Brown has approached his topic through epistemology. The wisdom of this is reinforced by a statement made by Einstein, near the end of his life, about the significance of recent physics and his own important part therein: "The reciprocal relation of epistemology and science is of noteworthy kind. They are dependent upon each other. Epistemology without contact with science becomes an empty scheme. Science without epistemology is—insofar as it is thinkable at all—primitive and muddled."¹

It is relevant to our present concern to show more in detail why this is the case, thereby revealing that what is true of physics is true also of religion and the humanities generally. We may begin by asking what it was in Einstein's own experience as a physicist which made epistemology so important for his particular science.

Briefly put, the answer is that a "primitive and muddled" conception of *what* one knows in physics was prevalent among physicists at the opening of this century because of an erroneous notion of *how* one knows it. Since the science of the *how* of knowing anything is epistemology, an epistemological examination of the relation between the basic concepts of physics and the observable data became necessary in order to remove the prevalent misconceptions and make possible the new way of thinking about old, as well as new, observable data which occurs in Einstein's special and general theories of relativity and, after him, in quantum mechanics.

In this connection, two statements made to me by Whitehead in 1922, when I went to study the fundamental concepts and epistemology of physics with him at the Imperial College of Science and Technology in London, are illuminating: "You must spend your days and nights with Hume" and "One cannot be too suspicious of ordinary language in science and philosophy."

The relevance of the first statement becomes evident when one notes that the modern English-speaking world's leading epistemologist is Hume. Later Einstein told me that it was his reading of Hume which convinced him that Newton was in error when the latter wrote that he

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had made no hypothesis but had instead deduced the fundamental concepts of his mechanics, as specified in his *Principia*, from the directly observable experimental data. Hume does this for anyone who thus "spends his days and nights" because, noting that observation can give only what the several human senses can convey, he then examines the deliverance of each sense one by one to show what our beliefs would be restricted to were they given by direct observation and what can be deduced logically from it alone à la Newton's claim.

Immediately such epistemological awareness makes it evident that neither the objectivity or the predictive power of physics nor our common-sense belief in the existence of an external world is given solely by observation. For example, the mechanical causality of modern physics, even in the restricted version of quantum mechanics, entails a relation of necessary connection between the present and future state of any physical system. Hume made it evident that one observes no relation of necessary connection; instead, the senses warrant only the belief in temporal succession. This is a quite different thing from causality, especially that of the mechanically physical kind.

The same is true of the invariants in physics which define objectivity. Such objectivity is not given, as many scientists and people of "common sense" persist in supposing, by observation and what can be deduced from it alone, throwing aside all speculatively introduced hypotheses. Instead, it is a speculatively discovered and introduced item of knowledge, confirmed or disconfirmed indirectly by testing its deduced consequences, via epistemological rules of correspondence, against the directly observed data, all of which, as Hume showed (as did Berkeley before him), are relative not merely to one's frame of reference but even to the perceiver's particular senses.

But how can erroneous epistemological notions of how we know corrupt any subject or science? At this point Whitehead's suspicion of ordinary language takes on relevance.

The key to what this means for physics becomes evident, I believe, when one recalls Mach's demonstration, in his *Science of Mechanics*, that the concept of mass in Newtonian physics had been misinterpreted by subsequent physicists, due to their epistemological error of supposing it to be a directly observed substance, when, in fact, it is a relational construct. Einstein tells us that his special and general theories of relativity derive from Mach's relational theories of mass, space, and time.

Combine this with Whitehead's suspicion concerning ordinary language and it begins to become evident why there is a present need in

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any and all subjects for epistemological expertness in distinguishing (1) what is directly observed through the several senses from (2) what is an unobservable, speculatively introduced relational construct with indirect confirmation by way of the senses, on the one hand, and from (3) ordinary-language distortion of both (1) and (2), on the other hand. Our ordinary language has a two-termed syntax in which any property or predicate is related to a subject term or noun by some form of the verb "to be." This leads one quite unconsciously in his subject to describe the data given by both the so-called outer and inner senses (quite counter to what an epistemological analysis of the deliverances of the senses exhibits) as predicates of underlying substances, the substances purportedly being directly known, because the properties qualifying them are immediately sensed.

When this happens to the mathematically linguistic relational construct, called "mass" in Newton's physics, as it did even with Newton at times and Descartes when they wrote in ordinary language, the pseudometaphysical myth called a material substance arises. Forthwith in the name of "realism" concerning human nature, the modern world's Hobbesian and Marxist materialists and power politicians are born. Note how not merely physics and its philosophy but also law, politics, and the humanities are corrupted. In an atomic age such distortion may well be suicidal in its consequences. When linguistic distortion and muddle is extended to the directly inspected data of introspective psychology and existential aesthetic and religious experience, the additional pseudometaphysical myth called a mental or soul substance is taken seriously. Forthwith the pseudometaphysical body-substance-mind-substance problem arises, with science, the muddles compounding, being assigned to the material substances, and the humanities and all values—moral, aesthetic and religious—to one's solipsistic private mental substance, so that "never the twain shall meet." Then C. P. Snow's *Two Cultures*, which cannot intercommunicate, are upon us, as are the primitive non sequiturs of the biological and anthropological emotional sermonizings by some members of later sessions of this conference.

Nor is the linguistic distortion and naïve epistemological confusion lessened, when, equally unsuspecting of ordinary language, and even deprecating the epistemological analysis that might clear up the mess, Continental-American existential humanists and Anglo-American self-styled "ordinary-language" philosophers, like Kant in the eighteenth century, substitute for the earlier material-substance-mental-substance

dualism an equally unbridgeable ordinary-language dualism between "is" descriptive and "ought" prescriptive statements, assigning natural science to the former and the humanities and religion to the latter. What linguistic distortion and epistemological naïveté have created, only linguistic sophistication born of expert epistemological analysis can cure.

In mathematical physics, with its more creative theoreticians, this cure has occurred—hence Einstein's statement about science without epistemology being well-nigh unthinkable and hence also the non-primitive and clarified trustworthiness of his subject today. It remains for the humanities and religion, and also biology, anthropology, sociology, law, and politics, to undergo a similar epistemologically informed linguistic transformation.

First must come the realization that, in any subject whatever, any word of ordinary language we use about its subject matter has at least three different epistemological meanings. A primitive and muddled state of the subject exists when any one of these three meanings is confused with the other. The transition from the "primitive and muddled" state of any subject to its correctly understood and trustworthy condition *begins, therefore, in clearly distinguishing, and having names for*, these three different meanings of any ordinary word.

The epistemological name for the primitive and confused meaning is "naïve realism." It arises, as noted above, when the two-termed thing-property syntax of ordinary language is read into any subject. All sciences and subjects use it in their early natural-history stage—hence Einstein's use of the word "primitive" to describe it. Nevertheless, it is confused and muddled if taken literally. Its error arises from reading into the inner and outer sense data of immediate experience an underlying thing-property objectivity and substantivity which they do not possess. Thereby the countless dualistic pseudoproblems, noted in part above, arise; also a directly observed factual indubitability is given to linguistically distorted, or to speculatively introduced and indirectly confirmed entities, which direct observation does not warrant.

Escape from this primitive and muddled naïve realistic notion of any subject arises by using epistemological inspection and analysis of the deliverance of the senses, and of immediate experience generally, to separate the directly inspected factors in a subject from speculatively introduced, mathematically linguistic factors designated by non-sensuous relational constructs. The epistemological name for any ordinary word in the first of these two latter meanings is "radical empiricism." The epistemological name for the speculatively introduced, indirectly con-

firmed factor in our knowledge, which I prefer, is "hypothetical logical realism"; another prevalent name is "constructs" or, as in Brown's paper, "a model."

The importance of "spending one's days and nights with Hume" is that, more than any other modern Western thinker, he makes us aware of the small part of what we believe in any subject is given by observation through the inner and outer senses alone. This part of what we know is the radical empirical part. Insofar as there is empirical warrant for writing or talking about "observed fact," in any subject, we must use our ordinary words solely in their radical empirical meaning. Also, most of us are apt, like Kant, Einstein, and Whitehead, among many others, to need to read and reflect deeply on Hume in order to become clear about what the character of mere directly observed experience is. Because he concentrated on determining this, he is called a "radical empiricist." To his findings must be added those of the radical empiricist William James, more recently those of Whitehead, and in classical Asia those of the Buddhist and non-dualistic Vedantic Hindu epistemologists. All agree that radically empirical immediacy does not warrant belief in a substance of any kind, be it material or mental. Thereby one escapes from the primitive confusion and linguistic distortions of naïve realism in both science and the humanities.

But these modern Western and classical Asian radical empiricists do not tell us everything. To suppose that they do is the error of the non-logical positivists and the contemporary existentialists. For there is also the part of any subject which may be designated by ordinary words in their logically realistic meaning. In short, there are the mathematically linguistic "constructs," or "models," which ordinary language has difficulty in conveying. In this meaning of any subject, Hume, James, and the aforementioned Asians were not expert, since logical realistic meaning requires the syntactical postulational thinking and techniques of the symbolic logic of relations and pure mathematics. Here, too, there are no substances, since, as Mach made clear in the case of the logically realistic word "mass" in mechanics, all such entities are relational, deriving their scientific properties, not through the senses, but from the formal properties of the relations in which they are the relata.

But as a mere symbolic logical model or mathematical construct, such a logically realistic concept designates merely a possible world. How then does one get from a possible world in symbolic logic and pure mathematics to the de facto world of mathematical physics? The answer is generally agreed upon by contemporary theoretical physicists and epistemological analysts of this subject. From the axioms or postulates

describing the formal properties of the relation that is the construct or model, theorems are rigorously deduced. Between (a) these theorems conceived in their logically realistic meaning and (b) the observational data known in their radical empirical denotative meaning, epistemological rules of correspondence involving operational definitions are set up. When the radically empirical images called for by the model's theorems and the epistemic rules of correspondence occur, as tested by the operationally prescribed experiments, the logically realistic theory is said to be confirmed to become a mathematical physical theory.

Applied to religion, the second major subject in the concern of this conference: What does this epistemological clarification of any subject mean? First, it means ridding religion of the muddles suggested by so much of its naïve, realistic language. Second, this entails using careful study of Hume, William James, and the Buddhist-Vedantic Hindu epistemologists to separate the radically empirical factor in human secular and religious literature and experience from the linguistically distorted on the one hand and from the warrantable speculatively inferred on the other hand, and then, in conjunction with a non-muddled radical empirical-logical realistic interpretation of science, determining whether such a non-muddled epistemological formulation, perhaps even with scientific content, does not exist also for religion.

There are reasons² for believing that the answer is "Yes!" Clearly, however, this is too difficult a matter to pursue on the present occasion.

NOTES

1. *Albert Einstein: Philosopher-Scientist*, ed. Paul A. Schilpp (Evanston, Ill.: Library of Living Philosophers, 1949), pp. 683-84.

2. Cf. my *Man, Nature and God* (New York: Simon & Schuster, 1962).

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Let me first underscore Brown's last point about the importance of analyzing wholes as well as parts. A statistical ensemble has relatively little unity but can usefully be treated as a unit. There are other cases

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