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The Philosophical Quarterly, Vol. 32, No. 128, Special Issue: Scientific Realism. (Jul., 1982), pp. 195-200.

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THE PHILOSOPHICAL QUARTERLY

VOL. 32 No. 128

JULY 1982

THREE KINDS OF SCIENTIFIC REALISM

BY HILARY PUTNAM

A. O. Lovejoy once distinguished thirteen varieties of pragmatism. I shall not emulate him by distinguishing thirteen varieties of scientific realism, but it may be helpful if I distinguish *three* and indicate my attitude towards each.

I. SCIENTIFIC REALISM AS MATERIALISM

I cannot follow “physicalists” (e.g., Hartry Field) who would argue that “intentional” or semantical properties (for example, reference) can be reduced to physical ones.¹ *A fortiori*, I cannot agree that *all* properties are physical. If “scientific realism” is scientific imperialism — physicalism, materialism — I am no scientific realist.

The leading idea of semantic physicalism is by now familiar: (*at least in “basic” cases*) *x* refers to *y* if and only if *x* is connected to *y* by a “causal” chain of the appropriate type. The familiar problem is that the physicalist is going to have difficulty specifying what counts as the “appropriate type” without using (unreduced) semantical notions.

I want to discuss a different difficulty. John Haugeland has remarked that identity theorists confuse two different notions of “cause”.² There is the notion used in mathematical physics: “causation” is a precise relation between “states” of a system, involving the existence of a transformation function (derived from the Hamiltonian or Lagrangian description of the situation) which deterministically “carries” the earlier state into the later

¹H. Field, “Tarski’s Theory of Truth”, *The Journal of Philosophy*, 49 (1972), 347-75. The “reduction” Field seeks is an *empirical* one; “physicalism” in this sense must not be confused with the logistic reductionism defended by Carnap.

²J. Haugeland, “Weak Supervenience”, *American Philosophical Quarterly*, 19 (1982).

state. (It is essential that the “states” themselves be mathematically precise objects.) Secondly, there is the notion of the cause as the “bringer about” or “instigator” of an event. In the second sense, my harsh criticism of a student’s paper may be the cause of his depression; but there is not the slightest reason to think (and every reason to deny³) that *this* relation of “causation” can be defined in terms of the primitive notions of physics. Indeed, the very division of the total situation into “background conditions” and “bringer about” is interest-relative and rationality-relative.⁴ It may be *better* to take the criticism as the “bringer about” and the student’s current emotional and physical state as the “background conditions” from the point of view of what we count as explanation, but this has nothing to do with *physics*.

Now a “causal chain of the appropriate type” is a chain of “bringers about”, not a causal chain in the state-cum-Hamiltonian sense. The notions the physicalist hopes to use in defining reference are *loaded* with non-physicalist content.

A physicalist could reply that “bringer about” can be elucidated, if not rigorously defined, *using* the notion of reference. (As I understand it, this is Mackie’s tack.) The “bringer about” is the factor we *refer to* as such, the one we *pick out*. (I don’t mean that Mackie thinks this is wholly arbitrary, or that there are no constraints.) But even if this is right, it is no help if the project is to *define* reference physicalistically. To define ‘refers’ in terms of a notion of “bringing about” which is itself explained in terms of reference is obviously circular.

Similar difficulties beset “evolutionary epistemology”. If we *know* what “rational procedures” are, then we can doubtless study the brain to find out how it executes them, and our evolutionary past (if data are available) to find out how the brain mechanisms that execute rational procedures were selected for. But the property of being a *rational* procedure is not the same as the property of being a procedure that promotes human survival, by any means. And I see no reason to believe (and every reason to deny⁵) that ‘rational’ could be defined or elucidated in biological terms.

Alvin Goldman has proposed to identify rationality with the propensity to find truth; but, even if this worked — and it does not — it would require a “substantial” (non-disquotational) notion of *truth*, which is just what the physicalist doesn’t have — unless he can define ‘reference’ physicalistically.

³I argue that “causation” in this sense is not a *physicalistic* relation in “Why there Isn’t a Ready-Made World”, *Synthese* (forthcoming).

⁴The doctrine of interest-relativity in connection with explanation and causation is explained in my *Meaning and the Moral Sciences* (London, 1978). (See also A. Garfinkel, *Forms of Explanation* (New Haven, 1981). In the lecture cited in the preceding note, I make the further point that the division of situations into what is a “background condition” and what is an instigating cause is not built into nature, but is rather a feature of our notion of *rational explanation*.

⁵I argue that “rational” is not a physicalistic notion (not “reducible” in Field’s sense) in “Why Reason Can’t be Naturalized”, *Synthese* (forthcoming).

I am, then, a dualist, or, better, a pluralist. Truth, reference, justification — these are *emergent*, non-reducible properties of terms and statements in certain contexts. I do not mean that they are not supervenient on the physical; of course they are. My dualism is not one of minds and bodies, but of physical properties and intentional properties. It does not even yield an interesting metaphysics. Who wanted *that* sort of “dualism”? Ugh. But, as Kant saw, we are stuck with just the sort of dualism we never wanted — “dualities in our experience”, as opposed to experience of duals, distinct substances.

II. SCIENTIFIC REALISM AS METAPHYSICS

Since we are discussing conceptual questions, let us suppose we live in a Newtonian world. Suppose we know this (as well as one can know any physical theory to be right). Consider two philosophers, one of whom, Jones, maintains that *there really are such things as spatial points*, while the other, Smith, maintains that *there are arbitrarily small finite regions but not points* (except as logical constructs⁶). Is there a fact of the matter who is right?

A “scientific realist” who answers, “There *must* be” — either there are “real” (unconstructed) spatial points or there aren’t — has become a “metaphysical” realist. He pretends to a notion of truth which (in a Newtonian world in which all particles are extended) wholly transcends what humans could know. The two theories — Jonesian physics (unreduced points) and Smithian physics (points as constructs) — are mathematically and empirically equivalent.⁷ If truth is correct assertibility in the language we actually use, then *both* the Jonesian description and the Smithian description are “true” (which does not mean they can just be *conjoined*; they are, in Goodman’s sense, different “versions”). No argument from “convergence” or from “the success of science” could ever justify (or even give sense to) a notion of truth which goes beyond the reach of correct assertibility (by beings with rational and sensible natures) which the Smithian and Jonesian versions *both* possess. If (as the metaphysical realist claims) we do have a recognition-transcendent notion of truth, then we cannot say what role it could play in our lives (since we cannot tell the “true” theory in *this* sense from infinitely many mathematically and empirically equivalent theories, or say what our “grasp” of this notion consists in). The metaphysical realist asks us to accept a *picture*, as if the picture explained itself.

Some would reply that *points* are “mathematical objects” and that realism should be confined to “physical objects” — particles, force fields, radiation, etc. (Field takes *space-time points* as *physical* objects.⁸) But the same problem arises. Again, assume a Newtonian world and let Jones be a

⁶Kant proposed that points are not individuals but only *limits*. One way of formalising this (due to Whitehead) is to identify points with sets (of, say, convergent spheres).

⁷For a discussion of the notion of empirical *equivalence*, see “Equivalence” in my *Philosophical Papers*, vol. 3 *Realism and Reason* (Cambridge, forthcoming, 1983).

⁸H. Field, *Science without Numbers* (Oxford, 1981).

scientist who comes up with Newton's theory (absolute space plus forces) and Smith be a scientist who comes up with one of the elegant space-time theories which leads to exactly the Newtonian trajectories. (In these theories there is a 4-dimensional space-time with the metric of special relativity, no notion of "same place at two different times", and a special "affine structure" — a definition of 'shortest time-like path' — which singles out the trajectories of freely falling bodies. David Malament has shown that this version of Newtonian physics is, in fact, *the limit of general relativity as the signal velocity is allowed to become infinite.*)

Now consider the questions:

- (a) Is there *really* a difference between these theories?
- (b) Is there *really* an absolute space (a sense to 'same place at different times'), as Jones claims?
- (c) Is there *really* a gravitational force (as opposed to a "warped" affine structure) as Jones claims?

If the "scientific realist" answers 'Yes' to (a) (so that questions (b) and (c) have determinate, version-independent answers), he is again stuck with the difficulties of "metaphysical" realism.

Finally, if the "scientific realist" says that theories which are equivalent may have "successor theories" (at a later time) which are no longer equivalent (because of the changed empirical assumptions), and that the successor theory may answer our questions, we must remind him that the one true theory, if there is such, *also* has infinitely many mathematically and empirically equivalent versions, which possess incompatible relative interpretations. (Since the problem is a conceptual one, I have been imagining we already *have* the realist's one true theory, or one of its equivalents.)

I am not a "metaphysical" realist. In my view, truth, insofar as we have the notion, does not go beyond correct assertibility (under the right conditions). What determines which are the right conditions? Many things:— I do not have a general theory.⁹ Truth is as plural, vague, open-ended, as *we* are.

III. SCIENTIFIC REALISM AS CONVERGENCE

Given the right setting (which includes the rest of the language being in place) the statement that there are electrons flowing through a wire may be as objectively true as the statement that there is a chair in this room or the statement that I have a headache. Electrons exist in every sense in which chairs (or sensations) exist; electron talk is no more derived talk *about* sensations or "observable things" than talk about sensations or chairs is derived talk about electrons. Here I *am* a "scientific realist".

⁹In particular, the idea that "ideal conditions" are at the "end" of indefinitely prolonged scientific inquiry (the "Peircian limit") seems to be biased towards exact science. This idea makes the claim that a statement about the past is true a *prediction* (of a most implausible kind, to boot).

Some philosophers of science would say that ‘There are electrons flowing through the wire’ can be true only in the sense that this statement (in conjunction with theory and auxiliary hypotheses) yields true predictions, or, in a more sophisticated version, in the sense that it has a model satisfying various “constraints” (including yielding true predictions). We do not expect that present-day physics will survive without change; we expect that tomorrow’s theory will have conceptual and empirical disagreements with present-day theory. Is there any sense in which tomorrow’s physics might give us a better description of (what *we* refer to as) *electrons*? Or is the notion of an electron bound to one temporary phase in the history of physics (as Aristotle’s notion of “spheres” carrying the planets was)?

Sometimes theorists like Sneed or Lakatos or David Lewis say that successor theories refer to the same entities as predecessor theories just in case the “core” assumptions or the “core” applications (or both) are retained by the later theory. But this is no help. Unless the distinction between “core” and “protective belt” *is drawn from the standpoint of the later theory* it is unlikely to be the case that “core” assumptions (or what looked to be such to the *earlier* theorists) *will be preserved*.

An example may help to clarify this point. Special relativity preserves many notions from Newtonian physics (while making them frame-relative): e.g., *momentum, kinetic energy, force*. We can view special relativity as preserving the “core” of Newtonian physics *if* we take the “core” to be the approximate correctness of the Newtonian laws at “non-relativistic” distances and speeds (i.e., speeds small in comparison with light, and distances small in comparison with a light-second). But this would be a totally arbitrary way to define the “core” of Newtonian physics from a *Newtonian* point of view.

There are other thinkers who hold that *no* sense can be made of the idea that terms in incompatible theories (theories with no models in common) refer to the same entities. None of the entities referred to by physicists a hundred years ago can be said to exist at all (since the “empirical claim” of these theories is false — e.g., some of their predictions turned out to be false — and since there is no sense in which later theories are *about* the entities countenanced by the earlier theories.) None of the entities referred to by present-day physics will be properly said to exist at all in a hundred years, if future physical theory is incompatible with ours (as it doubtless will be). Theories are “black boxes” which yield successful predictions, not successive approximations to a correct description of micro-entities, on these views.

These neo-positivistic views pay a high price for their “set-theoretic” account of theories. It has been a constant view of almost all philosophers that science holds to the *ideal of convergent knowledge*. Peirce’s *ideal limit of inquiry*, Popper’s *growth of knowledge*, and K. O. Apel’s *regulative ideal of consensus*, are expressions of the same theme. To give up the notion that

we ever arrive at a description which is stable, to give up the notion that we accept the ideal of such a description as even one among other regulative ideals, is to abandon a very central part of the scientific outlook — a part which informs scientific methodology in a host of ways.

The neo-positivistic thinkers I referred to would reply that they are *not* giving up the ideal of the growth of knowledge: they are simply limiting it to what can be stated in their language: observation language *plus* set theory. But exactly the same problem arises at the level of observation language.

Why should we say the term 'grass' refers to the same entity it referred to a hundred years ago? Answer: "Because 'grass' is synonymous with 'plant of a certain kind', and this semantical fact has not changed in a hundred years", and you make two mistakes! (1) 'grass' is not an analytically definable word; natural kind terms do not have analytic definitions, as I have argued elsewhere; and (2) the word 'plant' itself is connected today with a quite different body of belief from that a hundred years ago (involving photosynthesis, the possibility of one-celled plants, etc.). If you are willing to say 'plant' has the same reference that it did one hundred years ago in spite of the change in collateral theory, why not say the same about 'electron'? If you are not, then even if 'Grass is a plant' is still an accepted sentence, it does not *mean* what it did one hundred years ago, and so one cannot argue that 'grass' means what it did one hundred years ago from the supposed definability of this term with the aid of the word 'plant'. Equating almost any term in reference across a hundred years of growth of scientific knowledge requires the Principle of Charity in some form:¹⁰ but limiting the Principle of Charity to observation language is totally unmotivated.

I see no reason, then, not to accept the Principle of Charity (that is, the principle that we *should* often identify the referents of terms in different theories so as to avoid imputing too many false or unreasonable beliefs to those we are interpreting). Accepting it is, however, incompatible with accepting the "set-theoretic" view of theories. For, if the term 'electron' preserves its reference across (suitable) theory change, then "There are electrons flowing through this wire" can be *right*, in the sense of being the verdict on which inquiry would ultimately settle, *without* its being the case that present day theory has a completely true "empirical claim". There is no algorithmic equivalence between the truth of a particular statement in the language of a theory and the truth of the predictions of the theory. The search for such algorithmic links is a relic of logical positivism; it is high time it were abandoned.

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¹⁰Or better, The Principle of Benefit of the Doubt. Cf. my "Language and Reality", in *Philosophical Papers*, vol. 2, *Mind, Language and Reality* (Cambridge, 1975), 272-90.