

## ***Where Positivism Went Right: The Positron and the Literal View of Theories***

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Norwood Russell Hanson not only is widely regarded as one of the leading figures responsible for the downfall of logical positivism, but is easily identifiable as one of the earlier practitioners of integrated history and philosophy of science. My interest here, though, is neither in hagiography nor in the history of the philosophy of science. Rather it is in the discovery of the positron in the early 1930's, a topic on which Hanson had much to say. His principal thesis was that this discovery was anything but a " 'single line' disclosure of facts, reminiscent of the naturalist finding a new bug beneath a rock." Rather boldly, he claimed that the discovery of the positron was indeed a discovery of three distinct particles: Anderson's experimental discovery, Dirac's theoretical discovery, and Blackett and Occhialini's *meta*-physical discovery. As exaggerated as it may seem, Hanson's thesis contains an important truth, although not perhaps quite for reasons he would recognize.

My point of departure is the similarity in the way speak, on the one hand, about discarded hypotheticals entities in the history of science (celestial spheres, vital pneuma, Cartesian vortices, phlogiston, caloric, ether), and, on the other, about creatures of myth and fiction. Although we do not hold that the entities from either category exist, nonetheless we predicate various properties of them and hold some predications to be true or on target and others to be false or complete misses. For example, that caloric is conserved, that Sherlock Holmes is a detective is on target; that caloric is electrically charged, that Holmes is a married man off target. Moreover, in both cases we systematically distinguish between what I call *conformal* properties from *normal* properties. Being conserved, being a detective are conformal properties of caloric and Holmes, respectively, conformal in the sense that they are exemplified by their subjects *according to the theory* or *according to the story*. In other words the truth makers for conformal predication is *what is said* in the context in which they originate. In contrast, the truth makers for normal predication are various historical contingencies involving the way the world is. Take, for example, being listed as an element in Lavoisier's table of elements, or being more famous than any real live detective. Another mark distinguishing properties held normally from those held conformally is that both caloric and Holmes are complete with respect to their normal properties but incomplete with respect to their conformal. Neither is it the case that caloric is a good neutrino absorber nor is it *not* the case — the caloric theory is simply silent here. Similarly neither is it the case that Holmes has a mole next to his navel nor is it not the case. Finally, conformal properties are held necessarily. Caloric would not be caloric unless it were conserved, nor Holmes Holmes were he not a detective. Normal properties are by and large contingent properties.

Discarded hypotheticals and creatures of myth and fiction in their characteristic features

are instances of the more general category of objects of supposition. Included in this category are mathematical entities as well as idealizations and other useful fictions in science. The question is whether *all* hypothetical entities, not just the discarded ones, fall in this category. This would entail that a hypothetical entity could never be literally discovered. For if it is merely an object of supposition, discourse about it referentially tracks back only to what is said and does not refer to some concrete empirical entity. This is the point of departure for my deeper examination of the case of the positron. As it turns out, Dirac's anti-electron is a mere object of supposition. Anderson's positive electron is a concrete empirical entity. Blackett and Occhialini create a forged identity between the two, or so I shall argue.

If hypothetical entities are uniformly mere objects of supposition, then the literal view of theories, at least for theories that trade in hypotheticals, is simply wrong. Such theories are not even candidates for being true or false. Nonetheless they can be evaluated with regard to whether or not they are ultimately *vindicated*, whether in the course of ongoing research an identity is forged between the theory's hypotheticals and subsequently discovered empirical entities.