HOW DO VACUOUS TRUTHS BECOME LAWS?

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Idealizations and approximations used in science are assumptions or hypotheses which are known to be patently false. They enter into a scientific analysis or explanation in basically two ways. First, they may be joined to a theory as extraneous hypotheses, mainly to make it easier to work with the theory. Second, they may be embodied in the very statement or formulation of laws and theories; I call such laws idealizational laws. Thus, for example, assuming that the universe contains only two bodies is an idealizing hypothesis that may be used in some contexts as input to the law of gravitation and Newton's second law of motion. On the other hand, insofar as Newton's second law is conceived as applying only to point-masses, that law contains an idealization as part of its content.

In this paper I confine myself to an examination of the problems of testing pertaining to idealizational laws. I argue that the major theories of confirmation face difficulties in accounting for the confirmation and disconfirmation of such laws. Underlying their difficulties is the fact that those laws are about nonexistent objects. I propose an analysis of the meaning and the confirmation conditions for idealizational laws, which are law statements whose antecedents contain idealizational clauses.

Consider the simple conception that scientific laws are unrestricted universal statements of the form "For all x, $Fx \rightarrow Gx$", where the arrow sign is understood to denote material implication. If we assume the adequacy of this material-conditional interpretation of laws, the following problem arises. If no object instantiates the antecedent, as when, for example, F refers to the property of being a point mass or a frictionless plane, the law "For all x, $Fx \rightarrow Gx$" is true "vacuously." But of course we cannot be content with our laws being true vacuously, for in such laws the consequent can be any statement whatsoever and the "law" would be true. Explaining the possibility of falsifying idealizational laws, which are true vacuously, becomes an acute problem for Popperian falsificationism. Testability of vacuously true generalizations turns out to be a problem also for another theory of confirmation: the Bayesian theory. On the other hand, the notion of confirming an idealizational law by its "counterfactual instances" proves to be a sterile one.

The analysis I propose of the testing of idealizational laws is based on the fact that idealized objects comprising the domains of such laws can be approximated by real objects. Thus I suggest that we represent the form of an idealizational law as follows:

$$\text{For all } x, \approx \Uparrow Fx \rightarrow \approx \Uparrow Gx.$$

Here '$\approx \Uparrow Fx$' stands for "x approximates progressively to being an F," and '$\approx \Uparrow Gx$' stands for "x approximates progressively to being a G." Confirmatory instances of this reading of an idealizational law are those cases where making the experimental conditions more closely approximate to the idealizational antecedent F results in improved approximation of actual observations to G. And disconfirmatory instances of it are those cases where improved approximation to F does not make actual observations more closely aproximate to G.