Crucial Experiments and Social Psychological Inquiry

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Abstract. The difficulties in performing a crucial experiment in social psychology are addressed taking philosophical and epistemological issues into account. While previous discussions have proposed that present social psychological theories and methods prevent such tests, closer analysis indicates that this inability is not unique to social psychology, but is an aspect of any scientific inquiry.

Recent discussions of the theories and research methods employed in social psychology often reach quite conflicting conclusions. While several critics suggest revitalization and restructuring will be needed to correct some of the problems which are an inherent part of the study of social psychological phenomena, others argue in support of the discipline's scientific adequacy (cf., Armistead, 1974; Elms, 1975; Gergen, 1973; Harré & Secord, 1973; Schlenker, 1974). The problems these treatments address are generally valid ones concerning social psychology and scientific inquiry, but they sometimes serve to suggest that social psychologists "may still be able to benefit from lessons in the philosophy and history of science" (Elms, 1975, p. 973). While social psychologists' lack of familiarity with philosophical treatments of theory construction, hypothesis derivation, and confirmation is usually only suggested by instances of misused terminology, omitted discussion of major concepts and distinctions, and the presentation of philosophically naive and inaccurate conclusions, the problem becomes particularly obvious in discussions of the value and possibility of performing "crucial" experimental tests of social psychological theories.

Many of the experiments within social psychology are designed to examine the empirical adequacy of current theoretical frameworks, and several attempts have been made to provide crucial experimental tests of these theories (c.f., Bem & McConnell, 1970; Greenwald, 1975). As the term is usually used, a crucial experiment is one that will either confirm a given theory or, when two conflicting theories are involved, confirm one while disconfirming the alternative. For example, in the area of attitude change research, numerous attempts have been made to design and conduct experiments which critically examine dissonance and self-perception theory predictions. In his review of these experiments, Greenwald (1975, p. 494) proposes that these crucial tests "fail to take into account the capacity of each formulation to account adequately for results 'predicted' by the other" and must ultimately fail as crucial tests since dissonance theory and self-perception theory are uniquely non-disconfirmable.

However, explanation of the problems of a crucial test between cognitive dissonance and self-perception need not refer to any unique property inherent in the construction of the two theories or the strength of the links between theoretical concepts and operational definitions. Philosophers of science are fairly well agreed that a crucial test between any two competing theories or of any single theory is impossible, for a variety of reasons. An examination of the difficulties involved in the confirmation versus disconfirmation of theoretical propositions should make it obvious that there are logical problems involved in any scientific inquiry, and that these problems are not unique to social psychology.

Verification and Disconfirmation in Science

Most basically, the controversy over the possibility of a crucial test of a theory or between theories seems somewhat perplexing. While most researchers realize and frequently espouse the idea that data generated in a test of hypotheses derived from some theoretical statement or statements can never disconfirm or confirm any theory, these same researchers overlook the fact that this also implies that a test between two competing theories is equally impossible. To make salient this point, it becomes necessary to present and discuss the most basic reasons which have led philosophers to this conclusion.

The Duhemian thesis. In 1906, Duhem convincingly argued that an experimental test of the predictions made within any theoretical framework could neither confirm nor disconfirm the theory, no matter how directly these predictions were related to (deduced from) the theory. Duhem conceived of the various scientific disciplines as complete systems of interwoven theories and hypotheses, so complex and interrelated that it is impossible to subject any single hypothesis derived from a theory to a conclusive empirical test. He stated that any scientist "can never subject an isolated hypothesis to experimental test, but only a whole group of hypotheses; when the experiment is in disagreement with his predictions, what he learns is that at least one of the hypotheses constituting this group is unacceptable and ought to be modified; but the experiment does not designate which one should be changed" (p. 187). In reference to dissonance theory, for example, results that do not support that theory's predictions do not necessarily reflect on the adequacy of that type of explanation, but may be related to the social psychologist's particular conceptions of human cognitive processes. Failure to support predictions may indicate that individuals do not experience dissonance when the cognitions they hold conflict, but it may also indicate that other assumptions about the way people process information, the cognitive processes involved in forming and retaining thoughts and ideas, and the subjects' perceptions of the experimental situation may be in error. The disconfirming results only indicate that some error is present. They do not tell us where the error lies.

The logic of confirmation. As Kemeny (1959) points out, scientific explanation moves in a cycle from the formation of general principles based on certain observations, to deduction of testable hypotheses from these general principles, to the testing of these hypotheses. Evaluation of a theory becomes possible by observing the degree to which the predictions derived from the general theory are supported in the empirical test of the hypotheses. However, the test of the predictions does not reflect the truth or falsity of the theory for several basic reasons. First of all, in order to derive testable implications from any general theoretical statement, certain bridging or auxiliary statements must be introduced into the system (Hempel, 1966). As a consequence, any result that fails to support the hypothesis under investigation implies that either the hypothesis is incorrect, or that one of the auxiliary hypotheses is incorrect.

For example, in Snyder and Ebbesen (1972), the prediction was made from self-perception theory that the more salient the attitude to the holder, the less the attitude would change following counterattitudinal advocacy. Dissonance theory, Snyder and Ebbesen proposed, predicts just the opposite pattern -- that more attitude change would occur following counterattitudinal advocacy when the attitude was salient to the attitude

holder. Implicit in the experimental procedures employed to test these hypotheses, however, was the auxiliary assumption that attitude salience was directly related to the amount of time that subjects were given to "gather their thoughts on the issue." Any failure to support the predictions advanced by the two theories could be explained by noting that the auxiliary hypothesis, and not the theory-derived hypothesis, was incorrect.

Secondly, the implications that results have in terms of theory verification are limited because of the logical structure of deductive support. For example, let us assume that the Snyder and Ebbesen predictions concerning the relations between attitude salience and attitude change following counterattitudinal advocacy are logically correct for both the theories and that the attitude salience manipulation was effective (cf. Greenwald, 1975). For convenience, let us say that if dissonance theory (D) is correct, then when attitudes are salient, the holder will change their attitude more following counterattitudinal advocacy (M); if self-perception theory (S) is correct, then the holder would change a salient attitude less following counterattitudinal advocacy ($\overline{M}$). The reasoning which underlies the crucial test is schematized below:

If D is true, then so is M.
If S is true, then so is $\overline{M}$.

The results of the experiment indicate that $\overline{M}$ is the case, rather than M. Using modus tollens of logic, one can conclude that D is not true, but can say nothing about the truth or falsity of S. To state that finding $\overline{M}$ to be true implies that S is also true is to attempt to affirm the consequent, which is logically invalid. Thus, it is logically naive to expect that any experiment will disconfirm one hypothesis, while confirming an alternative, opposite hypothesis.

Observation. A third problem of verification of theories based on empirical tests lies in the fact that all our observations must, by necessity, be only approximate. As Kemeny notes (1959, p. 75), "Although the theory may be precise, our contact with experience is always subject to error." This is not to say that imprecision occurs because the phenomena scientists study are random to some degree making only probability statements necessary, but only that, given our measurement and observational abilities, inexactitude will always be present. Because of this uncertainty, no data can ever absolutely indicate that a rejection of any theory is necessary.

This problem of the tenuousness of observation is further compounded by its theory-ladenness. Not only is the recording of the data somewhat imprecise, but the theory which provides the framework for the hypothesis under consideration may also influence the meaning which is applied to the data. Both Popper (1959) and Feyerabend (1964), rejecting the positivistic notion of meaning-invariant descriptive statements, argue that the theoretical framework itself provides observational terms with their meaning. As Popper (p. 107) notes, "theory dominates the experimental work from its initial planning up to the finishing touches in the laboratory," even affecting the actual observation of research results. Thus it is never possible to know, in a strict sense, if seemingly identical terms used in different theories are commensurable in meaning.

Ad hoc hypotheses. In spite of the previously discussed logical and methodological problems involved in crucial experiments, some competing theories do seem to be specific enough to lend themselves to extremely rigorous examination. The Puy-de-Dome experiment in physics is a case in point. The simple hypothesis that water rises in a pump because

of air pressure, and not because nature abhors a vacuum was tested by measuring a column of quicksilver at different altitudes on the Puy-de-Dome. The height of the column fell as altitude increased, supporting the conclusion that water rushes up a pump barrel because of air pressure and not because nature abhors the vacuum created by the pump. Proponents of the horror vacui theory, however, dealt with this apparently devastating blow to their theory by introducing ad hoc hypotheses. These theorists simply stated that, as the experiment demonstrated, nature abhors a vacuum less with increasing altitude. The test, although logically and methodologically precise, could not discount ad hoc hypotheses that were invoked to explain the results. Similarly, since the first of the dissonance studies, failure to find significant effects has been attributed not to the inadequacies of the theory, but to the ad hoc conclusion that the subjects did not experience any dissonance arousal in that situation, or that other modes of dissonance reduction were operating.

Progress in Scientific Understanding

The literature from philosophy concerning confirmation of hypotheses indicates that complete proof or disproof of any theory is not possible. However, regardless of the logical, philosophical, and epistemological problems that arise in theory verification, theories are rejected in favor of other theories. If proof of a theory is impossible, how did the evolution from Kepler's Laws, to Newton's Laws, and to Einstein's Theory of Relativity occur? Philosophers disagree in their analysis of the degree to which theory replacement in science is non-logical, but generally conclude that theories can be rejected in an inferential manner that is essentially inductive in nature. Eventually, following numerous disconfirmations, failures to support predictions, specification of structural inadequacies, and similar scientific disappointments, a theory will be rejected for one that accounts for these inconsistencies (cf. Hempel, 1965; Kuhn, 1962; Popper, 1959). This selection among possible theories is possible since theories are not evaluated solely in terms of their empirical precision and adequacy. As Hempel (1966, p. 28) states "an experiment . . .may be crucial in a less strict, practical sense: it may reveal one of two conflicting theories as seriously inadequate and may lend strong support to its rival; and as a result, it may exert a decisive influence upon the direction of subsequent theorizing and experimentation." Extending the idea of inductive "strong inference" to the fullest, Platt (1964) cogently argues that "crucial" experiments can provide an excellent framework for scientific research, provided one is systematic in their application and recognizes the test's limitations. In terms of Popper's "sophisticated methodological falsificationism", which suggests that empirical research should attempt to falsify rather than verify theories, crucial experiments which simultaneously test several theories are essential for scientific progress. Tests, rather than being "two-cornered fights" between a theory and the data, should be designed to be "three-cornered fights" between two rival theories and the data. Of course, one must not forget that while the quantity, variety, and favorability of supporting evidence is important in deciding the acceptability of any theory, such factors as simplicity, generality, internal consistency, testability, and explanatory relevance are equally crucial. If one must conclude that dissonance theory and self-perception yield similar predictions, then acceptance is not "a matter of loyalty or aesthetics" (Bem & McConnell, 1970, p. 30), but depends upon which provides the most rigorously scientific explanation of the phenomenon.

Conclusion

It has been proposed that questions involving the nature of science cannot be intelligently discussed without adequate familiarity with the philosophical issues upon which they are based. Many of the problems of social psychology are not unique, but are characteristic of all scientific disciplines. The failure to recognize the relevant epistemological issues involved suggests that some of our difficulties may arise from the philosophical naivete of the average psychologist, rather than from any special characteristic of the field itself. Unfortunately, it does seem that this state of affairs lends support to Lakatos' (1970, p. 148) pet thesis "that most scientists tend to understand little more about science than fish about hydrodynamics." The solution to many of our problems thus lies not in the development of more precise research techniques, shifts in emphasis in graduate training, or the replacement of experimental laboratory methods with alternative data collection techniques, but in the more careful consideration of our endeavors, in a context provided by the history and philosophy of science.

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Footnote

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