DOCUMENT RESUME

ED 266 349 CG 018 829

AUTHOR Shanteau, James
TITLE Application of Information Integration Theory to Methodology of Theory Development.
PUB DATE Aug 85
NOTE 14p.; Paper presented at the Annual Convention of the American Psychological Association (93rd, Los Angeles, CA, August 23-27, 1985).
PUB TYPE Viewpoints (120) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Cognitive Processes; *Cognitive Restructuring; Concept Formation; *Epistemology; Generalization; *Induction; *Research Methodology; *Theories

ABSTRACT

Information integration theory (IIT) seeks to develop a unified theory of judgment and behavior. This theory provides a conceptual framework that has been applied to a variety of research areas including personality impression formation and decision making. In these applications information integration theory has helped to resolve methodological and theoretical problems. The core of the IIT approach lies in the inductive analysis of multiple causation. IIT is applied in an inductive mode; generalizations emerge from experimental analysis. In nearly every area in which integration theory has been applied, this focus has led to significant restructuring of basic issues. This shift in thinking affects every aspect of research, from mundane details of methodology to the epistemological nature of theory. Moreover, the inductive perspective sees behavioral science not as a formalized knowledge structure, but as an ongoing inquiry system. For IIT, the ultimate unit of analysis is the individual. The IIT approach has implications for various types of generality and for nomothetic versus ideographic research strategies. (Author/ABL)

APPLICATION OF INFORMATION INTEGRATION THEORY TO METHODOLOGY OF THEORY DEVELOPMENT

James Shanteau

Department of Psychology

Bluemont Hall

Kansas State University

Manhattan, Kansas 66506

Running head: Theory Development

Paper prepared for the symposium on "Developing a Methodology of Theory Development" at the American Psychological Association meeting, Los Angeles. (1985, August).

Abstract

The present paper describes information integration theory and its approach to the methodology of theory construction. The heart of this research program lies in the inductive analysis of multiple causation. In nearly every area in which integration theory has been applied, this focus has led to significant restructuring of basic issues. This shift in thinking effects every aspect of research, from mundane details of methodology to the epistemological nature of theory. Moreover, the inductive perspective sees behavioral science, not as a formalized knowledge structure, but as an ongoing inquiry system. The present approach has implications for various types of generality and for nomothetic versus ideographic research strategies.

APPLICATION OF INFORMATION INTEGRATION THEORY TO METHODOLOGY OF THEORY DEVELOPMENT

The purpose of this paper is to describe information integration theory (IIT) and its approach to the methodology of theory construction. There are five sections: (1) a brief discussion of the general characteristics of IIT, (2) a presentation of an illustrative example, (3) an analysis of the role of induction in theory development, (4) a consideration of various types of generality, and (5) the implications for nomothetic and ideographic research strategies. The ideas in this paper closely parallel the arguments presented in Anderson (1981, esp Sec 1.8; 1983).

Information Integration Theory

The goal of this research approach is to develop a unified theory of judgment and behavior. The theory provides a conceptual framework that has been applied to a variety of research areas, e.g., from personality impression formation and attitude change to psychophysics and decision making. In these applications, IIT has helped resolve a variety of methodological and theoretical problems. And it has unified many lines of thought that were previously isolated.

The heart of this research program lies in the analysis of multiple causation. Since virtually all judgments and behaviors are multiply determined, the processes involved in the integration of diverse stimuli are central. The analyses of these integration processes are at the core of IIT.

Most previous approaches do not possess effective methods for the study of multiple causation. In general, they have bypassed the study of multiple causation and focused instead on issues that could be studied with available methodology. Consequently, the nature of theory accommodates to those methods and those issues. Moreover, such

approaches tend to be applied to problems beyond their domain of usefulness

From the IIT view, prior perspectives often appear narrow and inadequate. In some cases, they lead to questions that seem inconsequential or that rest on untested verbal distinctions. In other cases, they lead to answers that are uninterpretable because of inadequate methodology or nongeneralizable because of untested implicit assumptions. And in most cases, both questions and answers seem to lack insight from the multiple causation perspective.

These criticisms should not be viewed as exclusive. To some extent, they apply to any research orientation (including the present approach). Nonetheless, the development of methods to investigate multiple causation places most previous techniques in a different perspective. Specifically, research orientations which are unable to investigate multiple causation are generally too narrow to provide a base for theory development.

The IIT perspective frequently requires shifts from previous lines of thinking. In nearly every area in which IIT has been applied, the focus on multiple causation has led to a significant restructuring of basic issues. This shift in thinking affects every aspect of research, from mundane details of methodology to the epistemological nature of theory. Some aspects of this difference are illustrated next.

Illustrative Research Application

Early studies of dating choice concluded that physical attractiveness dominates dating decision making (e.g., Walster, Aronson, Abrahams, & Rottmann, 1966; Huston, 1973). In these studies, however, information about the date other than physical attractiveness was either not provided or not systematically manipulated. Thus, the integration of information was not analyzed and the influence of multiple factors

could not be determined.

One recurring question in the dating literature has been whether individuals consider their chances of being accepted when choosing between alternative dates. That is, do subjects' inferences about probability of acceptance influence their selection of prospective dates? Initially, investigators felt that subjects would consider their chances for acceptance and, as a consequence, prefer dates of equal attractiveness to themselves (Walster, Aronson, Abrahams, & Rottmann, 1966). Although this "matching hypothesis" seemed reasonable, the results were at best indecisive (Berscheid, Dion, Walster, & Walster, 1971; Huston, 1973).

Shanteau and Nagy (1979) attempted to resolve this ambiguity by using IIT to determine how (and whether) probability is combined with physical attractiveness. To accomplish this goal, three studies were run. In the first, women college students were asked to make preferential choices between two males described by (1) a photograph and (2) a verbal statement of the probability that the pictured male would accept the subject as a date. The stimuli describing the two dates were systematically varied in a factorial design.

Anova analyses at the individual-subject level consistently revealed significant effects for both attractiveness and probability. Increases in both the attractiveness of the date and the probability of acceptance led to more favorable responses. Moreover, probability of acceptance had a greater effect as physical attractiveness increased, i.e., probabilities are more important for choosing attractive dates than for unattractive dates. This fan-like pattern of results is consistent with a multiplying integration rule (Shanteau, 1975). Psychologically, that means probability modified or modulated the effect of physical attractiveness.

An obvious limitation of this first study was that probability was explicitly provided for subjects -- information that is not normally available in actual dating situations. Therefore, two additional experiments were run where it was left up to subjects to infer (or not infer) probability from the photograph. Procedurally, subjects made preferential choices between all possible pairs of dates described by photos alone. At a separate time, subjects rated the physical attractiveness of each photo and also estimated the probability that they would be accepted by the pictured date.

The results for most subjects indicated that probability inferences are made and that they are reflected in subject's evaluations of prospective dating partners. In addition, these subjects had the greatest preference for dates of intermediate physical attractiveness; this finding is consistent with the matching hypothesis described earlier. There were some subjects, however, who always preferred the most attractive dates; these subjects also rated all dates as highly likely to accept. For almost all subjects, statistical analyses revealed that the integration of attractiveness and inferred probability could be described by multiplying combination rule

The major finding of Shanteau and Nagy is that subjects not only used probability of acceptance when it was provided explicitly, but also when it was left up to subjects to infer. In both cases, moreover, probability acted as a multiplicative moderator on the effects of physical attractiveness. Consequently, most subjects ended up supporting the matching hypothesis by preferring dates of intermediate attractiveness.

Induction in Theory Development

As illustrated in the preceding example, IIT is applied in an inductive mode: generalizations emerge from experimental analysis. The

multiplying combination rule for attractiveness and probability, for instance, emerged from the pattern of dating choice results. From its emphasis on problems of multiple causation, IIT provides an inductive framework for conceptualizing and studying these issues.

An alternative view sees science from an an axiomatic or deductive perspective. Beginning with a few postulates or axioms, a chain of deductive consequences is derived. This axiomatic approach has produced impressive results in physics. In psychology, it has achieved little.

It is important to distinguish between deductive thinking in conducting research and deductive derivations in theory construction. There are elements of deductive thinking in almost any empirical investigation, e.g., the derivation of specific consequences for experimental hypotheses. It can be deduced from the matching hypothesis, for instance, that there must be a tradeoff between attractiveness and probability. This is far different, however, from deductive derivations based on elemental propositions

Researchers working in the deductive mode see this approach as an ideal. It is sometimes viewed as the only truly scientific way of thinking (e.g., Coombs, 1964). Consequently, such researchers often have difficulty comprehending the value of the inductive approach. To them, it appears formless, undependable, and even random.

To researchers working in the inductive mode, however, the deductive approach produces a misplaced emphasis on formal theory construction. Although elegant in appearance, the deductive mode has produced little psychological insight. Moreover, what is claimed as deductive theory is often an indirect form of inductive theory.

Deductive theories are seldom discarded when their deductions fail. As Coombs as argued, "theories are not replaced by data, they are only replaced by other theories." In the face of disconfirming data,

deductive theories are modified, first in their operational (response) assumptions, then in their auxiliary (simplifying) assumptions, and finally in their basic (conceptual) assumptions. Thus following their introduction, deductive theories typically show a history of gradual assimilation of inductive change. An open acceptance of this inductive framework would seem both more accurate and more efficient for theory development.

Normative theories about how people "should" behave have attracted many investigators because of their logical or rational appeal. They usually have some axiomatic basis and thus appear as deductive theories. In the face of inconsistent data, they are frequently perceived as providing baseline predictions. Behavioral deviations from baseline are then viewed as containing clues to understanding and are even treated as a phenomenon to be explained.

Descriptive theories, in contrast, are concerned with understanding behavior as such. From this viewpoint, normative theories are irrelevant. Reducing deviations from normative predictions, of course, may be desirable in a practical sense. That does not make such deviations true phenomena, however, for they owe their existence to an external frame of reference that lacks psychological relevance. As argued by Shanteau (1978), little understanding is gained by comparing behavior to external standards that have no necessary connection to psychological mechanisms.

In summary, the inductive approach views science, not as a formalized knowledge structure, but as an ongoing inquiry system. It recognizes and incorporates essential research issues, such as methodology and individual differences, that are often overlooked in deductive formalizations. Most importantly, the inductive approach "listens to nature" by being open to empirical insights.

Generality

The problem of generality is pervasive in behavior research. Any one study is restricted to a specific range of behavior observed in a limited setting for a generally small sample of subjects. Given these limitations, the researcher nonetheless attempts to obtain some degree of generality. This fundamental problem of generality has two consequences that will be discussed here.

Empirical generality. Within any single experiment, statistical techniques can be used to analyze the internal consistency of the data. Such techniques provide powerful assessments of theory adequacy for a particular set of results. In the dating study, for instance, the multiplying rule for integrating attractiveness and probability was supported by rigorous goodness-of-fit tests. No single experiment, clearly, can establish generality by itself. Thus when the outcome of a study disagrees with existing knowledge, it is often suspected of being an accident arising either from statistical or methodological idiosyncracies. Hence, replicability is essential to establish the empirical generality of any finding.

The problem of generality, however, is not just empirical. IIT is based on the premise that only an interlocking set of experiments and conceptually-based analyses can provide the generality needed for theory construction. In Shanteau and Nagy, for example, the multiplying integration rule was verified when probability was explicitly provided and when subjects were left to infer probability from attractiveness. Combined with other evidence on multiplying rules (e.g., see Shanteau, 1975; Shanteau & Nagy, 1976, 1984), this establishes a degree of generality which provides a solid foundation for theory development.

Prediction and understanding. Two quite different goals can be pursued in psychological research: one is the goal of predicting

behavior, the other is the goal of understanding behavior. The goal of prediction typically leads to a search for outcome generality, i.e., direct generalization of empirical results. The goal of understanding typically leads to a search for process generality, i.e., generalization about integration rules.

Although it might be desirable otherwise, the goals of predicting and understanding are often incompatible. Each goal imposes its own constraints on design and procedure. Attempts to pursue both goals within a single study requires compromises in methodology that are likely to compromise the usefulness of the results. This point is nicely illustrated by the problem of "weak inference" with linear models (Anderson & Shanteau, 1977). Linear (additive) models can be quite useful for purposes of practical prediction, i.e., they almost always provide a good correlational fit to data. But this very usefulness tends to obscure their limitations for providing theoretical insight. Methodologies which work well in outcome studies are often carried over to process studies, where they are not only ineffective but may actually be misleading (Shanteau, 1977).

The emphasis on process-outcome incompatibility is not an argument against either approach. Rather it is an argument against well-intentioned but ineffective compromises in design and procedure. What's needed is mutual interaction, not mutual integration.

Nomothetic versus Ideographic Research Strategies

The nomothetic approach seeks generality across individuals whereas the ideographic approach seeks generality within individuals. Nomothetic studies are usually oriented toward the analysis of stimulus effects using data aggregated across individuals. Ideographic studies are usually oriented toward individual differences. This distinction is often perceived as an irreconcilable schism (Cronbach, 1957).

Integration theory combines both nomothetic and ideographic approaches. The predominant locus of analysis is at the level of the individual subject: the goal is to understand the psychological processes used by each subject. Nonetheless, consistencies across individuals are still observed, especially at the level of the integration function.

This joint nomothetic-ideographic approach is illustrated by the dating choice study. Individual analyses showed that all subjects followed the same multiplying integration rule -- a nomothetic result. Not all subjects, however, used this rule to follow the matching hypothesis -- an ideographic results. Thus, although subjects used the same combination rule, it did not necessarily lead to the same pattern of choices.

For IIT, the ultimate unit of analysis is the individual. Group averages are often useful and even necessary for publication. But the goal is to understand behavior at the level of the individual. Only single-subject analysis provides the degree of precision needed for detailed analyses of psychological processes.

Concluding Comment

No matter how defined, "methodology" is a tainted word to many. Almost all researchers have a concern with methods, of course, but the term suggests an overly narrow focus on procedures and data analysis. In the present view, however, methodology is an integral part of substantive inquiry. The validity of a theory derives from the methods used both to develop the theory and to examine its consequences. Accordingly, theory cannot be divorced from the methods by which it was developed. And methodology without theoretical perspective is empty.

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