METHODS IN PSYCHOLOGICAL RESEARCH

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Summary

The impetus of psychological research is the inability of psychologists to accommodate new phenomena or problems with their existing knowledge. Conducting research is a formal and systematic exercise for the following reasons. First, conceptual skills are deployed to propose a theory for the to-be-explained phenomenon. Second, deductive logic is used to derive the research hypotheses from the theory. This is possible only if the theory is sufficiently specific. Third, researchers collect data systematically according to a plan or design. Fourth, the inductive rule that underlies the experimental design makes it possible to exclude some potential interpretations of the data. Fifth, appropriate statistical procedures are used to tabulate and analyze the data. Lastly, deductive logic is used to draw the theoretical conclusion. In short, the success of the research process depends on a confluence of conceptual, meta-theoretical, methodological, and statistical skills.

For various reasons, psychologists may emphasize some of the six aforementioned reasons at the expense of the other issues. Consequently, psychologists use a wide array of research methods. This sometimes gives the impression of fundamental methodological differences among psychologists. While this is not necessarily undesirable, it is hoped that the discussion of the meta-theoretical and philosophical issues serves to set the methodological disagreements among psychologists in the proper context. For example, before considering whether empirical research should be driven atheoretically by data or be guided conceptually by theory, it may be helpful to examine first whether or not there is "pure" observation. At the same time, realizing that all observations are theory-dependent, should we conclude that no objectivity is possible, particularly when psychologists appeal to the incorporeal entity, the mind? Before attempting to answer the question as to whether or not the mind can be reduced to the brain, we may find it necessary to see how cognitive psychologists study

unobservable hypothetical structures or processes like perception, memory, intelligence, motives, and the like.

Explanations are qualitative in the sense that psychological phenomena are explained in terms of hypothetical mechanisms to which theoretical properties are attributed. Are psychologists being inconsistent when they insist on using statistics or psychometric tests? How is it possible to use quantitative data as evidential support for qualitative theories? How do psychologists generalize from their data that are collected in an artificial setting to real-life phenomena? What is the rationale of experimentation in psychological research? How can psychologists assess their research?

1. Introduction

Conducting research differs from informal gathering of information in that researchers collect data systematically so as to answer a well-defined question. The research is systematic if data are collected in strict accordance with a predetermined plan or design. The question is well defined if it originates from an unambiguous theoretical statement. These requirements seem reasonable for studying tangible and durable phenomena (e.g. a floating vessel). However, they would seem at first blush impossible for psychologists to conduct research in view of the following challenges.

First, much of what interests psychologists is not observable in the way physical objects like chairs and cars are tangible. To skeptics, the incorporeal nature of mental phenomena (e.g. memory, drives, thinking, etc.) precludes them from being observed or measured. This, in turn, renders it impossible to study them systematically. Second, individual human beings are unique and unpredictable in a way physical objects are not. It would seem inappropriate to strive for general statements, let alone functional laws or explanatory theories that apply to all human beings without exception.

Third, unlike inanimate objects whose nature is relatively durable, psychological phenomena are colored by fleeting wants, desires, fears, and the like. Is it possible to study inconstant phenomena systematically and objectively? Fourth, while it may be possible to study a complex object bit by separate bit if the object is the sum of its components, this analytical approach is inappropriate for psychology because individual character has a unity that is more than the sum of its parts. For example, taking away Smith's motives (if it were possible), psychologists are no longer studying Smith. Conversely, it is not meaningful to talk about Smith without taking into account Smith's motives. Fifth, human affairs are value laden. Can, or should, psychological research be objective?

This introduction to the research methods used in psychology begins with how the confluence of psychologists' conceptual, logical, meta-theoretical, theoretical, and statistical skills serves to ensure that research data are collected systematically to answer well-defined questions. Next is a summary of the multiplicity of research methods at the disposal of psychologists. The philosophical and methodological assumptions underlying the aforementioned reservations about psychological research are considered before the discussion of how research findings are assessed. The discussion concludes with an affirmation of the primacy and importance of theoretical considerations.

2. The Confluence of Issues from Different Domains

A description of various skills implicated in conducting research provides the backdrop for subsequent discussion of various philosophical and methodological issues implicated in psychological research. It is also essential for understanding why psychologists do things the way they do.

2.1. Conceptual Issues

Psychologists begin a research project when confronted with a phenomenon that cannot be readily accommodated by the existing conceptual scheme. For example, why does the normally reserved Joe become an ardent activist who participates in protests? Why do drivers sometimes "see" the red traffic light after they are half a block past the intersection **(see *Experimentation in Psychology—Rationale, Concepts, and Issues*)**? The first step in conducting research is the conceptual task of coming up with a conjecture that makes sense of the to-be-understood phenomenon. Note that the phenomenon exists before the research, and that the research is about an explanation of the phenomenon, not the phenomenon itself (for a discussion of the analogous distinction between the interpretation of test scores and the test scores themselves in **see *The Construction and Use of Psychological Tests and Measures*)**.

In Psychologist A's view, Joe's new found activism is the expression of his previously suppressed aggressiveness. However, Psychologist B considers the change as a sign that Joe has overcome a crippling inhibition. Can the two explanations be true at the same time? Which one is correct if they are incompatible? At the same time, both may be incorrect. For example, Joe's change may be brought about by a newly acquired insight into social policies. It is a sophisticated conceptual task to design appropriate research to sort out these questions.

Psychologist C may suggest that Joe's previous reserve was, in fact, aloofness, which camouflaged Joe's aggressiveness. Such a stance raises the conceptual issue as to how it is possible that aggressiveness can account for two apparently unrelated, if not opposite, phenomena (aloofness and activism). A related conceptual issue is whether or not aggressiveness would be evoked to explain Joe's reserve had his demeanor been characterized as shy instead of aloof. That is, the direction of the research depends on how the phenomenon is conceptualized in the first place.

Native speakers of a language are not necessarily good at explaining what makes an utterance grammatical in the native language. This is because the ability to analyze and talk about natural language is a meta-linguistic skill different from the ability to use the language. Likewise, a different conceptual skill is required to explicate or analyze the rationale of psychological research, namely, a familiarity with some logical rules and relationships, as well as some methodological issues.

2.2. Logical Rules and Relationships

Psychologists dispute whether a scientific psychology is deductive or inductive. In contrast, satirizing some psychologists' scientific aspiration as mere scientism (an

exaggerated faith in the propriety or efficacy of applying the methods used in the physical sciences to the social sciences and humanities), some psychologists suggest that adductive rules be used in psychological theorizing. This sets in high relief the need to clarify the role of logic in psychological research. In fact, researchers have to use deduction, induction, and adduction, albeit for different purposes at different stages of the research. Moreover, researchers have to be well versed in three logical relations.

2.2.1. Deductive Logic

Deductive logic consists of rules that make it possible to derive a valid conclusion from a set of premises. Of particular interest are the four conditional syllogistic paradigms (or argument forms) shown in Table 1. The modus tollens argument form may be used to introduce the terms necessary for subsequent discussion.

1	Modus tollens ("denying the consequent"): Major premise: If A is true, then B is found. Minor premise: –B (B is not found). Conclusion: A is definitely not true.
2	Affirming the consequent: Major premise: If A is true, then B is found. Minor premise: B (B is found). Conclusion: A's truth-value is indeterminate.
3	Modus ponens ("affirming the antecedent"): Major premise: If A is true, then B is found. Minor premise: A (A is true). Conclusion: B is definitely true.
4	Denying the antecedent: Major premise: If A is true, then B is found. Minor premise: –A (A is not true). Conclusion: B's truth-value is indeterminate.

Table 1. Four conditional syllogistic argument forms whose major premise is a conditional proposition

Consider the meanings of "truth-value" and "categorical proposition" with reference to [E1] and [E2]:
[E1]: An automobile has four wheels.
[E2]: If Theory T is true, then Implication I is true.
If what is described in [E1] is indeed the case, E1's truth-value is true. If what [E1] describes is not the case, [E1] has "false" as its truth-value. [E1] is a categorical proposition in the sense that its truth-value is determined solely by what it says without referring to any other proposition. This is not the case with [E2], which has three components: the two categorical propositions, "Theory T is true" and "Implication I is true," and the logical operator "If . . . then . . ."
The operator "If . . . then . . ." stipulates the logical operations that are permissible on the antecedent and consequent. [E2] is a conditional proposition in the sense that its truth-value is contingent on the truth-values of its antecedent and consequent. The proposition that follows "If" is the antecedent, whereas the proposition that follows

"then" is the consequent of the conditional proposition. As may be seen from Table 2, the conditional proposition is false only when it has a true antecedent and a false consequent.

Truth-value of antecedent "A is true"	**Truth-value of consequent "B is found"**	**Truth-value of the conditional proposition "If A is true, then B is found"**
True	True	True
True	False	False
False	True	True
False	False	True

Table 2. The truth-values of the conditional proposition

An argument is a syllogism if it is made up of three propositions such that the first two (called the "major premise" and "minor premise," respectively) form the basis for deriving the third one (the conclusion). A conditional syllogism is one whose major premise is a conditional proposition. The inferential foundation of empirical research is the conditional syllogism.

As may be seen from Table 1, the categorical proposition used as the minor premise of the conditional syllogism may affirm or deny the truth of the antecedent or consequent. Such a state of affairs gives rise to four argument forms. The modus tollens form says that denying the truth of the consequent warrants concluding that the antecedent is false. The modus ponens form says that affirming the truth of the antecedent justifies accepting the consequent as true. No definite conclusion can be drawn when the consequent is affirmed or when the antecedent is denied **(see *Quasi-Experimentation*).**

2.2.2. Graphical Representation of the Conditional Syllogisms

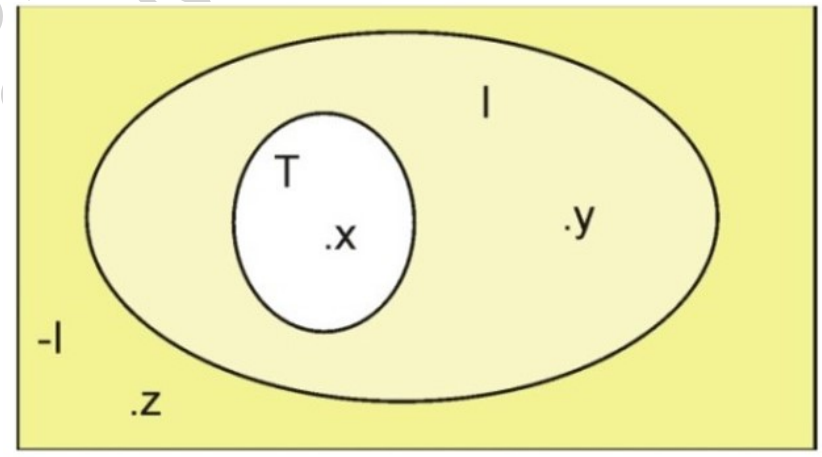

Figure 1. A Venn diagram illustrating the four conditional syllogistic argument forms

A graphical representation may be used to overcome the counter-intuitive feel of the "affirming the consequent" and "denying the antecedent" paradigms. For the purpose of the present exposition, "If T, then I" means that all members of T are members of I. This is represented in Figure 1 by placing the smaller oval T inside the larger oval I.

The area outside oval T is –T. By the same token, the area outside oval I is –I. The elements x, y, and z represent particular members of T, I, and –I, respectively. The four syllogistic argument forms shown in Table 1 may now be explicated, shown in Figure 1.

In terms of Figure 1, to assert –I is to say that there is an element that is not a member of I. This is the assertion of the minor premise of the modus tollens argument form. Such an element may either be y or z. As both y and z are outside oval T, neither of them can be a member of T. This shows why denying I (i.e. asserting –I) warrants the –T conclusion in the modus tollens paradigm.

To say that I is true, amounts to saying that there is an element that is a member of I. Both x and y fill the bill. However, while x is member of T, y is not. In other words, knowing that there is a member of I does not warrant the conclusion that there is a member of T. Hence, affirming the consequent leaves indeterminate the truth-value of the antecedent of the conditional proposition.

The modus ponens rule may be explicated in like manner. Being a member of T, x is also a member of I by virtue of the inclusion of T in I. Hence, if T is true, I is true. Although neither y nor z is a member of T (i.e. –T), y is nonetheless a member of I. Consequently, knowing that there is an element that is not a member of T is not informative as to its membership in I. Hence, denying the antecedent of "If T, then I" leaves the truth-value of I indeterminate.

2.2.3. Inductive Logic

The proposition "All X are Y" is a universal (or general) proposition in the sense that it makes an assertion about **all** tokens of X, namely, that they are all members of Y. In contrast, "Some X are Y" is a particular statement that asserts that only some tokens of X are members of Y.

The function of inductive logic is commonly understood as a means that enables us to leap from the particular proposition to its universal counterpart. For example, having seen white swans without exception in the past, the budding naturalist may conclude (albeit incorrectly) that "All swans are white." That is, induction in such a view is generalization on the basis of enumeration. However, this commonly held view is unsatisfactory.

For example, what is the minimal number of white swans that warrants the generalization? Psychologists actually use more sophisticated inductive rules to reduce ambiguities in their explanation of data **(see *Experimentation in Psychology—Rationale, Concepts, and Issues*)**.

2.2.4. Three Logical Relationships

References are often made in theoretical discussions to one of three logical relationships between two variables or between a variable and a phenomenon: (a) the necessary condition, (b) the sufficient condition, and (c) the necessary and sufficient condition. Each of them (particularly the necessary and sufficient condition) at various times has been identified with the causal agent.

Z is the necessary condition for E if, in the absence of Z, E cannot occur. Suppose that Z refers to studying conscientiously and E stands for passing the examination. Suppose that students who do not study conscientiously do not pass the examination. In such an event, studying conscientiously is the necessary condition for passing the examination.
W is the sufficient condition for Y when Y always occurs in the presence of W. An example may be the observation that whenever an individual gives birth, the individual is always a female. That is, Y refers to being a female, and W stands for giving birth. (However, as will be seen in ***Section 2.2.5. Formal Rules and Relationships in Theoretical Discussion***, giving birth is not the sufficient condition for being a female.)
Variable A is the necessary and sufficient condition for Event B if (a) Event B cannot occur in the absence of Variable A, and (b) Event B occurs whenever Variable A is present. Suppose that A refers to water, and B stands for the flourishing garden. In the presence of plenty of sunshine and good soil, water is the necessary and sufficient condition for the flourishing garden.

2.2.5. Formal Rules and Relationships in Theoretical Discussion

The logical rules and relationships described are applicable to all subject matters. This shows that logic and substantive issues belong to different domains. Specifically, knowing that water is the necessary and sufficient condition for the garden to flourish is to become knowledgeable of a formal relationship between water, sunshine, soil quality, and plant growth. There still remains the substantive question as to why water bears such a relationship to plant growth, given sunshine and a good soil. It follows that the necessary and sufficient condition cannot be identified with the cause. Similarly, neither a sufficient nor a necessary condition should be so identified. A logical relation is simply not a causal relationship.

The seahorse's breeding method is unusual because it is the males who give birth. Hence, it is incorrect to say that being a mother is a sufficient condition for being a female. This counter example shows that the "induction by enumeration" procedure is an unsatisfactory means for establishing knowledge. It takes only one negative example to give the lie to the putative sufficient relationship between motherhood and being a female. Likewise, the four conditional syllogisms are formal rules. Indicative of their having no substantive import is the fact that they are used in the same way, regardless of what T and I represent or how T and I are obtained. This does not pose any problem for logicians because they do not have to consider what T or I says or why Propositions T and I have the implicative relationship entailed in "If T, then I." Nor have they to explain why the minor premise is I or –I. Nonetheless, the logical relations and four conditional syllogistic argument forms are implicated in theoretical discussion **(see *Quasi-Experimentation*).**

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Biographical Sketch

Siu L. Chow obtained his B.A. Honours from the University of Adelaide, Australia, and his Ph.D. from the University of Toronto, Canada. He is currently professor of psychology at the University of Regina, Canada.