

Behavioral Science

Psychology is a Behavioral Science. Our basic questions are about human and animal behavior and the brain/mental processes that underlie this behavior.

In trying to explain behavior, we will use terms like thinking, feeling, etc. These terms are part of our explanation or theory of behavior. *They are not, themselves, observable.*

Example: What does it mean to say that the color of something is **blue**? How would you convey the experience of "**blue**" to someone who is blind? The *perception* of color is a mental event, it is private and unobservable.

To investigate color perception, we rely on observable events, such as the verbal labels people give to colors, their ability to match colors, to distinguish among different colors, to recognize a previously presented color, and the speed with which they can do these tasks.

Mental events (e.g. perception) are part of our theory that we use to explain observable events (behavior).

I. Benefits of Scientific Approach

- A) Increased understanding of human and animal behavior

- B) Solutions to practical problems

II. Benefits of Learning the Scientific Method

- A) To conduct research into problems that you find interesting

- B) To be able to evaluate information (data and conclusions) that is presented to you

III. The Research Process:

A) Research Idea

1. Observation
2. Experts
3. Journals & Books

B) Formulate a Testable Hypothesis

Restate idea as a proposed relation between variables. Specify precisely how variables are to be measured (*operational definition*).

C) Review the Literature

Find out what has been done, how it has been done, what variables need to be controlled, what explanations have been proposed.

D) Research Protocol

Prepare a research proposal for review of the ethical considerations in the use of human/animal participants.

E) Pilot Study

Small scale test to check out instructions, task, equipment, etc.

F) Run Study

G) Tabulate and Analyze Data

This involves the use of descriptive and inferential statistics.

H) Write Report/Communicate Results

Science is a public enterprise and can only be self correcting and contribute to our (human) knowledge when others have access to the data and their interpretation.

IV. Potential Problem Areas

A) Ethical treatment of subjects (human or animal).

B) Poorly formulated hypothesis, operational definitions that do not adequately capture the variables being investigated.

C) Research design that can not answer the hypothesis being tested. Conclusions that are not justified based on data.

D) Biased research (overt or covert) so that data are not valid.

E) Unreliable communication. Use of terms in science requires more precision than in everyday language.

Science - Data and Explanation

I. Science as a Way of Acquiring Knowledge

A science is a discipline that uses the *scientific method* to organize, explain, and predict *facts*.

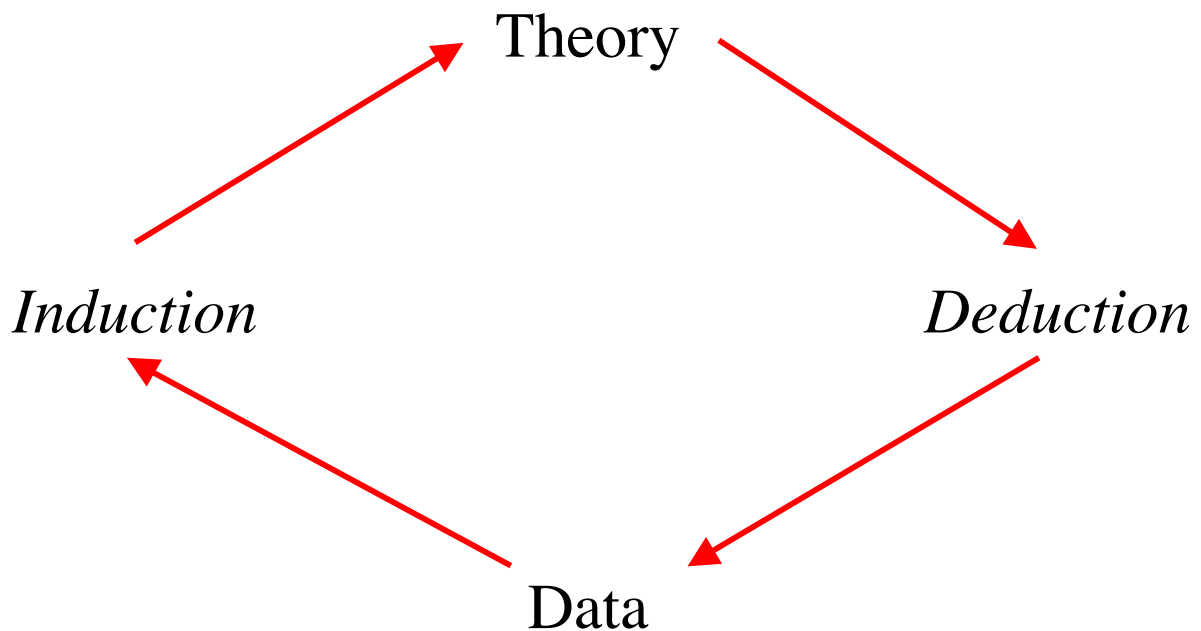
The facts are observable events. These events are often termed data. Thus, the scientific method incorporates *empiricism* (observation).

The organization, explanation, and prediction of facts is based on logic. Thus, science incorporates *rationalism*. The logic used involves induction and deduction:

Induction - reasoning from a set of data to an explanation (theory).

Deduction - deriving predictions from an explanation (theory) about new data.

The scientific method involves collecting the data (facts) under well defined, repeatable (public) conditions. Because of this, explanations (theories) can be tested, modified and/or discarded on the basis of evidence. That is, explanations (Theory) in science have an objective process for testing and correcting. The scientific method is often described as self correcting.



II. Other Ways of Acquiring Knowledge

A) **Authority** - Accept from an authority. Religion, parents, teachers, etc. often rely on this. It is fast and efficient, but not self correcting.

B) **Tenacity** - Holding an idea because it has “always been that way”. Cultures, religion, also use this. It is fast and efficient, but not self correcting.

C) **A priori or Intuition** - Believed if it seems reasonable. Common sense, cultural norms. Not (usually) self correcting.

None of these are self correcting. Science uses rationalism and empiricism in a self-correcting cycle.

III. Explanation (Theory) in Science

Data, by themselves, are not science. The data must be organized and explained. Also, we need to be able to anticipate (predict) new data. *This is the role of a theory or explanation.*

Note that simply labeling or classifying something is NOT an explanation or theory. It is a description.

All theories meet certain criteria:

A) Precision

A theory is a series of statements that relate conditions in the world to data. The statements can be in a natural language, computer program, or mathematical equations. *These statements should be as precise as possible.*

Precision eliminates ambiguity and makes possible our second criterion.

B) Testability

Regardless of form, the statements must be capable of being tested, empirically. *We must be able to translate the explanation into predictions that are testable using observation. If this can not be done, then the theory is not testable and is useless.*

The theory must also make predictions that could be disconfirmed. That is, it must be possible to disprove (refute) the theory. *If the predictions are not, in principle, refutable, then the theory is not testable and is useless.*

C) Parsimony

Theories often use intervening variables to explain how data are related. *All other things being equal, the fewer the number of intervening variables, the better the theory.* Put another way, the simpler the better.

D) Question 1 - Which type of evidence is stronger? Confirmation of a theory (data that come out as predicted) or disconfirmation (data that do *not* come out as predicted)?

Confirming data can NOT show a theory to be true. You can NOT prove a theory to be correct. To prove a theory, you would need to know all of the facts related to the theory. In addition, would other theories have made the same prediction?

Disconfirming data do show a theory (or the part of the theory being tested) to be false.

Thus, *disconfirming data are stronger evidence.*

Example of using disconfirming evidence:

Statement to be evaluated (Theory): If a card has a letter on one side that is a *vowel*, then the digit on the other side will be *even*.

Which of the four cards, below, would you turn over to test this theory?



1. Card with vowel E. If an odd digit is on other side, statement is false.
2. Card with digit 5. If a vowel is on the other side, statement is false.

Regardless of what is on the other side of the card with J or the card with 8, the statement can not be disconfirmed.

E) Question 2 - How do we choose between two competing theories?

- a) parsimony
- b) precision
- c) empirical test

Empirical test provides the best route. Each theory must make falsifiable predictions. Find a set of conditions where their predictions are different. Run the study. There are three basic possible outcomes:

1. Theory 1 predictions verified, Theory 2 falsified
2. Theory 2 predictions verified, Theory 1 falsified
3. Both theories falsified

This approach is called *strong inference*. Basically, we are asking not only that the theory being tested be falsifiable, but that there must be a reasonable, alternative theory that makes different predictions than the theory of interest. This guarantees that we will get strong evidence (falsification of one or more theories) out of the experiment.

IV. Hard Science vs. Soft Science

A) Are the hard sciences (physics, chemistry, etc.) the appropriate model for psychology?

No - The core aspects of human experience (arts, literature, religion) defy scientific analysis.

Yes - While questions like whether there is a god or whether a painting is beautiful may not be amenable to scientific analysis, the question of how people obtain, maintain, and act on these beliefs is.

B) The Hard Science Approach: There are three basic ways that we can do scientific/empirically based psychology:

1. *Naturalistic observation* - taking advantage of naturally occurring events and situations to observe various aspects of behavior (dependent variable).

The case study, involving extensive study of a single individual, is similar.

2. *Relational & survey designs* - controlled measurement of naturally occurring variation in behaviors (dependent variable) hypothesized to be related.

3. *Experimental designs* - controlled manipulation of situation (independent variable) and measurement of behaviors (dependent variable) hypothesized to be related.

The first two have the advantage of "relevance" to the real world. The later two have the advantage of greater "control" of potential problems in interpreting the data (confounding variables). Experimental designs have the additional advantage of allowing us to *infer causation*. Applied and basic research make use all three. Human and animal behavior are understood by using all three.

C) Example: Social Loafing -

This phenomenon, described by Ringelmann, is where a person working in a group does not put out as much effort (does not work as hard) as when working alone.

1. Example: Rope pulling task. Effort while pulling is measured. Our baseline is having each individual pull by themselves. This represents “full” effort. Then, they pull with one, two or seven others (groups of 2, 3, and 8 total).

Group size	Percent Effort
1	100%
2	95%
3	85%
8	49%

This is an experimental demonstration of the phenomenon. Since everything except the number of people pulling together is held constant or controlled, only something about working in a group must be the cause of the decrease in effort.

2. Work of Latané -

Showed that this effect occurs with other tasks, with a range of ages including children, and with different cultures.

Explanation was diffusion of responsibility. With more people in a group, each individual feels less responsible for the group work product.

This has applications in the workplace to issues of productivity and quality control.

The explanation of diffusion of responsibility leads to a prediction. If individuals in a group know that their contribution is being monitored, then diffusion of responsibility should not happen. Studies in both the laboratory and in factory settings confirm this prediction.

V. Basic and Applied Research

A) *Basic Research* – directed at testing theories and our understanding of human behavior without necessarily having a connection to a particular problem in the world around us. Cognitive Psychology is the study of human mental processes and their relation to individual behavior.

B) *Applied Research* – directed at answering questions about particular real world problems. Human Factors is the study of how humans interact with machines and the environment in particular, real world situations. In a sense, Human Factors is applied Cognitive Psychology.

Scientific progress depends upon the interaction between basic and applied research. Without the theory and data of basic research, applied research has little direction and no underlying explanations. Without applied research, basic research loses its connection to the real world.

Advances in applied research often come from unexpected aspects of basic or other applied research. This is part of the reason that advances in technology (applied research) are more likely to happen with a strong base of basic research.

Sample Questions for Chapter 1

1. When we draw general conclusions on the basis of observations from a limited sample or set of data, we are using: a) induction b) deduction c) intuition d) a & b above

2. When it comes to evaluating theories: a) the nature of induction makes negative evidence more important than positive support - if data confirm a prediction, one cannot be certain that the theory is true b) the nature of induction makes positive support more important than negative evidence - if data confirm a prediction, one can be certain that the theory is true c) the logic of deduction is a more sound scientific reasoning than the logic of induction d) b & c above

3. The major functions of a psychological theory are to organize and explain data, and to predict new data. To do this, all theories must meet certain criteria. Which of the following are criteria for a scientific theory? a) a series of precise statements that organize and explain observations b) it must be possible to prove the theory to be correct c) it must generate predictions that are, in principle, refutable d) a & c above

4. Understanding or knowing about the world through the observation of events is called: a) intuition b) rationalism c) empiricism d) none of the above

5. The basic facts in the scientific study of Psychology are: a) the mental state(s) of the individual b) the observable behavior of the individual c) the theories proposed to explain behavior d) all of the above