Explanation

Finally, explanation allows us to identify the causes that determine when and why a behavior occurs. To explain a behavior, we need to demonstrate that we can manipulate the factors needed to produce or eliminate the behavior. For example, if our channel-changing example, if gender predicts channel changing, what might cause it? It could be genetic or environmental. Maybe men have less tolerance for commercials and thus change channels at a greater rate. Maybe women are more interested in the content of commercials and are thus less likely to change channels. Maybe the attention span of women is longer. Maybe something associated with having a Y chromosome increases channel changing, or something associated with having two X chromosomes leads to less channel changing. Obviously there are a wide variety of possible explanations. As scientists, we test these possibilities to identify the best explanation of why a behavior occurs. When we try to identify the best explanation for a behavior, we must systematically eliminate any alternative explanations. To eliminate alternative explanations, we must impose control over the research situation. We will discuss the concepts of control and alternative explanations shortly.

An Introduction to Research Methods in Science

The goals of science map very closely onto the research methods scientists use. In other words, there are methods that are descriptive in nature, predictive in nature, and explanatory in nature. We will briefly introduce these methods here; the remainder of the text covers these methods in far greater detail. Descriptive methods are covered in Chapter 4, and descriptive statistics are discussed in Chapter 5; predictive methods and statistics are covered in Chapters 6 and 13; and explanatory methods are covered in Chapters 9 through 12. Thus, what follows will briefly introduce you to some of the concepts that we will be discussing in greater detail throughout the remainder of this text.

Descriptive Methods

Psychologists use three types of descriptive methods. First is the observational method—simply observing human or animal behavior. Psychologists approach observation in two ways. Naturalistic observation involves observing how humans or animals behave in their natural habitat. Observing the mating behavior of chimpanzees in their natural setting is an example of this approach. Laboratory observation involves observing behavior in a more controlled and controlled situation, usually the laboratory. Bringing children to a laboratory playroom to observe play behavior is an example of this approach. Observation involves description at its most basic level. One advantage of the observational method, as well as other descriptive methods, is the flexibility to change whatever you are studying. A disadvantage of descriptive methods is that the researcher has little control. As we use more powerful methods, we gain control but lose flexibility.

A second descriptive method is the case study method. A case study is an in-depth study of one or more individuals. Freud used case studies to develop his theory of personality development. Similarly, Jean Piaget used case studies to develop his theory of cognitive development in children. This method is descriptive in nature because it involves simply describing the individual(s) being studied.

The third method that relies on description is the survey method—questioning individuals on a topic or topics and then describing their responses. Surveys can be administered by mail, over the phone, on the Internet, or in a personal interview. One advantage of the survey method over the other descriptive methods is that it allows researchers to study larger groups of individuals more easily. This method has disadvantages, however. One concern is whether the group of people who participate in the study (the sample) is representative of all of the people about whom the study is meant to generalize (the population). This concern can usually be overcome through random sampling. A random sample is achieved when, through random selection, each member of the population is equally likely to be chosen as part of the sample. Another concern has to do with the wording of questions. Are they easy to understand? Are they written in such a manner that they bias the respondents' answers? Such concerns relate to the validity of the data collected.

Predictive (Relational) Methods

Two methods allow researchers not only to describe behaviors but also to predict from one variable to another. The first, the correlational method, assesses the degree of relationship between two measured variables. If two variables are correlated with each other, then we can predict from one variable to the other with a certain degree of accuracy. For example, height and weight are correlated. The relationship is such that an increase in one variable (height) is generally accompanied by an increase in the other variable (weight). Knowing this, we can predict an individual's approximate weight, with a certain degree of accuracy, based on knowing the person's height.

One problem with correlational research is that it is often misinterpreted. Frequently, people assume that because two variables are correlated, there must be some sort of causal relationship between the variables. This is not so. Correlation does not imply causation. Please remember that a correlation simply means that the two variables are related in some way. For example, being a certain height does not cause you to also be a certain weight. It would be nice if it did because then we would not have to worry about being either underweight or overweight. What if I told you that watching violent television and displaying aggressive behavior were correlated? Psychologists have established that such a relationship exists (Bushman & Anderson, 2007; Gunter, 2008; Murray, 2008). What could you conclude based on this correlation? Many people might conclude that watching violent television causes one to act
more aggressively. Based on the evidence given (a correlational study), however, we cannot draw this conclusion. All we can conclude is that those who watch more violent television programs also tend to exhibit more aggression. It is possible that violent television causes aggression, but we cannot draw this conclusion based only on correlational data. It is also possible that those who are aggressive by nature are attracted to more violent television programs, or that some other "third" variable is causing both aggressive behavior and violent television watching. The point is that observing a correlation between two variables means only that they are related to each other.

The correlation between height and weight, or violent television and aggressive behavior, is a positive relationship: as one variable (height or violent television) increases, we observe an increase in the second variable (weight or aggressive behavior). Some correlations indicate a negative relationship, meaning that as one variable increases, the other variable systematically decreases. Can you think of an example of a negative relationship between two variables? Consider this: as mountain elevation increases, temperature decreases. Negative correlations also allow us to predict from one variable to another. If I know the mountain elevation, it will help me predict the approximate temperature.

Besides the correlational method, a second method that allows us to describe and predict is the quasi-experimental method. The quasi-experimental method allows us to compare naturally occurring groups of individuals. For example, we could examine whether alcohol consumption by students in a fraternity or sorority differs from that of students not in such organizations. You will see in a moment that this method differs from the experimental method, described later, in that the groups studied occur naturally. In other words, we do not control whether or not people join a Greek organization. They have chosen their groups on their own, and we are simply looking for differences (in this case, in the amount of alcohol typically consumed) between these naturally occurring groups. This is often referred to as a subject or participant variable—a characteristic inherent in the subjects that cannot be changed. Because we are using groups that occur naturally, any differences that we find may be due to the variable of being or not being a Greek member, or they may be due to other factors that we were unable to control in this study. For example, maybe those who like to drink more are also more likely to join a Greek organization. Once again, if we find a difference between these groups in amount of alcohol consumed, we can use this finding to conclude that Greeks (or Greek students) are more likely to drink more. However, we cannot conclude that belonging to a Greek organization causes one to drink more because the subjects came to us after choosing to belong to these organizations. In other words, what is missing is a causal relationship because there could be other alternative explanations for this relationship. An alternative explanation is the idea that it is possible that some other, uncontrolled, extraneous variable may be responsible for the observed relationship. For example, maybe those who choose to join Greek organizations come from higher-income families and have more money to spend on such things as alcohol. Or maybe those who choose to join Greek organizations are more interested in socialization and drinking alcohol before they even join the organization. Thus, because these methods leave the possibility for alternative explanations, we cannot use them to establish cause-and-effect relationships.

Explanatory Method

When using the experimental method, researchers pay a great deal of attention to eliminating alternative explanations by using the proper controls. Because of this, the experimental method allows researchers not only to describe and predict but also to determine whether a cause-and-effect relationship exists between the variables of interest. In other words, this method enables researchers to know when and why a behavior occurs. Many preconditions must be met for a study to be experimental in nature; we will discuss many of these in detail in later chapters. Here, we will simply consider the basics—the minimum requirements needed for an experiment.

The basic premise of experimentation is that the researcher controls as much as possible to determine whether a cause-and-effect relationship exists between the variables being studied. Let's say, for example, that a researcher is interested in whether cell phone use while driving affects driving performance. The idea behind experimentation is that the researcher manipulates at least one variable (known as the independent variable) and measures at least one variable (known as the dependent variable). In our study, what should the researcher manipulate? If you identified the use of cell phones while driving, then you are correct. If cell phone use while driving is the independent variable, then driving performance is the dependent variable. For comparative purposes, the independent variable has to have at least two groups or conditions. We typically refer to these two groups or conditions as the control group and the experimental group. The control group is the group that serves as the baseline or "standard" condition. In our cell phone use while driving study, the control group does not use a cell phone while driving. The experimental group is the group that receives the treatment—in this case, those who use cell phones while driving. Thus, in an experiment, one thing that we control is the level of the independent variable that subjects receive.

What else should we control to help eliminate alternative explanations? Well, we need to control the type of subjects in each of the treatment conditions. We should begin by drawing a random sample of subjects from the population. After we have our sample of subjects, we have to decide who will serve in the control group versus the experimental group. To gain as much control as possible and eliminate as many alternative explanations as possible, we should use random assignment—assigning subjects to conditions in such a way that each participant has an equal probability of being
placed in any condition. Random assignment helps us to gain control and eliminate alternative explanations by minimizing or eliminating differences between the groups. In other words, we want the two groups of participants to be as alike as possible. The only difference we want between the groups is that of the independent variable we are manipulating—either using or not using cell phones while driving. After subjects are assigned to conditions, we measure driving performance (the dependent variable) for subjects in each condition using a driving simulator. Studies such as this one have already been completed by researchers. What researchers have found is that cell phone use while driving has a negative effect on driving performance (Beede & Kans, 2006; Dula, Martin, Fox, & Leonard, 2011).

Let’s review some of the controls we have used in the present study. We have controlled who is in the study (we want a sample representative of the population about whom we are trying to generalize), who participates in each group (we should randomly assign subjects to the two conditions), and the treatment each group receives as part of the study (some take the driving test while using cell phones whereas others take the driving test while not using cell phones). Can you identify other variables that we might need to consider controlling in the present study? How about past driving record, how long subjects have driven, age, and their proficiency with cell phones? There are undoubtedly other variables we would need to control if we were to complete this study. We will discuss control in greater detail in later chapters, but the basic idea is that when using the experimental method, we try to control as much as possible by manipulating the independent variable and controlling any other extraneous variables that could affect the results of the study. Randomly assigning participants also helps to control for participant differences between the groups. What does all of this control gain us? If, after completing this study with the proper controls, we found that those in the experimental group (those who drove while using a cell phone) did, in fact, have lower driving performance scores than those in the control group, we would have evidence supporting a cause-and-effect relationship between these variables. In other words, we could conclude that driving while using a cell phone negatively impacts driving performance.

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**CRITICAL THINKING CHECK**

1. In a recent study, researchers found a negative correlation between income level and incidence of psychological disorders. Jim thinks this means that being poor leads to psychological disorders. Is he correct in his conclusion? Why or why not?
2. In a study designed to assess the effects of smoking on life satisfaction, subjects were assigned to groups based on whether or not they reported smoking. All subjects then completed a life satisfaction inventory.
   a. What is the independent variable?
   b. What is the dependent variable?
   c. Is the independent variable a subject variable or a true manipulated variable?
3. What type of method would you recommend researchers use to answer the following questions?
   a. What percentage of cars run red lights?
   b. Do student athletes spend as much time studying as student nonathletes?
   c. Is there a relationship between type of punishment used by parents and aggressiveness in children?
   d. Do athletes who are randomly assigned to use imaging techniques perform better than those who are not randomly assigned to use such techniques?
4. Your mother claims that she has found a wonderful new treatment for her arthritis. She read "somewhere" that rubbing vinegar in the affected area for 10 minutes twice a day would help. She tried this and is convinced that her arthritis has been lessened. She now thinks that the medical community should recommend this treatment. What alternative explanation(s) might you offer to your mother for why she feels better? How would you explain to her that her evidence is not sufficient for the medical/scientific community?

**Doing Science**

Although the experimental method can establish a cause-and-effect relationship, most researchers would not wholeheartedly accept a conclusion from only one study. Why is that? Any one of a number of problems can occur in a study. For example, there may be control problems. Researchers may believe they have controlled everything but miss something, and the uncontrolled factor may affect the results. In other words, a researcher may believe that the manipulated independent variable caused the results when, in reality, it was something else.

Another reason for caution in interpreting experimental results is that a study may be limited by the technical equipment available at the time. For example, in the early part of the 19th century, many scientists believed that studying the bungs on a person’s head allowed them to know something
about the internal mind of the individual being studied. This movement, known as phrenology, was popularized through the writings of physician Joseph Gall (1758–1828). Based on what you have learned in this chapter, you can most likely see that phrenology is a pseudoscience. However, at the time it was popular, phrenology appeared very "scientific" and "technical."

Obviously, with hindsight and with the technological advances that we have today, the idea of phrenology seems somewhat laughable to us now.

Finally, we cannot completely rely on the findings of one study because a single study cannot tell us everything about a theory. The idea of science is that it is not static; the theories generated through science change. For example, we often hear about new findings in the medical field, such as "Eggs are so high in cholesterol that you should eat no more than two a week." Then, a couple of years later, we might read "Eggs are not as bad for you as originally thought. New research shows that it is acceptable to eat them every day," followed a few years later by even more recent research indicating that "two eggs a day are as bad for you as smoking cigarettes every day" (Spence, Jenkins, & Davignon, 2012). People may complain when confronted with such contradictory findings: "Those doctors, they don’t know what they’re talking about. You can’t believe any of them. First they say one thing, and then they say completely the opposite. It’s best to just ignore all of them." The point is that when testing a theory scientifically, we may obtain contradictory results. These contradictions may lead to new, very valuable information that subsequently leads to a theoretical change. Theories evolve and change over time based on the consensus of the research. Just because a particular idea or theory is supported by data from one study does not mean that the research on that topic ends and that we just accept the theory as it currently stands and never do any more research on that topic.

**Proof and Disproof**

When scientists test theories, they do not try to prove them true. Theories can be supported based on the data collected, but obtaining support for something does not mean it is true in all instances. Proof of a theory is logically impossible. As an example, consider the following problem, adapted from Griggs and Cox (1982). This is known as the Drinking Age Problem (the reason for the name will become readily apparent).

Imagine that you are a police officer responsible for making sure that the drinking age rule is being followed. The four cards below represent information about four people sitting at a table. One side of a card indicates what the person is drinking, and the other side of the card indicates the person’s age. The rule is: "If a person is drinking alcohol, then the person is 21 or over." In order to test whether the rule is true or false, which card or cards below would you turn over? Turn over only the card or cards that you need to check to be sure.

---

Does turning over the beer card and finding that the person is 21 years of age or older prove that the rule is always true? No, the fact that one person is following the rule does not mean that it is always true. How, then, do we test a hypothesis? We test a hypothesis by attempting to falsify or disprove it. If it cannot be falsified, then we say we have support for it. Which cards would you choose in an attempt to falsify the rule in the Drinking Age Problem? If you identified the beer card as being able to falsify the rule, then you were correct. If we turn over the beer card and find that the individual is under 21 years of age, then the rule is false. Is there another card that could also falsify the rule? Yes, the 16 years of age card can. How? If we turn that card over and find that the individual is drinking alcohol, then the rule is false. These are the only two cards that can potentially falsify the rule. Thus, they are the only two cards that need to be turned over.

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Even though disproof or disconfirmation is logically sound in terms of testing hypotheses, falsifying a hypothesis does not always mean that the hypothesis is false. Why? There may be design problems in the study, as described earlier. Thus, even when a theory is falsified, we need to be cautious in our interpretation. The point to be taken is that we do not want to completely discount a theory based on a single study.
The Research Process

The actual process of conducting research involves several steps, the first of which is to identify a problem. Accomplishing this step is discussed more fully in Chapter 2. The other steps include reviewing the literature (Chapter 2), generating hypotheses (Chapter 7), designing and conducting the study (Chapters 4 and 8 through 13), analyzing the data and interpreting the results (Chapters 5 through 6, 8, 10 through 12, and 14), and communicating the results (Chapter 15).

Summary

We began the chapter by stressing the importance of research in psychology. We identified different areas within the discipline of psychology in which research is conducted such as psychobiology, cognition, human development, social psychology, and psychotherapy. We discussed various sources of knowledge, including intuition, superstition, authority, tenacity, rationalism, empiricism, and science. We stressed the importance of using the scientific method to gain knowledge in psychology. The scientific method is a combination of empiricism and rationalism; it must meet the criteria of systematic empiricism, public verification, and empirically solvable problems. We outlined the three goals of science (description, prediction, and explanation) and related them to the research methods used by psychologists. Descriptive methods include observation, case study, and survey methods. Predictive methods include correlation and quasi-experimental methods. The experimental method allows for explanation of cause-and-effect relationships. Finally, we introduced some practicalities of doing research, discussed proof and disproof in science, and noted that testing a hypothesis involves attempting to falsify it.

KEY TERMS

- knowledge via superstition
- knowledge via authority
- knowledge via tectonic
- knowledge via rationalism
- knowledge via empiricism
- knowledge via science
- hypothesis
- variable
- theory
- skeptic
- systematic empiricism
- publicly verifiable knowledge
- empirically solvable problems
- principle of falsifiability
- pseudoscience
- basic research
- applied research
- description
- prediction
- explanation
- observational method
- naturalistic observation
- laboratory observation
- case study method
- survey method
- sample
- population
- random sample
- correlational method
- positive relationship
- negative relationship
- quasi-experimental method
- subject (participant) variable
- alternative explanation
- experimental method
- independent variable
- dependent variable
- control group
- experimental group
- random assignment
- control

CHAPTER EXERCISES

(Answers to odd-numbered exercises appear in Appendix C.)

1. Identify a piece of information that you have gained through each of the sources of knowledge discussed in this chapter (superstition and intuition, authority, tenacity, rationalism, empiricism, and science).

2. Provide an argument for the idea that basic research is as important as applied research.

3. Why is it a compliment for a scientist to be called a skeptic?

4. An inferences of science "A study proves that Fat-Blacs work, and it will work for you also."

5. Many psychology students believe that they do not need to know about research methods because they plan to pursue careers in clinical/counseling psychology. What argument can you provide against this view?

6. In a study of the effects of types of study in exam performance, subjects are randomly assigned to one of two conditions. In one condition, subjects study in a traditional manner—alone using notes they took during class lectures. In a second condition, subjects study in interactive groups with notes from class lectures. The amount of time spent studying is held constant. All students then take the same exam on the material.

   a. What is the independent variable in this study?

   b. What is the dependent variable in this study?

7. Researchers interested in the effects of caffeine on anxiety have randomly assigned participants to one of two conditions in a study—the no-caffeine condition or the caffeine condition. After drinking two cups of either regular or decaffeinated coffee, participants will take an anxiety inventory.

   a. What is the independent variable in this study?

   b. What is the dependent variable in this study?

   c. Identify the control and experimental groups in this study.

   d. Is the independent variable manipulated, or is it a subject variable?

8. Gerontologists interested in the effects of aging on reaction time have two groups of subjects take a test in which they must indicate as quickly as possible whether a probe word was a member of a previous set of words. One group of subjects is between the ages of 25 and 45, and the other group is between the ages of 65 and 85. The time it takes to make the response is measured.

   a. What is the independent variable in this study?

   b. What is the dependent variable in this study?

   c. Identify the control and experimental groups in this study.

   d. Is the independent variable manipulated, or is it a subject variable?

CRITICAL THINKING CHECK ANSWERS

1.1

1. Knowledge via authority

2. Knowledge via empiricism

3. Knowledge via superstition or intuition

1.2

1. A theory such as Freud's violates the principle of falsifiability because it is not possible to falsify or test the theory. Freud attributes much of personality to unconscious drives, and there is no way to test whether this is so—or, for that matter, whether there is such a thing as an unconscious drive. The theory is irreducible not just because it deals with unconscious drives but also because it is too vague and flexible—it can explain any outcome.

2. Belief in paranormal events is a currently popular pseudoscience (based on the popularity of various cable shows on ESP, psychics, and ghost-hunters). Belief in paranormal events
WEB RESOURCES

The book-specific website at CengageBrain.com offers students a variety of study tools and useful resources such as glossaries and flashcards.

Chapter 1 · Study Guide

CHAPTER 1 SUMMARY AND REVIEW: THINKING LIKE A SCIENTIST

We began the section by stressing the importance of research in psychology. We identified different areas within the discipline of psychology in which research is conducted, such as psychology, cognition, human development, social psychology, and psychotherapy. We discussed various sources of knowledge, including intuition, superstition, authority, tenacity, rationalism, empiricism, and science. We stressed the importance of using the scientific method to gain knowledge in psychology. The scientific method is a combination of empiricism and rationalism; it must meet the criteria of systematic empiricism, public verification, and empirically solvable problems. We outlined the three goals of science (description, prediction, and explanation) and related them to the research methods used by psychologists. Descriptive methods include observation, case study, and survey methods. Predictive methods include correlational and quasi-experimental methods. The experimental method allows for explanation of cause-and-effect relationships. Finally, we introduced some practicalities of doing research, discussed proof and disproof in science, and noted that testing a hypothesis involves attempting to falsify it.

CHAPTER 1 REVIEW EXERCISES

(Answers to exercises appear in Appendix C.)

FILL-IN SELF-TEST

Answer the following questions. If you have trouble answering any of the questions, restudy the relevant material before going on to the multiple-choice self-test.

1. A correlation is the study of psychological issues that have practical significance and potential solutions.
2. The independent variable is life satisfaction.
3. a. Naturalistic observation
   b. Controlled observation
   c. Correlational study
   d. Experimental study
4. A correlation coefficient indicates the strength of the relationship.
5. A correlation indicates that there is a relationship between two variables in a study.
6. A correlation indicates that there is a relationship between two variables in a study.
7. The three goals of science are
8. Methodology involves the study of psychological issues that have practical significance and potential solutions.
9. An in-depth study of a one or more individuals.
10. All of the people about whom a study is meant to generalize are the.
11. The experimental method is a method in which the degree of relationship between at least two variables is assessed.
12. A characteristic inherent in the subjects that cannot be changed is known as a.
13. The variable in a study that is manipulated is the.
14. The human group is the group of subjects that serves as the baseline in a study. They do not receive any level of the independent variable.

MULTIPLE-CHOICE SELF-TEST

Select the single best answer for each of the following questions. If you have trouble answering any of the questions, restudy the relevant material.

1. A belief that is based on subjective feelings is gained knowledge via a. superstition
   b. rationalism
   c. authority
   d. science
2. Tom did really well on his psychology exam last week, and he beliefs that it is because he used his lucky pen. He has now decided that he must use this pen for every exam that he writes because he believes that it will make him lucky. This belief is based on:
   a. superstition
   b. rationalism
   c. authority
   d. science
3. A prediction regarding the outcome of a study is a(n) ________ and an organized system of assumptions and principles that attempts to explain certain phenomena and how they are related is a(n) ________
   a. theory; hypothesis
   b. hypothetico; theory
   c. independent variable; dependent variable
   d. dependent variable; independent variable
4. ________ involves making claims that appear to be scientific but that actually violate the criteria of science.
   a. The principle of falsifiability
   b. Systemic empiricism
   c. Being a skeptic
   d. Pseudoscience
5. The study of psychological issues to seek knowledge for its own sake is ________ research, and the study of psychological issues that have practical significance and potential solutions is ________ research.
   a. basic; applied
   b. applied; basic
   c. naturalistic; laboratory
   d. laboratory; naturalistic
6. Ray was interested in the mating behavior of squirrels so he went into the field to observe them. Ray is using the ________ method of research.
   a. case study
   b. laboratory observational
   c. naturalistic observational
   d. correlational
7. Negative correlation is to ________ and positive correlation is to ________
   a. increasing or decreasing together; moving in opposite directions
   b. moving in opposite directions; increasing or decreasing together
   c. independent variable; dependent variable
   d. dependent variable; independent variable
8. Which of the following is a subject (participant) variable?
   a. amount of time given to study a list of words
   b. fraternity membership
   c. the number of words in a memory test
   d. all of the above
9. If a researcher assigns subjects to groups based on, for example, their earned GPA, the researcher would be employing:
   a. a manipulated independent variable.
   b. random assignment.
   c. a subject variable.
   d. a manipulated dependent variable.
10. In an experimental study of the effects of time spent studying on grades, time spent studying would be the:
    a. control group.
    b. independent variable.
    c. experimental group.
    d. dependent variable.
11. Baseline is to treatment as ________ to ________
    a. independent variable; dependent variable
    b. dependent variable; independent variable
    c. experimental group; control group
    d. control group; experimental group
12. In a study of the effects of alcohol on driving performance, driving performance would be the:
    a. control group.
    b. independent variable.
    c. experimental group.
    d. dependent variable.