MODULE 3

Research in Psychology

"Birds of a feather flock together" . . . or "opposites attract"?

"Two heads are better than one" . . . or "if you want a thing done well, do it yourself"?

"The more the merrier" . . . or "two's company, three's a crowd"?

If we were to rely on common sense to understand behavior, we'd have considerable difficulty—especially because commonsense views are often contradictory. In fact, one of the major undertakings for the field of psychology is to develop suppositions about behavior and to determine which of those suppositions are accurate.

Key Concepts

What is the scientific method?

How do psychologists use theory and research to answer questions of interest?

What research methods do psychologists use?

How do psychologists establish cause-and-effect relationships in research studies?

The Scientific Method

Psychologists—as well as scientists in other disciplines—meet the challenge of posing appropriate questions and properly answering them by relying on the scientific method. The **scientific method** is the approach used by psychologists to systematically acquire knowledge and understanding about behavior and other phenomena of interest. As illustrated in Figure 1, it consists of three main steps: (1) identifying questions of interest, (2) formulating an explanation, and (3) carrying out research designed to support or refute the explanation.

Scientific method: The approach through which psychologists systematically acquire knowledge and understanding about behavior and other phenomena of interest.

THEORIES: SPECIFYING BROAD EXPLANATIONS

In using the scientific method, psychologists start by identifying questions of interest. We have all been curious at some time about our observations of everyday behavior. If you have ever asked yourself why a particular teacher is so easily annoyed, why a friend is always late for appointments, or how your dog understands your commands, you have been formulating questions about behavior.

Psychologists, too, ask questions about the nature and causes of behavior. They may wish to explore explanations for everyday behaviors or for various phenomena. They may also pose questions that build on findings from their previous research or from research carried out by other psychologists. Or they may produce new questions that are based on curiosity, creativity, or insight.

Once a question has been identified, the next step in the scientific method is to develop a theory to explain the observed phenomenon. **Theories** are broad explanations and predictions concerning phenomena of interest. They provide a framework for understanding the relationships among a set of otherwise unorganized facts or principles.

Theories: Broad explanations and predictions concerning phenomena of interest.

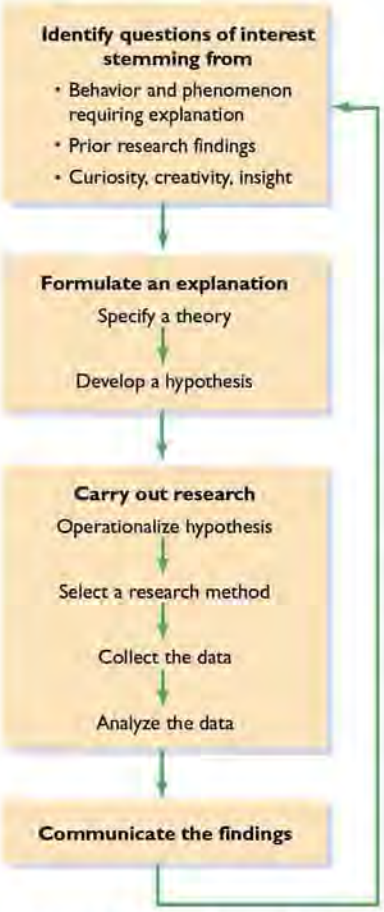

FIGURE 1 The scientific method, which encompasses the process of identifying, asking, and answering questions, is used by psychologists, and by researchers from every other scientific discipline, to come to an understanding about the world. What do you think are the advantages of this method?

Hypothesis: A prediction, stemming from a theory, stated in a way that allows it to be tested.

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The Scientific Method

All of us have developed our own informal theories of human behavior, such as "People are basically good" or "People's behavior is usually motivated by self-interest." However, psychologists' theories are more formal and focused. They are established on the basis of a careful study of the psychological literature to identify relevant research conducted and theories formulated previously, as well as psychologists' general knowledge of the field (Sternberg & Beall, 1991; McGuire, 1997).

Growing out of the diverse approaches employed by psychologists, theories vary both in their breadth and in their level of detail. For example, one theory might seek to explain and predict a phenomenon as broad as emotional experience. A narrower theory might attempt to explain why people display the emotion of fear nonverbally after receiving a threat.

Psychologists Bibb Latané and John Darley, responding to the failure of bystanders to intervene when Kitty Genovese was murdered in New York, developed what they called a theory of *diffusion of responsibility* (Latané & Darley, 1970). According to their theory, the greater the number of bystanders or witnesses to an event that calls for helping behavior, the more the responsibility for helping is perceived to be shared by all the bystanders. Thus, the greater the number of bystanders in an emergency situation, the smaller the share of the responsibility each person feels—and the less likely it is that any single person will come forward to help.

HYPOTHESES: CRAFTING TESTABLE PREDICTIONS

Although the diffusion of responsibility theory seems to make sense, it represented only the beginning phase of Latané and Darley's investigative process. Their next step was to devise a way to test their theory. To do this, they needed to create a hypothesis. A **hypothesis** is a prediction stated in a way that allows it to be tested. Hypotheses stem from theories; they help test the underlying validity of theories.

In the same way that we develop our own broad theories about the world, we also construct hypotheses about events and behavior. Those hypotheses can range from trivialities (such as why our English instructor wears those weird shirts) to more meaningful matters (such as what is the best way to study for a test). Although we rarely test these hypotheses systematically, we do try to determine whether they are right. Perhaps we try comparing two strategies: cramming the night before an exam versus spreading out our study over several nights. By assessing which approach yields better test performance, we have created a way to compare the two strategies.

Latané and Darley's hypothesis was a straightforward prediction from their more general theory of diffusion of responsibility: The more people who witness an emergency situation, the less likely it is that help will be given to a victim. They could, of course, have chosen another hypothesis (for instance, that people with more first-aid skills will be less affected by the presence of others and more likely to help than will those with fewer first-aid skills), but their initial formulation seemed to offer the most direct test of the theory.

Psychologists rely on formal theories and hypotheses for many reasons. For one thing, theories and hypotheses allow them to make sense of unorganized, separate observations and bits of information by permitting them to place the pieces within a structured and coherent framework. In addition, theories and hypotheses offer psychologists the opportunity to move beyond already known facts and principles and make deductions about unexplained phenomena. In this way, theories and hypotheses provide a reasoned guide to the direction that future investigation ought to take (Howitt & Cramer, 2000; Cohen, 2003).

In short, the scientific method, with its emphasis on theories and hypotheses, helps psychologists pose appropriate questions. With properly stated questions in hand, psychologists then can choose from a variety of research methods to find answers. (To get a better understanding of the scientific method used by psychologists, try the PsychInteractive exercise on the scientific method.)

Psychological Research

Research—systematic inquiry aimed at the discovery of new knowledge—is a central ingredient of the scientific method in psychology. It provides the key to understanding the degree to which hypotheses (and the theories behind them) are accurate.

Just as we can apply different theories and hypotheses to explain the same phenomena, we can use a number of alternative methods to conduct research (Ray, 2000). First, though, the hypothesis must be restated in a way that will allow it to be tested, which involves creating an operational definition. An **operational definition** is the translation of a hypothesis into specific, testable procedures that can be measured and observed.

Operational definition: The translation of a hypothesis into specific, testable procedures that can be measured and observed.

There is no single way to go about devising an operational definition for a hypothesis; it depends on logic, the equipment and facilities available, the psychological perspective being employed, and ultimately the creativity of the researcher. For example, one researcher might develop a hypothesis in which she uses an increase in heart rate as an operational definition of "fear." In contrast, another psychologist might use a written response to the question "How much fear are you experiencing at this moment?" as an operational definition of "fear."

In our discussion of research methods, we will consider several major tools in the psychologist's research kit. Keep in mind that their relevance extends beyond testing and evaluating hypotheses in psychology. Even people who do not have degrees in psychology often carry out elementary forms of research on their own. For instance, a supervisor might need to evaluate an employee's performance; a physician might systematically test the effects of different doses of a drug on a patient; a salesperson might compare different persuasive strategies. Each of these situations draws on the research practices we are about to discuss.

Furthermore, knowledge of the research methods used by psychologists permits us to better evaluate the research that others conduct. The media constantly bombard us with claims about research studies and findings. Knowledge of research methods allows us to sort out what is credible from what should be ignored. Finally, there is evidence that by studying some kinds of research methods in depth, people learn to reason more critically and effectively. Understanding the methods by which psychologists conduct research can enhance our ability to analyze and evaluate the situations we encounter in our everyday lives (Shaughnessy, Zechmeister, & Zechmeister, 2000; Shadish, Cook, & Campbell, 2002; Tryon & Bernstein, 2003).

Descriptive Research

Let's begin by considering several types of **descriptive research** designed to systematically investigate a person, group, or patterns of behavior. These methods include archival research, naturalistic observation, survey research, and case studies.

Descriptive research: An approach to research designed to systematically investigate a person, group, or patterns of behavior.

ARCHIVAL RESEARCH

Suppose that, like the psychologists Latané and Darley (1970), you were interested in finding out more about emergency situations in which bystanders did not provide help. One of the first places you might turn to would be historical accounts. By searching newspaper records, for example, you might find support for the notion that a decrease in helping behavior historically has accompanied an increase in the number of bystanders.

Using newspaper articles is an example of archival research. In **archival research,** existing data, such as census documents, college records, and newspaper clippings, are examined to test a hypothesis. For example, college records may be used to determine if there are gender differences in academic performance.

Archival research: Research in which existing data, such as census documents, college records, and newspaper clippings, are examined to test a hypothesis.

Dian Fossey, a pioneer in the study of endangered mountain gorillas in their native habitat, relied on naturalistic observation for her research. What are the advantages of this approach?

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Naturalistic Observation

Naturalistic observation: Research in which an investigator simply observes some naturally occurring behavior and does not make a change in the situation.

Survey research: Research in which people chosen to represent a larger population are asked a series of questions about their behavior, thoughts, or attitudes.

Archival research is a relatively inexpensive means of testing a hypothesis because someone else has already collected the basic data. Of course, the use of existing data has several drawbacks. For one thing, the data may not be in a form that allows the researcher to test a hypothesis fully. The information could be incomplete, or it could have been collected haphazardly (Simonton, 2000; Riniolo et al., 2003).

Most attempts at archival research are hampered by the simple fact that records with the necessary information often do not exist. In these instances, researchers often turn to another research method: naturalistic observation.

NATURALISTIC OBSERVATION

In **naturalistic observation,** the investigator observes some naturally occurring behavior and does not make a change in the situation. For example, a researcher investigating helping behavior might observe the kind of help given to victims in a high-crime area of a city. The important point to remember about naturalistic observation is that the researcher simply records what occurs, making no modification in the situation that is being observed (Schutt, 2001; Moore, 2002).

Although the advantage of naturalistic observation is obvious—we get a sample of what people do in their "natural habitat"—there is also an important drawback: the inability to control any of the factors of interest. For example, we might find so few naturally occurring instances of helping behavior that we would be unable to draw any conclusions. Because naturalistic observation prevents researchers from making changes in a situation, they must wait until the appropriate conditions occur. Furthermore, if people know they are being watched, they may alter their reactions, producing behavior that is not truly representative. (To get more information on research using naturalistic observation, try the PsychInteractive exercise on naturalistic observation.)

SURVEY RESEARCH

There is no more straightforward way of finding out what people think, feel, and do than asking them directly. For this reason, surveys are an important research method. In **survey research,** a *sample* of people chosen to represent a larger group of interest (a *population*) are asked a series of questions about their behavior, thoughts, or attitudes. Survey methods have become so sophisticated that even with a very small sample researchers are able to infer with great accuracy how a larger group would respond. For instance, a sample of just a few thousand voters is sufficient to predict within one or two percentage points who will win a presidential election—if the representative sample is chosen with care (Sommer & Sommer, 2001; Groves et al., 2004).

Researchers investigating helping behavior might conduct a survey by asking people to complete a questionnaire in which they indicate their reasons for not wanting to come forward to help another individual. Similarly, researchers interested in learning about sexual practices have carried out surveys to learn which practices are common and which are not and to chart changing notions of sexual morality over the last several decades.

However, survey research has several potential pitfalls. For one thing, if the sample of people who are surveyed is not representative of the broader population of interest, the results of the survey will have little meaning. For instance, if a sample of voters in a town only included Republicans, it would hardly be useful for predicting the results of an election in which both Republicans and Democrats were voting (Daley, 2003).

People may also respond inaccurately if the survey includes *loaded questions*, questions that represent only one side of an issue or lead to biased responses. For example, someone who answers the question "Do you support reducing welfare benefits in order to reduce the budget deficit?" positively may actually be against a reduction in welfare benefits but agree with the question because it is placed in the context of deficit reduction.

Finally, survey respondents may not want to admit to holding socially undesirable attitudes. To overcome participants' reluctance to be truthful, researchers have developed alternative, and often ingenious, research techniques. For example, sexual pedophiles' interest in children may be assessed by a survey asking respondents to rate the attractiveness of a series of photos of adults and children. But what researchers are really measuring is how long they look at the photos of children compared with adults, and ignoring their ratings of the photos' attractiveness, which are easily manipulated. (See also the PsychInteractive exercise on self-report bias in surveys for information.)

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Self-report Bias in Surveys

THE CASE STUDY

When a coordinated group of terrorists bombed the London subway system in 2005, many people wondered what it was about the bombers' personalities or backgrounds that might have led to their behavior. To answer this question, psychologists might conduct a case study. In contrast to a survey, in which many people are studied, a **case study** is an in-depth, intensive investigation of a single individual or a small group. Case studies often include *psychological testing*, a procedure in which a carefully designed set of questions is used to gain some insight into the personality of the individual or group (Breakwell, Hammond, & Fife-Schaw, 2000; Gass et al., 2000).

Case study: An in-depth, intensive investigation of an individual or small group of people.

When case studies are used as a research technique, the goal is often not only to learn about the few individuals being examined but also to use the insights gained from the study to improve our understanding of people in general. Sigmund Freud developed his theories through case studies of individual patients. Similarly, case studies of the London bombers might help identify others who are prone to violence.

The drawback to case studies? If the individuals examined are too unique, it is impossible to make valid generalizations to a larger population. Still, they sometimes lead the way to new theories and treatments.

CORRELATIONAL RESEARCH

In using the descriptive research methods we have discussed, researchers often wish to determine the relationship between two variables. **Variables** are behaviors, events, or other characteristics that can change, or vary, in some way. For example, in a study to determine whether the amount of studying makes a difference in test scores, the variables would be study time and test scores.

Variables: Behaviors, events, or other characteristics that can change, or vary, in some way.

Correlational research: Research in which the relationship between two sets of variables is examined to determine whether they are associated, or "correlated."

In **correlational research,** two sets of variables are examined to determine whether they are associated, or "correlated." The strength and direction of the relationship between the two variables are represented by a mathematical statistic known as a *correlation* (or, more formally, a *correlation coefficient*), which can range from +1.0 to –1.0.

A *positive correlation* indicates that as the value of one variable increases, we can predict that the value of the other variable will also increase. For example, if we predict that the more time students spend studying for a test, the higher their grades on the test will be, and that the less they study, the lower their test scores will be, we are expecting to find a positive correlation. (Higher values of the variable "amount of study time" would be associated with higher values of the variable "test score," and lower values of "amount of study time" would be associated with lower values of "test score.") The correlation, then, would be indicated by a positive number, and the stronger the association was between studying and test scores, the closer the number would be to +1.0. For example, we might find a correlation of +.85 between test scores and amount of study time, indicating a strong positive association.

In contrast, a *negative correlation* tells us that as the value of one variable increases, the value of the other decreases. For instance, we

"This is the New York Times' Business Poll again, Mr. Landau. Do you feel better or worse about the economy than you did twenty minutes ago?"

might predict that as the number of hours spent studying increases, the number of hours spent in partying decreases. Here we are expecting a negative correlation, ranging between 0 and –1.0. More studying is associated with less partying, and less studying is associated with more partying. The stronger the association between studying and partying is, the closer the correlation will be to –1.0. For instance, a correlation of –.85 would indicate a strong negative association between partying and studying.

Of course, it's quite possible that little or no relationship exists between two variables. For instance, we would probably not expect to find a relationship between number of study hours and height. Lack of a relationship would be indicated by a correlation close to 0. For example, if we found a correlation of –.02 or +.03, it would indicate that there is virtually no association between the two variables; knowing how much someone studies does not tell us anything about how tall he or she is.

When two variables are strongly correlated with each other, it is tempting to assume that one variable causes the other. For example, if we find that more study time is associated with higher grades, we might guess that more studying *causes* higher grades. Although this is not a bad guess, it remains just a guess—because finding that two variables are correlated does not mean that there is a causal relationship between them. The strong correlation suggests that knowing how much a person studies can help us predict how that person will do on a test, but it does not mean that the studying causes the test performance. It might be, for instance, that people who are more interested in the subject matter tend to study more than do those who are less interested, and that the amount of interest, not the number of hours spent studying, predicts test performance. The mere fact that two variables occur together does not mean that one causes the other. (To better understand this principle, use the PsychInteractive exercise on correlation to participate in a demonstration of how correlation is unrelated to causation.)

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Correlation

Another example illustrates the critical point that correlations tell us nothing about cause and effect but merely provide a measure of the strength of a relationship between two variables. We might find that children who watch a lot of television programs featuring high levels of aggression are likely to demonstrate a relatively high degree of aggressive behavior and that those who watch few television shows that portray aggression are apt to exhibit a relatively low degree of such behavior (see Figure 2). But we cannot say that the aggression is *caused* by the TV viewing, because several other explanations are possible.

Experiment: The investigation of the relationship between two (or more) variables by deliberately producing a change in one variable in a situation and observing the effects of that change on other aspects of the situation.

Many studies show that the observation of violence in the media is associated with aggression in viewers. Can we conclude that the observation of violence causes aggression?

For instance, it could be that children who have an unusually high level of energy seek out programs with aggressive content *and* are more aggressive. The children's energy level, then, could be the true cause of the children's higher incidence of aggression. Finally, it is also possible that people who are already highly aggressive choose to watch shows with a high aggressive content *because* they are aggressive. Clearly, then, any number of causal sequences are possible—none of which can be ruled out by correlational research.

The inability of correlational research to demonstrate cause-and-effect relationships is a crucial drawback to its use. There is, however, an alternative technique that does establish causality: the experiment.

Experimental Research

The *only* way psychologists can establish cause-and-effect relationships through research is by carrying out an experiment. In a formal **experiment,** the relationship between two (or more) variables is investigated by deliberately changing one variable in a controlled situation and observing the effects of that change on other aspects of the situation. In an experiment, then, the conditions are created and controlled by the researcher, who deliberately makes a change in those conditions in order to observe the effects of that change.

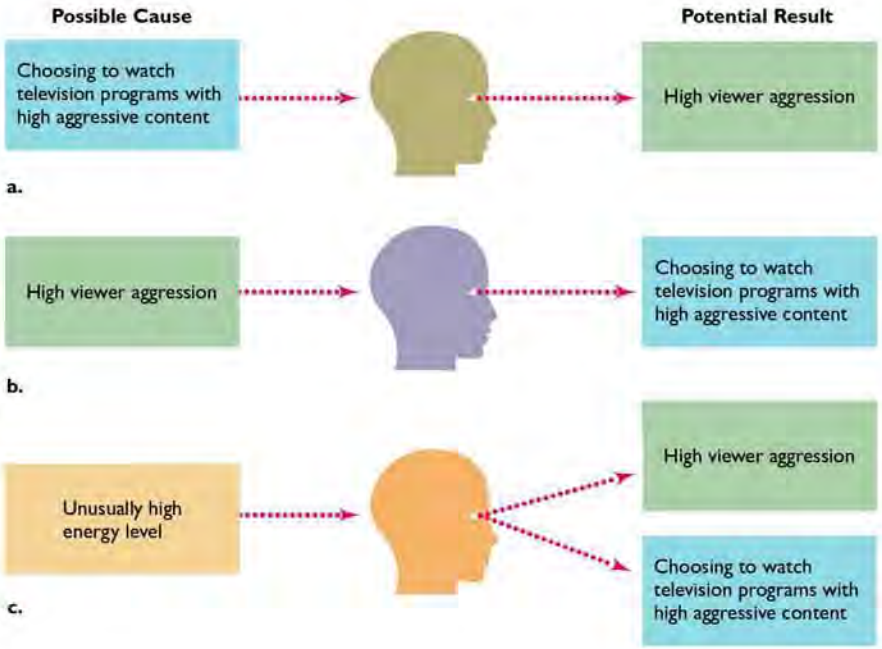
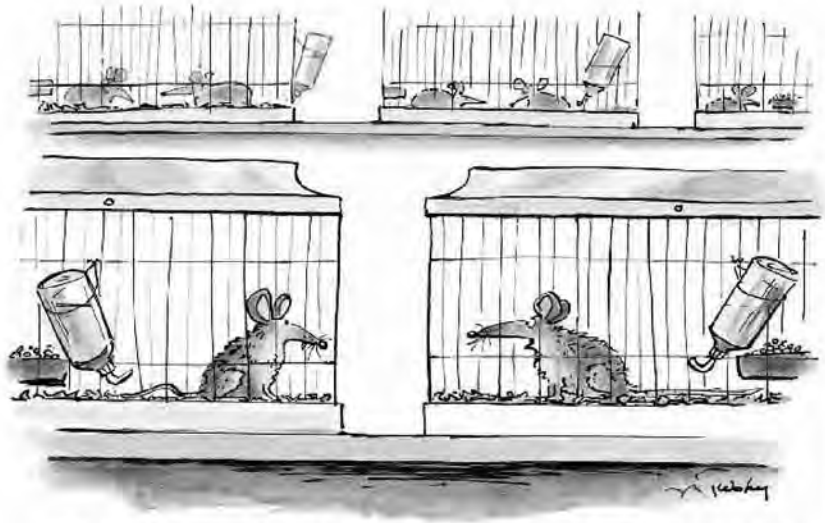


FIGURE 2 If we find that frequent viewing of television programs with aggressive content is associated with high levels of aggressive behavior, we might cite several plausible causes, as suggested in this figure. For example, choosing to watch shows with aggressive content could produce aggression (a); or being a highly aggressive person might cause one to choose to watch televised aggression (b); or having a high energy level might cause a person to both choose to watch aggressive shows and act aggressively (c). Correlational findings, then, do not permit us to determine causality. Can you think of a way to study the effects of televised aggression on aggressive behavior that is not correlational?

The change that the researcher deliberately makes in an experiment is called the **experimental manipulation.** Experimental manipulations are used to detect relationships between different variables.

Experimental manipulation: The change that an experimenter deliberately produces in a situation.

Several steps are involved in carrying out an experiment, but the process typically begins with the development of one or more hypotheses for the experiment to test. For example, Latané and Darley, in testing their theory of the diffusion of responsibility in bystander behavior, developed this hypothesis: The higher the number of people who witness an emergency situation is, the less likely it is that any of them will help the victim. They then designed an experiment to test this hypothesis.



"What if these guys in white coats who bring us food are, like, studying us and we're part of some kind of big experiment?"

In this experiment, preschoolers' reactions to the puppet are monitored. Can you think of a hypothesis that might be tested in this way?

Their first step was to formulate an operational definition of the hypothesis by conceptualizing it in a way that could be tested. Latané and Darley had to take into account the fundamental principle of experimental research mentioned earlier: Experimenters must manipulate at least one variable in order to observe the effects of the manipulation on another variable while keeping other factors in the situation constant. However, the manipulation cannot be viewed by itself, in isolation; if a cause-and-effect relationship is to be established, the effects of the manipulation must be compared with the effects of no manipulation or a different kind of manipulation.

EXPERIMENTAL GROUPS AND CONTROL GROUPS

Experimental research requires, then, that the responses of at least two groups be compared. One group will receive some special **treatment**—the manipulation implemented by the experimenter—and another group will receive either no treatment or a different treatment. Any group that receives a treatment is called an **experimental group;** a group that receives no treatment is called a **control group.** (In some experiments there are multiple experimental and control groups, each of which is compared with another group.)

Treatment: The manipulation implemented by the experimenter.

Experimental group: Any group participating in an experiment that receives a treatment.

Control group: A group participating in an experiment that receives no treatment.

By employing both experimental and control groups in an experiment, researchers are able to rule out the possibility that something other than the experimental manipulation produced the results observed in the experiment. Without a control group, we couldn't be sure that some other variable, such as the temperature at the time we were running the experiment, the color of the experimenter's hair, or even the mere passage of time, wasn't causing the changes observed.

For example, consider a medical researcher who thinks she has invented a medicine that cures the common cold. To test her claim, she gives the medicine one day to a group of twenty people who have colds, and finds that ten days later all of them are cured. Eureka? Not so fast. An observer viewing this flawed study might reasonably argue that the people would have gotten better even without the medicine. What the researcher obviously needed was a control group consisting of people with colds who *don't* get the medicine and whose health is also checked ten days later. Only if there is a significant difference between experimental and control groups can the effectiveness of the medicine be assessed. Through the use of control groups, then, researchers can isolate specific causes for their findings—and draw cause-and-effect inferences.

Returning to Latané and Darley's experiment, we see that the researchers needed to translate their hypothesis into something testable. To do this, they decided to create a false emergency situation that would appear to require the aid of a bystander. As their experimental manipulation, they decided to vary the number of bystanders present. They could have had just one experimental group with, say, two people present, and a control group for comparison purposes with just one person present. Instead, they settled on a more complex procedure involving the creation of groups of three sizes—consisting of two, three, and six people—that could be compared with one another.

INDEPENDENT AND DEPENDENT VARIABLES

Independent variable: The variable that is manipulated by an experimenter.

Latané and Darley's experimental design now included an operational definition of what is called the **independent variable.** The independent variable is the condition that is manipulated by an experimenter. (You can think of the independent variable as being independent of the actions of those taking part in an experiment; it is controlled by the experimenter.) In the case of the Latané and Darley experiment, the independent variable was the number of people present, which was manipulated by the experimenters.

The next step was to decide how they were going to determine the effect that varying the number of bystanders had on behavior of those in the experiment. Crucial

to every experiment is the **dependent variable,** the variable that is measured and is expected to change as a result of changes caused by the experimenter's manipulation of the independent variable. The dependent variable is dependent on the actions of the *participants* or *subjects*—the people taking part in the experiment.

Dependent variable: The variable that is measured and is expected to change as a result of changes caused by the experimenter's manipulation of the independent variable.

Latané and Darley had several possible choices for their dependent measure. One might have been a simple yes/no measure of the participants' helping behavior. But the investigators also wanted a more precise analysis of helping behavior. Consequently, they also measured the amount of time it took for a participant to provide help.

Latané and Darley now had all the necessary components of an experiment. The independent variable, manipulated by them, was the number of bystanders present in an emergency situation. The dependent variable was the measure of whether bystanders in each of the groups provided help and the amount of time it took them to do so. Consequently, like all experiments, this one had both an independent variable and a dependent variable. (To remember the difference, recall that a hypothesis predicts how a dependent variable depends on the manipulation of the independent variable.) All true experiments in psychology fit this straightforward model. (Try the PsychInteractive exercise on experimental design for more information.)

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Experimental Design

RANDOM ASSIGNMENT OF PARTICIPANTS

To make the experiment a valid test of the hypothesis, Latané and Darley needed to add a final step to the design: properly assigning participants to a particular experimental group.

The significance of this step becomes clear when we examine various alternative procedures. For example, the experimenters might have assigned just males to the group with two bystanders, just females to the group with three bystanders, and both males and females to the group with six bystanders. If they had done this, however, any differences they found in helping behavior could not be attributed with any certainty solely to group size, because the differences might just as well have been due to the composition of the group. A more reasonable procedure would be to ensure that each group had the same composition in terms of gender; then the researchers would be able to make comparisons across groups with considerably more accuracy.

Participants in each of the experimental groups ought to be comparable, and it is easy enough to create groups that are similar in terms of gender. The problem becomes a bit more tricky, though, when we consider other participant characteristics. How can we ensure that participants in each experimental group will be equally intelligent, extroverted, cooperative, and so forth, when the list of characteristics—any one of which could be important—is potentially endless?

The solution is a simple but elegant procedure called **random assignment to condition:** Participants are assigned to different experimental groups or "conditions" on the basis of chance and chance alone. The experimenter might, for instance, flip a coin for each participant and assign a participant to one group when "heads" came up, and to the other group when "tails" came up. The advantage of this technique is that participant characteristics have an equal chance of being distributed across the various groups. When a researcher uses random assignment—which in practice is usually carried out using computer-generated random numbers—chances are that each of the groups will have approximately the same proportion of intelligent people, cooperative people, extroverted people, males and females, and so on.

Random assignment to condition: A procedure in which participants are assigned to different experimental groups or "conditions" on the basis of chance and chance alone.

Figure 3 provides another example of an experiment. Like all experiments, it includes the following set of key elements, which are important to keep in mind as you consider whether a research study is truly an experiment:

- An independent variable, the variable that is manipulated by the experimenter
- A dependent variable, the variable that is measured by the experimenter and that is expected to change as a result of the manipulation of the independent variable

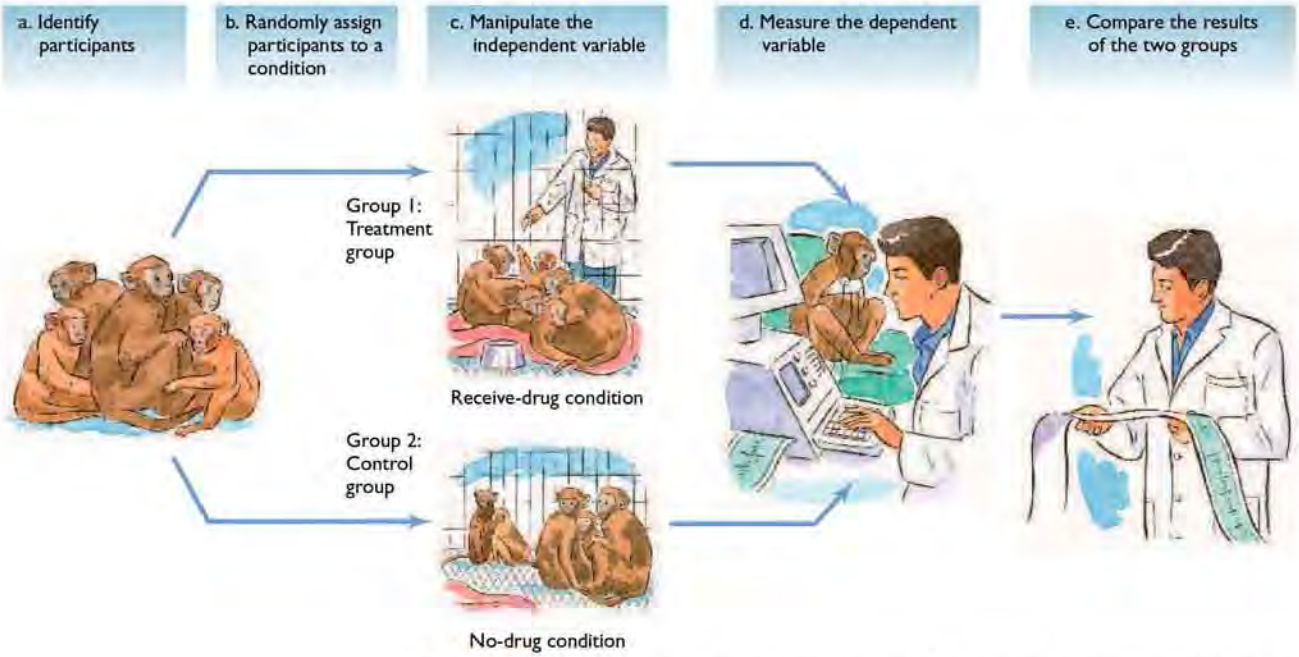

FIGURE 3 In this depiction of a study investigating the effects of the drug propranolol on stress, we can see the basic elements of all true experiments. The participants in the experiment were monkeys, who were randomly assigned to one of two groups. Monkeys assigned to the treatment group were given a drug, propranolol, hypothesized to prevent heart disease, whereas those in the control group were not given the drug. Administration of the drugs, then, was the independent variable. All the monkeys were given a high-fat diet that was the human equivalent of two eggs with bacon every morning, and they occasionally were reassigned to different cages to provide a source of stress. To determine the effects of the drug, the monkeys' heart rates and other measures of heart disease were assessed after twenty-six months. These measures constituted the dependent variable. (The results? As hypothesized, monkeys that received the drug showed lower heart rates and fewer symptoms of heart disease than those who did not.) (Based on a study by Kaplan & Manuck, 1989.)

- A procedure that randomly assigns participants to different experimental groups or "conditions" of the independent variable
- A hypothesis that predicts the effect the independent variable will have on the dependent variable

Only if each of these elements is present can a research study be considered a true experiment in which cause-and-effect relationships can be determined. (For a summary of the different types of research that we've discussed, see Figure 4.)

WERE LATANÉ AND DARLEY RIGHT?

To test their hypothesis that increasing the number of bystanders in an emergency situation would lower the degree of helping behavior, Latané and Darley placed the participants in a room and told them that the purpose of the experiment was to talk about personal problems associated with college. The discussion was to be held over an intercom, supposedly to avoid the potential embarrassment of face-to-face contact. Chatting about personal problems was not, of course, the true purpose of the experiment, but telling the participants that it was was a way of keeping their expectations from biasing their behavior. (Consider how they would have been affected if they had been told that their helping behavior in emergencies was being tested. The experi-

Research Method	Description	Advantages	Shortcomings
Descriptive and correlational research	Researcher observes a previously existing situation but does not make a change in the situation	Offers insight into relationships between variables	Cannot determine causality
Archival research	Examines existing data to confirm hypothesis	Ease of data collection because data already exist	Dependent on availability of data
Naturalistic observation	Observation of naturally occurring behavior, without making a change in the situation	Provides a sample of people in their natural environment	Cannot control the "natural habitat" being observed
Survey research	A sample is chosen to represent a larger population and asked a series of questions	A small sample can be used to infer attitudes and behavior of a larger population	Sample may not be representative of the larger population; participants may not provide accurate responses to survey questions
Case study	Intensive investigation of an individual or small group	Provides a thorough, in-depth understanding of participants	Results may not be generalizable beyond the sample
Experimental research	Investigator produces a change in one variable to observe the effects of that change on other variables	Experiments offer the only way to determine cause-and-effect relationships	To be valid, experiments require random assignment of participants to conditions, well-conceptualized independent and dependent variables, and other careful controls

FIGURE 4 Research strategies.

menters could never have gotten an accurate assessment of what the participants would actually do in an emergency. By definition, emergencies are rarely announced in advance.)

The sizes of the discussion groups were two, three, and six people, which constituted the manipulation of the independent variable of group size. Participants were randomly assigned to these groups upon their arrival at the laboratory. Each group included a trained *confederate*, or employee, of the experimenters. In each two-person group, then, there was only one real "bystander."

As the participants in each group were holding their discussion, they suddenly heard through the intercom one of the other participants—the confederate—having what sounded like an epileptic seizure and calling for help.

The participants' behavior was now what counted. The dependent variable was the time that elapsed from the start of the "seizure" to the time a participant began trying to help the "victim." If six minutes went by without a participant's offering help, the experiment was ended.

As predicted by the hypothesis, the size of the group had a significant effect on whether a participant provided help. The more people who were present, the less likely it was that someone would supply help, as you can see in Figure 5 (Latané & Darley, 1970).

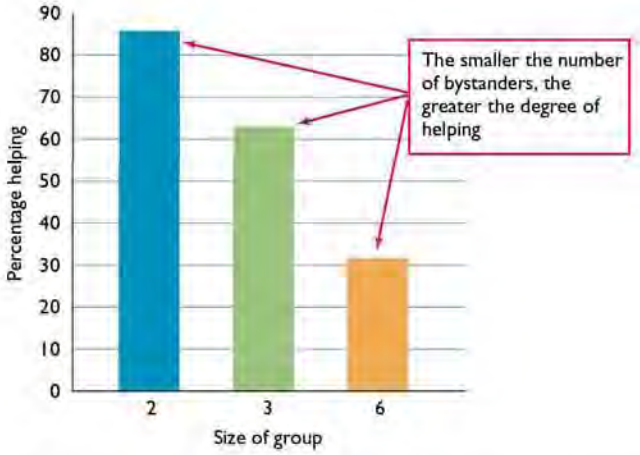

FIGURE 5 The Latané and Darley experiment showed that as the size of the group witnessing an emergency increased, helping behavior decreased.

Because these results are so straightforward, it seems clear that the experiment confirmed the original hypothesis. However, Latané and Darley could not be sure that the results were truly meaningful until they determined whether the results represented a **significant outcome.** Using statistical analysis, researchers can determine whether a numeric difference is a real difference or is due merely to chance. Only when differences between groups are large enough that statistical tests show them to be significant is it possible for researchers to confirm a hypothesis (Cwikel, Behar, & Rabson-Hare, 2000; Cohen, 2002).

Significant outcome: Meaningful results that make it possible for researchers to feel confident that they have confirmed their hypotheses.

MOVING BEYOND THE STUDY

The Latané and Darley study contains all the elements of an experiment: an independent variable, a dependent variable, random assignment to conditions, and multiple experimental groups. Consequently, we can say with some confidence that group size *caused* changes in the degree of helping behavior.

Of course, one experiment alone does not forever resolve the question of bystander intervention in emergencies. Psychologists require that findings be **replicated,** or repeated, sometimes using other procedures, in other settings, with other groups of participants, before full confidence can be placed in the validity of any single experiment. A procedure called *meta-analysis* permits psychologists to combine the results of many separate studies into one overall conclusion (Peterson & Brown, 2005).

Replication: The repetition of research, sometimes using other procedures, settings, and groups of participants, to increase confidence in prior findings.

In addition to replicating experimental results, psychologists need to test the limitations of their theories and hypotheses to determine under which specific circumstances they do and do not apply. It seems unlikely, for instance, that increasing the number of bystanders *always* results in less helping. Therefore, it is critical to continue carrying out experiments to understand the conditions in which exceptions to this general rule occur and other circumstances in which the rule holds (Aronson, 1994; Garcia et al., 2002).

Before leaving the Latané and Darley study, it's important to note that it represents a good illustration of the basic principles of the scientific method that we considered earlier (as outlined in Figure 1). The two psychologists began with a *question of interest,* in this case stemming from a real-world incident in which bystanders in an emergency did not offer help. They then *formulated an explanation* by specifying a theory of diffusion of responsibility, and from that formulated the specific hypothesis that increasing the number of bystanders in an emergency situation would lower the degree of helping behavior. Finally, they *carried out research* to test their hypothesis. This three-step process embodied in the scientific method underlies all scientific inquiry, allowing us to develop a valid understanding of others'—and our own—behavior.

RECAP/EVALUATE/RETHINK

RECAP

What is the scientific method?

- The scientific method is the approach psychologists use to understand behavior. It consists of three steps: identifying questions of interest, formulating an explanation, and carrying out research that is designed to support or refute the explanation. (p. 27)
- For a hypothesis to be tested, it must be operationalized: Research must translate the abstract concepts of the hypothesis into the actual procedures used in the study. (p. 29)

How do psychologists use theory and research to answer questions of interest?

- Research in psychology is guided by theories (broad explanations and predictions regarding phenomena of interest) and hypotheses (theory-based predictions stated in a way that allows them to be tested). (p. 29)

What research methods do psychologists use?

- Archival research uses existing records, such as old newspapers or other documents, to test a hypothesis. In naturalistic observation, the investigator acts mainly as an observer, making no change in a naturally occurring situation. In survey research, people are asked a series of questions about their behavior, thoughts, or attitudes. The case study is an in-depth interview and examination of one person or group. (pp. 29–31)
- These descriptive research methods rely on correlational techniques, which describe associations between variables but cannot determine cause-and-effect relationships. (pp. 31–32)

How do psychologists establish cause-and-effect relationships in research studies?

- In a formal experiment, the relationship between variables is investigated by deliberately producing a change—called the experimental manipulation—in one variable and observing changes in the other variable. (pp. 32–33)
- In an experiment, at least two groups must be compared to assess cause-and-effect relationships. The group receiving the treatment (the special procedure devised by the experimenter) is the experimental group; the second group (which receives no treatment) is the control group. There also may be multiple experimental groups, each of which is subjected to a different procedure and then compared with the others. (p. 34)
- The variable that experimenters manipulate is the independent variable. The variable that they measure and expect to change as a result of manipulation of the independent variable is called the dependent variable. (pp. 34–35)
- In a formal experiment, participants must be assigned randomly to treatment conditions, so that participant characteristics are distributed evenly across the different conditions. (pp. 35–36)
- Psychologists use statistical tests to determine whether research findings are significant. (p. 38)

EVALUATE

1. An explanation for a phenomenon of interest is known as a _____.
2. To test this explanation, it must be stated in terms of a testable question known as a _____.
3. An experimenter is interested in studying the relationship between hunger and aggression. She decides that she will measure aggression by counting the number of times a participant will hit a punching bag. In this case, her _____ definition of aggression is the number of times the participant hits the bag.
4. Match the following forms of research to their definition:
   1. Archival research
   2. Naturalistic observation
   3. Survey research
   4. Case study

   a. Directly asking a sample of people questions about their behavior
   b. Examining existing records to test a hypothesis
   c. Looking at behavior in its true setting without intervening in the setting
   d. Doing an in-depth investigation of a person or small group
5. Match each of the following research methods with its primary disadvantage:
   1. Archival research
   2. Naturalistic observation
   3. Survey research
   4. Case study

   a. May not be able to generalize to the population at large
   b. People's behavior can change if they know they are being watched
   c. The data may not exist or may be unusable
   d. People may lie in order to present a good image
6. A psychologist wants to study the effect of attractiveness on willingness to help a person with a math problem. Attractiveness would be the _____ variable, and the amount of helping would be the _____ variable.
7. The group in an experiment that receives no treatment is called the _____ group.

RETHINK

1. Starting with the theory that diffusion of responsibility causes responsibility for helping to be shared among bystanders, Latané and Darley derived the hypothesis that the more people who witness an emergency situation, the less likely it is that help will be given to a victim. How many other hypotheses can you think of that are based on the same theory of diffusion of responsibility?
2. Can you describe how a researcher might use naturalistic observation, case studies, and survey research to investigate gender differences in aggressive behavior at the workplace? First state a hypothesis and then describe your research approaches. What positive and negative features does each method have?
3. *From a health care worker's perspective:* Tobacco companies have asserted that no experiment has ever proved that tobacco use causes cancer. Can you explain this claim in terms of the research procedures and designs discussed in this module? What sort of research would establish a cause-and-effect relationship between tobacco use and cancer? Is such a research study possible?

Answers to Evaluate Questions

1. theory; 2. hypothesis; 3. operational; 4. 1-b, 2-c, 3-a, 4-d; 5. 1-c, 2-b, 3-d, 4-a; 6. independent, dependent; 7. control

KEY TERMS

scientific method p. 27
theories p. 27
hypothesis p. 28
operational definition p. 29
descriptive research p. 29
archival research p. 29
naturalistic observation p. 30
survey research p. 30
case study p. 31
variables p.31
correlational research p. 31
experiment p. 32
experimental manipulation p. 33
treatment p. 34
experimental group p. 34
control group p. 34
independent variable p. 34
dependent variable p. 35
random assignment to condition p. 35
significant outcome p. 38
replication p. 38