Module 5

The Scientific Method and Description

Module Learning Objectives

1. Describe how theories advance psychological science.
2. Describe how psychologists use case studies, naturalistic observation, and surveys to observe and describe behavior, and explain the importance of random sampling.

Psychologists share their scientific attitude with the scientific method—a self-correcting process for evaluating ideas with observation and analysis. Its attempt to describe and explain human nature, psychological science welcomes hunches and plausible-sounding theories. And it puts them to the test. If a theory works—if the data support its predictions—so much the better for that theory. If the predictions fail, the theory will be revised or rejected.

The Scientific Method

How do theories advance psychological science?

Chatting with friends and family, we often use theory to mean “mere hunch.” In science, a theory explains behaviors or events by offering ideas that organize what we have observed. By organizing isolated facts, a theory simplifies. By linking facts with deeper principles, a theory offers a useful summary. As we connect the observed dots, a coherent picture emerges.

A theory about the effects of sleep on memory, for example, helps us organize countless sleep-related observations into a short list of principles. Imagine that we observe over and over that people with good sleep habits tend to answer questions correctly in class, and they do well at test time. We might therefore theorize that sleep improves memory. So far so good. Our principle neatly summarizes a list of facts about the effects of a good night's sleep on memory.

Yet no matter how reasonable a theory may sound—and it does seem reasonable to suggest that sleep could improve memory—we must put it to the test. A good theory produces testable predictions, called hypotheses. Such predictions specify what results (what behaviors or events) would support the theory and what results would cast doubt on the theory. To test our theory about the effects of sleep on memory, our hypothesis might be that when sleep-deprived, people will remember less from the day before. To test that hypothesis, we might assess how well people remember course materials they studied before a good night’s sleep, or before a shortened night’s sleep. (FIGURE 5.1). The results will either confirm our theory or lead us to revise or reject it.

Operational definitions: a careful worded statement of the exact procedures (operations) used in a research study. For example, “memory intelligence may be operationally defined as what an intelligent test measures.”

Replication: repeating the essence of a research study, usually with different participants in different situations, to see whether the basic findings extend to other participants and circumstances.

Hypothesis: a testable prediction, often implied by a theory.

Theory: an explanation using an integrated set of principles that organizes observations and predicts behaviors or events.

Theories: Example: Sleep boosts memory.

Research and observations:
- Example: Give study material to people before (a) an ample night’s sleep, or (b) a shortened night’s sleep, then test memory.

Hypothesis: Example: When sleep deprived, people remember less from the day before.

Our theories can bias our observations. Having theorized that better memory springs from more sleep, we may see what we expect: we may perceive sleep-deprived people’s comments as less insightful. Perhaps you are aware of students who, because they have developed such an excellent reputation, can now do no wrong in the eyes of teachers. If they’re in the hall during class, nobody worries. Other students can do no good, because they have behaved badly in the past, even their positive behaviors are viewed suspiciously.

As a check on their biases, psychologists use operational definitions when they report their studies. “Sleep deprived,” for example, may be defined as “X hours less” than the person’s natural sleep. Unlike dictionary definitions, operational definitions describe concepts with precise procedures or measures. These exact descriptions will allow anyone to replicate (repeat) the research. Other people can then re-create the study with different participants and in different situations. If they get similar results, we can be confident that the findings are reliable.

Let’s summarize. A good theory:
- effectively organizes a range of self-reports and observations.
- leads to clear hypotheses (predictions) that anyone can use to check the theory.
- often stimulates research that leads to a revised theory which better organizes and predicts what we know. Or, our research may be replicated and supported by similar findings. (This has been the case for sleep and memory studies, as you will see in Module 24.)

We can test our hypotheses and refine our theories in several ways:
- Descriptive methods describe behaviors, often by using case studies, surveys, or naturalistic observations.
- Correlational methods associate different factors, or variables. (You’ll see the word variable often in descriptions of research. It refers to anything that contributes to a result.)
- Experimental methods manipulate variables to discover their effects. To think critically about popular psychology claims, we need to understand the strengths and weaknesses of these methods.
Description

How do psychologists use case studies, naturalistic observation, and surveys to observe and describe behavior, and why is random sampling important?

The starting point of any science is description. In everyday life, we all observe and describe people, often drawing conclusions about why they act as they do. Professional psychologists do much the same, though more objectively and systematically, through:

- case studies (analyses of special individuals);
- naturalistic observation (watching and recording the natural behavior of many individuals);
- surveys and interviews (asking people questions).

The Case Study

Psychologists use the case study, which is among the oldest research methods, to examine one individual or group in depth in the hope of revealing things true of all of us. Some examples:

Much of our early knowledge about the brain came from case studies of individuals who suffered a particular impairment after damage to a certain brain region. Jean Piaget taught us about children’s thinking through case studies in which he carefully observed and questioned individual children. Studies of only a few chimpanzees have revealed a lot about understanding and language. Intensive case studies are sometimes very revealing. They show how things happen, and they often suggest directions for further study.

But individual cases may mislead us if the individual is atypical. Unrepresentative information can lead to mistaken judgments and false conclusions. Indeed, any researcher mentors a finding ("Smokers die younger: sixty-five per cent of men over 65 are non-smokers") someone is sure to offer a contradictory anecdote ("Well, I have an aunt who smoked two packs a day and lived to 89.") Dramatic stories and personal experiences (even psychological case examples) command our attention and are easily remembered. Journalists understand that, and so begin an article about bank foreclosures with the sad story of one family put out of their house, not with foreclosed statistics. Stories move us. But stories can mislead. Which of the following do you find more memorable?

1) "In one study of 1,000 dream reports concerning kidnapped children, only 5 per cent correctly envisioned the child as dead." (Murray & Wheeler, 1997).

2) "I know a man who dreamed his sister was in a car accident, and two days later she died in a head-on collision!" Numbers can be numbing, but the plausibility of anecdote is not. As psychologist Gordon Allport (1954, p. 9) said, "Given a thousand of (dramatic) facts we rash to make generalizations as large as a tub." The point is memorable: Individual cases can suggest fruitful ideas. What’s true of all of us can be glimpsed in any one of us. But to discern the general truths that cover individual cases, we must answer questions with other research methods.

Naturalistic Observation

A second descriptive method records behavior in natural environments. These naturalistic observations range from watching chimpanzee societies in the jungle, to unobtrusively videotaping (and later systematically analyzing) parent-child interactions in different cultures, to recording racial differences in students’ self-writing patterns in a school cafeteria. Like the case study, naturalistic observation describes behavior. It describes it. Nevertheless, descriptions can be revealing. We once thought, for example, that only humans use tools. Then naturalistic observation revealed that chimpanzees sometimes insert a stick in a termite mound and withdraw it, eating the stick’s load of termites. Such unobtrusive naturalistic observations proved the way for later studies of animal thinking, language, and emotion, which further expanded our understanding of our fellow animals. Observations, made in the natural habitat, helped to show that the societies and behavior of animals are far more complex than previously supposed," chimpanzee observer Jane Goodall noted (1986). Thanks to researchers’ observations, we know that chimpanzees and baboons use deception. Psychologists Andreas Whiten and Richard Byrne (1988) repeatedly saw one young baboon pretending to have been attacked by another as a trick to get its mother to drive the other baboon away from its food. The more developed a primate’s species brain, the more likely it is that the animals will display deceptive behaviors (Byrne & Corp, 2004). Naturalistic observations also illuminate human behavior. Here are four findings you might enjoy:

- A funny finding. We humans laugh 30 times more often in social situations than in non-social situations, so you wonder how seldom you laugh when alone!? As we laugh, 17 muscles contort our mouth and squeeze our eyes, and we emit a series of 75-millisecond vowel-like sounds, spaced about one-fifth of a second apart (Povine, 2001).

- Sounding out students. What, really, are college psychology students saying and doing during their everyday lives? To find out, researchers equipped 52 such students from the University of Texas with electronic recorders (Meikle & Penebaker, 2003). For up to four days, the recorders captured 30 seconds of the students’ waking hours every 12.5 minutes, thus enabling the researchers to eavesdrop on more than 10,000 half-minute slices of life at the end of the study. On what percentage of the slices do you suppose they found the students talking with someone? What percentage of the students at a computer? The answers: 28 and 9 percent. (What percentage of your waking hours are spent in these activities?)

- What’s on your mind? To find out what was on the mind of their University of Nevada, Las Vegas, students, researchers gave them beepers (Heavey & Hurlbut, 2006). On a half-dozen occasions, a beep interrupted students’ daily activities, signaling them to pull out a notebook and record their inner experience at that moment. When the researchers later coded the reports in categories, they found 11 common forms of inner experience (Table 6.1 on the next page).

- Culture, climate, and the pace of life. Naturalistic observation also enabled researchers to compare the pace of life in 31 countries (Levitt & Nenczynska, 1999). (Their random definition of pace of life included walking speed, the speed with which postal clerks completed a simple request, and the accuracy of public clocks.) Their conclusion: Life is fastest paced in Asian and Western Europe, and slower paced in economically less-developed countries. People in colder climates also tend to live at a faster pace (and are more prone to die from heart disease).
Table 5.1: A Penny for Their Thoughts: The Inner Experience of
University Students

<table>
<thead>
<tr>
<th>Inner Experience</th>
<th>Example</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inner speech</td>
<td>Susan was saying to herself, &quot;I've got to get to class.&quot;</td>
<td>26%</td>
</tr>
<tr>
<td>Inner seeing</td>
<td>Paul was imagining the face of a best friend, including her nose and head.</td>
<td>34%</td>
</tr>
<tr>
<td>Unselfishized thinking</td>
<td>Alphonse was wondering whether the workers would drop the bricks.</td>
<td>22%</td>
</tr>
<tr>
<td>Feeling</td>
<td>Courtney was experiencing anger and its physical symptoms.</td>
<td>26%</td>
</tr>
<tr>
<td>Sensory awareness</td>
<td>Fiona was feeling the cool breeze on her cheek and her hair moving.</td>
<td>22%</td>
</tr>
</tbody>
</table>

* More than one experience could occur at once.

Naturalistic observation offers interesting snapshots of everyday life, but it does so without controlling for all the variables that may influence behavior. It's one thing to observe the pace of life in various places, but another to understand what makes some people walk faster than others.

The Survey

A survey looks at many cases in less depth. Researchers do surveys when wanting to estimate, from a representative sample of people, the attitudes or reported behaviors of a whole population. Questions about everything from cell phone use to political opinions are put to the public. In recent surveys,

- Half of all Americans reported experiencing more happiness and enjoyment than worry and stress on the previous day (Gallop, 2010).
- Online Canadians reported using new forms of electronic communication and thus receiving 35 percent fewer e-mails in 2010 than in 2008 ( Ipsos, 2010a).
- 1 in 5 people across 22 countries reported believing that alien beings have come to Earth and now walk among us disguised as humans (Pew, 2013b).
- 68 percent of all humans—some 4.6 billion people—say that religion is important in their daily lives (Diener et al., 2011).

But asking questions is tricky, and the answers often depend on the way questions are worded. Respondents are chosen.

Wording Effects

As we will see in Module 35, even subtle changes in the order or wording of questions—the way we frame a question—can have major effects. People are much more approving of "aid to the needy" than of "welfare," of "affirmative action" than of "preferential treatment," of "not allowing" televised cigarette ads and pornography than of "censoring" them, and of "revenue enhancers" than of "taxes." In 2009, three in four Americans in one national survey approved of giving people a "choice" of public, government-run, or private health insurance. Yet in another survey, most Americans were not in favor of "creating a public health care plan administered by the federal government that would compete directly with private health insurance companies" (Stein, 2009). Because wording is such a delicate matter, critical thinkers will reflect on how the phrasing of a question might affect people's expressed opinions.

random sampling bias: a flawed sampling process that produces an unrepresentative sample.

population: all those in a group being studied, from which samples may be drawn. (Note: Except for statistical studies, this does not refer to a country's whole population.)

random sample: a sample that likely represents a population because each member has an equal chance of inclusion.

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RANDOM SAMPLING

In everyday thinking, we tend to generalize from samples we observe, especially vivid cases. Given (a) a statistical summary of auto owners' evaluations of their car make and (b) the vivid comments of a biased sample—two frustrated owners—our impression may be influenced as much by the two unhappy owners as by the many more evaluations in the statistical summary. The temptation to ignore the sampling bias and to generalize from a few vivid but unrepresentative cases is nearly irresistible.

The point is to remember: The best basis for generalizing is from a representative sample. But it's not always possible to survey everyone in a group. So how do you obtain a representative sample—say, of the students at your high school? How could you choose a group that would represent the total student population, the whole group you want to study and describe? Typically, you would seek a random sample, in which every person in the entire group has an equal chance of participating. You might number the names in the general student listing and then use a random number generator to pick your survey participants. (Sending each student a questionnaire wouldn't work because the conscientious people who returned it would not be a random sample.) Large representative samples are better than small ones, but a small representative sample of 100 is better than an unrepresentative sample of 50.

Political pollsters sample voters in national election surveys just this way. Using only 1500 randomly sampled people, drawn from all areas of a country, they can provide an extremely accurate snapshot of the nation's opinions. Without random sampling (also called random selection), large samples—including cell-in-phone samples and TV or website polls think of American Idol fans voting)—often merely give misleading results.

The point is to remember: Before accepting survey findings, think critically: Consider the sample. You cannot compensate for an unrepresentative sample by simply adding more people.

Before You Move On

▶ Ask Yourself

Can you recall examples of misleading surveys you have experienced or read about? What survey principles did they violate?

▶ Test Yourself

What are some strengths and weaknesses of the three different methods psychologists use to describe behavior—case studies, naturalistic observation, and surveys?

Answers to the Test Yourself questions can be found in Appendix A at the end of the book.