1 How to Make Orderly Observations

> Direct, intuitive observation, accompanied by questioning, imagination, or creative intervention, is a limited and misleading prescientific technique.
>
> C. F. MONTE (1975)
>
> The perversity of animate subjects has, of necessity, whelped a remarkable degree of experimental sophistication in the behavioral sciences.
>
> S. N. ROSCOE (1980)

This book is meant to teach you how to do experiments in the science of psychology. Aside from the fact that learning to do this is required of psychology majors at many colleges, why would you want to know how to do psychological experimentation? One reason could be because you plan to become a psychologist, a scientist studying human and, sometimes, animal behavior. The experimental method is one of the major research tools for collecting data to build the scientific body of knowledge in psychology. I will briefly discuss some of the other tools in this book, but most of the book is concerned with how to do experiments.

Even if you do not plan to become a psychologist, learning about the use of experimentation in psychology can help you become a well-educated person and can provide you with useful skills that generalize to a number of careers. For example, suppose you go into the banking business and work your way up to being a vice president. Obviously, some of what you learn in psychology courses can help you succeed because you know something about human relations. However, what you know about experimentation can also help. Your boss calls you in and says: "As you know, we've just installed all these automatic tellers in our banks. We spent a lot of money on these newfangled machines, but for some reason the customers don't like to use them. I want you to figure out why and make whatever changes are necessary to get them to use the machines."

You will see as you read this book that carrying out such an assignment, while not a formal experiment, requires most of the skills needed for doing a psychology experiment. First, you must form several hypotheses

about why the automatic tellers are not being used: Do the customers feel depersonalized interacting with a machine? Are they intimidated? Do they not know how to use them? Do they feel less safe carrying their money around without the security of another person present? As a second step, some sort of data must be collected to narrow down the possible hypotheses, perhaps by doing interviews or using a questionnaire. Then you would probably want to make a manipulation to see whether you can change the customers' behavior: perhaps offering an educational program, if knowledge is a problem; perhaps giving prizes, if motivation is a problem; perhaps increasing privacy, if security is a problem. Finally, you would want to measure customers' behavior to see whether it changes with your manipulation and to determine whether any such change is meaningful. Although your boss did not ask you to do a psychology experiment, you have carried out most of the steps required to do one. Most jobs require the solving of people problems, and the skills you learn from this book should make you a better people-problem solver.

If you do wish to become a psychologist, the reasons for learning about research and experimentation are probably obvious. Certainly if you want to be an experimental psychologist, then doing experiments will be your main activity and you will repeatedly use the techniques taught in this book. But even if you plan on becoming a clinician or a counselor, at the very least you should know how psychological research is done; ideally, you should be able to do it. One of the major characteristics that distinguish clinical psychologists from others who do therapy, such as social workers and psychiatrists, is how closely tied to behavioral data they are. Early in the history of clinical training, some 50 years ago, educators got together and decided that clinical psychology students should be trained first as scientists and then as therapists, that without the science they would just be guessing about which therapeutic techniques work and which do not. That is why most clinical psychologists get a Ph.D. (doctor of philosophy), a research degree. It is true that today about a quarter of clinical psychologists get a Psy. D. (doctor of psychology) rather than a Ph.D. However, the curriculum for this degree still requires students to be thoroughly versed in research methods. Clinicians must be able to understand research and experimentation or they will not be able to determine the effectiveness of various treatments and to evaluate new interventions as they are introduced. Learning about experimentation is extremely important for future clinicians.

Over and above these practical reasons for learning to do psychology experiments, I hope that part of the reason you want to learn these skills is just because it's fun! We are all curious about the world around us. We want to know why things happen as they do. Humans invented science in order to better understand their world.[1] Science is an attempt to approach this discovery process in an orderly way. Early in life I found out that, for

[1]And, in the case of astronomy, other worlds as well.

me, experimentation was the most intriguing tool of science because it leads to the discovery of relationships that have never been known. Then when I learned about the science of psychology, I further discovered that this powerful tool could be used to understand what I considered to be the most interesting subject of all, human behavior.

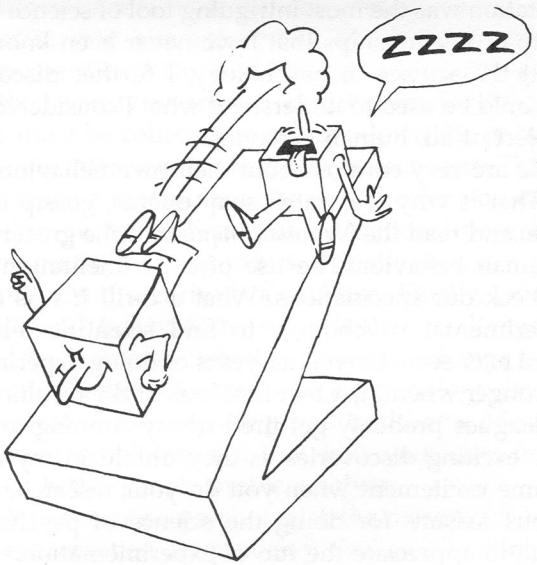
Most people are very curious about their own behavior and the behavior of others. That is why we watch soap operas, gossip behind people's backs, fantasize, and read the *National Enquirer* in the grocery line—to speculate about human behavior. The use of experimentation in psychology allows us to check our speculations. What a thrill it was during my first course in experimental psychology to find scientific relationships that nobody else had ever seen. Even after years of doing experiments, my heart beats a little stronger when I get that first look at the results of a new experiment. My colleagues probably get tired of my running to their offices to show them the exciting discoveries as they unfold in my lab. I hope that you feel the same excitement when you do your research. Although there are more serious reasons for doing the science of psychology, may you always continue to appreciate the fun of experimentation.

Psychology as a Science

Psychologists go about their business much like scientists do in other scientific fields. In their search for an understanding of human behavior, psychologists attempt to (1) establish relationships between circumstances and behaviors and (2) fit these relationships into an orderly body of knowledge. In this book we will deal primarily with the first activity, although we will touch on the second activity in Chapters 3 and 13.

What kind of relationship is acceptable to us as scientists? When we can demonstrate that one event is related to a second event in some predictable way, we have a statement that will fit into the scientific body of knowledge. At least one of these events must be a measurable behavior. Here we can make a distinction among the sciences. The behavior of major concern to us as psychologists is human behavior (and sometimes animal behavior). And this is where we run into one of our first problems, a problem that haunts psychologists but not physical scientists. Humans and animals are variable. We humans often cannot repeat a response precisely even if we wish to, and in some cases we may not wish to. In terms of variability, physical scientists typically have it easier than psychologists.

A physicist measuring the coefficient of friction for a wooden block might measure the time it takes the block to slide down an inclined plane. Although the times might vary from trial to trial, such variability would be relatively small. The physicist would not be making too great an error if he or she considered the variability a minor nuisance and measured the time for only one trial. However, a psychologist who wanted to measure the time it takes a human to press a button in response to a light would



be making a considerably greater error by ignoring human variability. Although it is unlikely that our physicist's block will be a little slow on certain trials because it has its mind on other things, isn't ready, or is blinking or asleep, a human can experience these and many other problems.

In addition to variability among trials, variability among humans must also be taken into account by psychologists. Our physicist could construct another block of the same size, weight, and surface finish as the original and repeat the experiment. The psychologist, however, cannot re-create humans. Humans seldom have exactly the same genetic background (identical twins being an exception), and they never have exactly the same environmental background. For this reason, in responding to the light, typically one individual's fastest response is considerably slower than another individual's slowest response. Thus, as psychologists we have to deal not only with one person's variability from trial to trial but also with the variability among humans.[2]

One way to handle variability is to use statistical techniques. Many psychology students learn to do this by taking a statistics class early in their course work. Because this is not a statistics text, we will not spend much time considering statistical solutions. The topic is briefly mentioned in Chapter 12, where interpreting the results of experiments is discussed, and in Appendix A, where simple statistical operations are demonstrated. A second way to handle variability is to control it as much as possible in the

[2] You can see why some psychologists decide to use animals in experiments. Whereas psychologists can breed animals with similar genetic characteristics and rear them in similar environments, it would be frowned upon if they tried to do the same thing with humans. Your friends may say, "All men are animals" or "All women are alike," but don't believe them!

design of your research. This book is written to help you do good research, which is a simple way of saying, "Know where the variability is, and be able to account for it."

Psychologists and other social scientists use a variety of research techniques to make orderly observations in an attempt to account for variability. In this chapter I will give you an overview of the various techniques. Then in the next chapter and in most of the rest of the book I will expand on experimentation because that is the main technique emphasized in this book. In Chapter 10 I will also go into more detail about several less traditional techniques: questionnaires, single-subject designs, and quasi-experimental designs.

The most widely used research techniques are sometimes called **quantitative designs,** those in which events can be quantified so that the data end up being numbers. These designs include experiments and correlational observations. In order to give you a complete picture of the research techniques available, in this chapter we will also briefly look at **qualitative designs,** in which the events being studied are not easily converted into numbers.

Quantitative Designs

THE EXPERIMENTAL METHOD

We as scientists establish relationships between events, but these events are not always behaviors. In fact, when we do an experiment, or use the **experimental method,** the relationship of interest is between a set of circumstances and a behavior. A physicist wants to know the time it takes a block to slide down a plane when the plane is at a particular angle, has a particular surface, and has a particular temperature. A psychologist, on the other hand, may want to study students' behavior in a classroom. Both scientists are attempting to establish relationships between a set of circumstances and a behavior, the behavior of a physical object or a human. These relationships are scientific facts, the building blocks with which we build our science.

Unfortunately, designing an experiment to establish such a relationship is not always easy. Ideally, we would like to specify exhaustively and precisely a particular set of circumstances and then measure all the behaviors taking place under those circumstances. We could then say that whenever this set of circumstances recurred, the same behaviors would result. However, if we could list *all* the circumstances, we would have a unique set. Again if we wanted to study students in a classroom, what circumstances would interest us? Perhaps we would like to know the effect of the teacher's sex, or perhaps the type of clothes the teacher wears, or perhaps the effect of class size, or perhaps the use of computers in the classroom, or perhaps what time of day the class meets. As you can see, there are many circumstances we might like to investigate. In fact, there is an infinite

number of circumstances, and these form a unique set that would never be repeated.

As is the case with the physicist, the psychologist wants to relate circumstances to behaviors, and here a similar problem arises. Which behaviors do we want to investigate? Perhaps how attentive the students are. Or perhaps how many notes the students are taking. Or perhaps how many questions the students ask. Or perhaps class attendance. Or even what type of brainwave activity students are producing. Again, as with the circumstances, there is an infinite number of behaviors that we might choose to measure.

Thus, we are caught in a dilemma. On one hand, we want to build our science on statements of precise relationships between circumstances and behaviors. On the other hand, if we did that, we would end up with an infinite number of statements, one for each unique set of circumstances paired with each of an infinite number of behaviors. Although we would have precise statements about the relationship between circumstances and behaviors, we would never be able to predict future behavior from circumstances because we would never again find those particular circumstances paired with a particular behavior. How do we resolve this paradox?

Scientists have had to make a compromise. They choose only a few circumstances to investigate at any one time and let the other circumstances form a general set of circumstances. That means that the circumstance (or circumstances) of most interest is precisely specified, whereas the other circumstances form a general set. In this way the circumstances no longer form a unique set but rather a general set that can recur repeatedly.

In using the experimental method the scientist manipulates at least one of the circumstances and measures at least one behavior. For example, suppose we were interested in finding out whether words that occur more frequently in the English language are easier to remember. We might make up lists of high-frequency words like *automobile, tree, house,* and *hand* and another set of lists having low-frequency words like *cucumber, hammock, chime,* and *bonnet.* We could then present these lists to people and find out how many trials it takes them to learn each type of list. So we have chosen one circumstance to manipulate—word frequency; set it at two levels—high and low; and measured trials to learn. In this way, when we have done our experiment, we should be able to make a clear statement about whether word frequency has any effect on learning ability. It is true that we cannot just ignore all the other circumstances. As we will see in the next chapter, we have to consider carefully how to handle the circumstances we are not manipulating. However, when an experiment is done correctly, it is possible to make a clear statement that any change in the measured behavior that occurs when the circumstance of interest is manipulated is caused by that manipulation. The reason that the experimental method is so widely used in science is that no other method allows us to make such a strong causal statement. As you will see when we discuss the other scientific meth-

ods in this chapter, they all fall a little short of the ideal, being able to say unequivocably that the change in the circumstance *caused* the change in the behavior.

CORRELATIONAL OBSERVATION

In establishing relationships that add to our knowledge of human behavior, it is not always possible to conduct an experiment. In such cases, **correlational observation** is often appropriate. In correlational observation we try to determine whether two variables are related without attempting to manipulate either one experimentally. Suppose, for example, we were interested in finding the relationship between parental discipline and rate of juvenile delinquency. To fit this problem into the experimental model, we would have to make parental discipline a circumstance we can manipulate and force the parents of a cross section of newborn infants to discipline their children at a particular level of strictness or leniency. When the children reached age 18, we might count the number of appearances before juvenile court for each child. Obviously, few parents would agree to such an experiment, nor would our society smile on our sincere effort to do good research. Rather than give up on what might be an important question, however, we could consider using a correlational observation.

In making such an observation, we could choose a number of children randomly and send their parents questionnaires asking such questions as "How often do you spank your child?" "Does your child have a specific bedtime?" and so on. Based on the answers to these questions, we could assign each set of parents a number on a scale from strict to lenient. Then we could survey court records to determine the number of offenses for each child and determine if a relationship might exist.

Data[3] from correlational observations are typically pictured in a **scatterplot,** in which each variable is represented on an axis and each point represents a single measurement. For example, hypothetical data from our parental-discipline study are plotted in Figure 1-1. In this case, each point represents the parental-discipline score and the number of court appearances for each child. For example, the upper right point in the graph represents a child having four court appearances and a lenient parental-discipline score; the lower left point, a child with no court appearances and a strict parental-discipline score. This scatterplot shows that there is a moderate relationship between parental discipline and court appearances in our fictitious example. The data points tend to cluster about an imaginary line running from the lower left to the upper right of the graph. In this hypothetical example children whose parents are strict tend to have fewer court appearances.

[3] Every good experimenter must remember that *data* is a plural word; a datum is, but data are. If you chant to yourself "these data are" three times every morning when you wake up, you'll probably still forget!

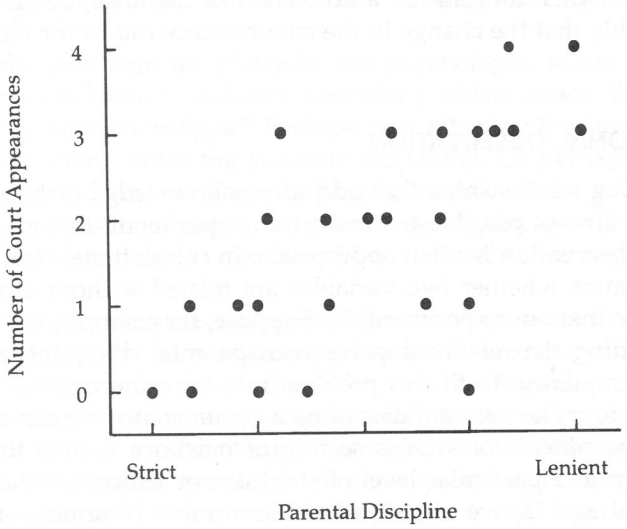


FIGURE 1-1 Fictitious data showing the relationship between parental discipline and the number of court appearances for children

We agreed at the beginning of this chapter that the business of scientists is establishing relationships between events; why then is this result not as good as the result of an experiment? Remember from our discussion of the experimental method that when we have conducted a good experiment, we can say that the change in the circumstance we manipulated caused a change in the behavior we measured. From a correlational observation, however, the best we can do is conclude that one *variable is related* to a second variable.

Why can't we say that leniency *causes* juvenile delinquency? Basically because we have not manipulated any circumstance; all we have done is measure two behaviors. Only if we had set up an experiment in which we manipulated leniency, perhaps by training one set of parents to be more lenient and one set to be less lenient, would we have been able to make a causal statement. Instead, what we did was allow parents to choose how they would discipline their child. Thus type of discipline was a behavior rather than a manipulated circumstance, and the strong causal conclusion we could make for experimentation no longer applies. Why?

For correlational observation it may be that one of the behaviors is causing the other, but even if this is the case we do not know which behavior is doing the causing and which is being caused. This problem is sometimes referred to as the **directionality problem.** For instance, in our example it may be that as juveniles become more delinquent, parents become more afraid of using strict discipline. In other words, delinquency may cause lenient discipline. From a correlational study we are unable to know the causal direction even if one behavior did cause the other.

It may also be the case that neither behavior directly caused the other even though there is a relationship. Some third variable may have caused both behaviors—cleverly known as the **third variable problem.** Perhaps the following example will illustrate why it is difficult to make casual statements based on correlational observation. The U.S. Army conducted a study of motorcycle accidents, attempting to correlate their number with other variables such as socioeconomic level and age. The best predictor was found to be the number of tattoos the rider had! It would be a ridiculous error to conclude that tattoos cause motorcycle accidents or, for that matter, that motorcycle accidents cause tattoos. Obviously, a third variable is related to both—perhaps preference for risk. A person who is willing to take risks likes to be tattooed and also takes more chances on a motorcycle.

I am sure you are aware of the historical debate between the tobacco industry and the government on the health consequences of smoking. The dilemma faced by the U.S. Surgeon General a decade or so ago is a good illustration of the difficulty in making causal statements based on correlational data. Although it had been known for some time that a positive correlation exists between the number of cigarettes smoked and the incidence of lung cancer and other health problems, the Surgeon General was reluctant to say that smoking caused lung cancer. Some of this reluctance may have been politically motivated. However, much of it was justifiable scientific caution, for there could have been a third variable that caused the cancer but also influenced smoking. For example, people who are nervous might produce a chemical that keeps the body in an irritated

state, producing irritated cells that are prone to malignancy. It might also be true that nervous people smoke more cigarettes. Nervousness, then, could have caused the change in both variables.

Thus, the Surgeon General's office would have had to perform an experiment to say definitively from one study that smoking causes lung cancer. Such an experiment might require 1000 people to smoke 40 cigarettes a day, another 1000 people to smoke 30 a day, and so on. In this design, experimenters could determine the probability that an individual in each group would have gotten lung cancer during his or her lifetime. Assuming that the experiment was done properly, any real difference in the incidence of cancer between the groups could be said to be caused by the cigarettes. However, our society requires that a person's preference be honored, so ethically such an experiment could not be and was not conducted.

How, then, did cigarette packs come to have the following warning printed on them: "SURGEON GENERAL'S WARNING: Smoking causes lung cancer, heart disease, emphysema, and may complicate pregnancy"?[4] In this case, correlations were determined for many of the other variables that could have been related to health problems and smoking. As more and more of these variables were eliminated, it became increasingly likely that cigarette smoking was the cause. The Surgeon General apparently felt that all the logically possible third variables had finally been eliminated. That fact, in combination with animal experiments that did show a causal relationship, convinced him that such a statement could be made.

The point, then, is that sometimes we must collect correlational data to establish important psychological relationships. However, we must consider these data carefully to avoid the common error of interpreting the results of a correlational observation as a causal relationship.

As was the case in the example I used earlier in this section, one of the techniques frequently used to collect data for correlational observations is a survey, which can be in the form of a questionnaire or interview. Because students taking a research course and using this book often do a course project that uses a questionnaire, I will discuss the use of questionnaires in more detail in Chapter 10. Here let me just give a quick overview of surveys.

SURVEYS

Surveys typically ask people about their behavior or their opinions. You have probably participated in many surveys yourself, in some cases perhaps without realizing it. For example, in my school graduating seniors are mailed a survey asking them about their experiences at the university: effectiveness of professors, access to health care, availability of career counseling, tastiness of food service meals, etc. Or perhaps you have answered

[4] There are actually several statements that warn of the dire consequences of smoking, but they all imply that it is smoking that *causes* health problems.

the phone and been asked questions by a political party regarding your feelings about issues and candidates. On the Internet when you subscribe to some services you have to answer questions about who you are and what your preferences are. Even this is a type of survey.

Surveys include questionnaires that may be in paper-and-pencil form and administered in person either individually or to groups of participants (usually called respondents). Questionnaires can also be mailed or even sent out over the Internet. Surveys also include interviews that can be done face-to-face or over the telephone. Each of these methods has advantages and disadvantages that will be discussed further in Chapter 10.

There are several general advantages to doing survey research. One is that you can directly ask respondents about their opinions, attitudes, and motivations rather than having to infer these from their behaviors. For example, we might do an experiment by changing the way merchandise is displayed at a store and discover customers buy more. However, although we know customers are buying more, we really do not know why. Perhaps they feel more positive toward the store, or perhaps they can find what they are looking for more easily. A survey would allow us to determine why they buy more, or at least why they think they buy more. A second advantage is that it is relatively easy to collect large amounts of data quickly. I watched the president's state of the union address last night, and a TV network presented the results of a viewer survey just a few minutes after it was over.

There are also some disadvantages to surveys. While you may think that people are giving you factual information about their behavior or opinions, what they say may differ from the truth. For example, the Gallup Organization has been asking people about church attendance for 60 years, and about 40% of respondents typically say they attend a worship service once a week. This figure is far higher than in other Western nations, and many churches report a drop in membership in recent years. What is the truth? C. Kirk Hadaway and Penny Long Marler (1998) decided to consult pastors and do head counts. They found attendance at closer to 20% rather than to 40%. Why are all these good church people lying? Perhaps some decide that even if they didn't go the week before, they usually do go so it's okay to answer yes. Or perhaps they think that good people should go to church and they want to be identified as good people. Whatever the reason, we know that in surveys people tend to exaggerate how often they vote or give to charities and underestimate how often they use drugs or the office copier for personal use. So as a researcher you must remember that the biggest problem with surveys is that they can tell you only how people *say* they behave or what they think, not how they actually behave or what they actually think.

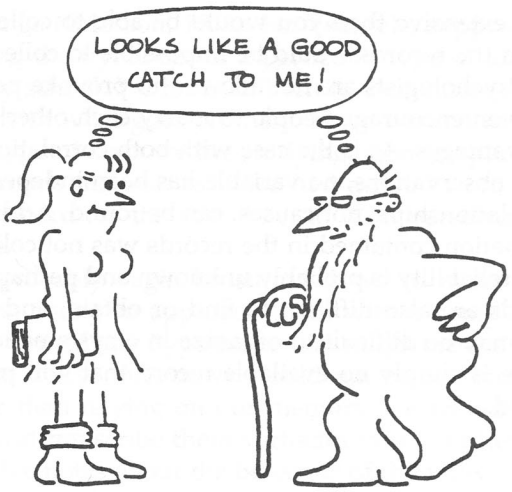
Another disadvantage of surveys is the same as one of the advantages —they give you so much data. One problem is that collecting these data requires a lot of respondents, and in some settings the number of respondents is limited. In my university, for instance, researchers who do large

surveys using the pool of introductory psychology students as respondents must sometimes wait until other researchers have completed their research or else the whole pool could be exhausted by a few surveys. A more serious difficulty for the researcher is that the large amount of data collected are difficult to interpret. I have read many reports of survey research written by students in which they list the results of a survey they have done but then do not know what more to say. Because survey research is seldom driven by theory, the results do not support or refute some theory, as experiments usually do. In addition, to do detailed analysis of survey results often requires using complex statistical techniques, such as factor analysis, that are beyond the training of beginning researchers. Some of the other advantages and disadvantages of surveys will be discussed in Chapter 10, where I go into much greater detail about questionnaires.

ARCHIVAL RESEARCH

Another form of correlational observation is archival research. In this case other people have done you a favor by recording your observations for you. That is, there may be public or private records containing information that is useful to you. When you examine these records for research purposes and attempt to organize and interpret the information to find relationships, you are doing **archival research.** I include this under quantitative research because most of these records can be quantified and turned into numbers. However, when the records consist of interviews, case histories, and the like, this research could be characterized as qualitative research. Just some of the records of interest to psychologists are census data, court records, newspapers, hospital files, accident reports, crime reports, clinical files, government agency records, salary listings of public officials, telephone directories, and corporate sales figures.

As an example of research using archival data, Doug Kenrick and a colleague at Arizona State University examined the marriage listings of a number of newspapers (Kenrick & Keefe, 1992). They were testing a sociobiological theory of personal attraction. This theory says that one of the major reasons that a woman finds a man attractive is because of his potential to provide resources for his children. A man, on the other hand, finds a woman attractive, at least in part, because of her potential to give birth to many children. If these statements are true, the theory predicts, women should in general be attracted to and marry older men who have already accumulated resources, and men should marry younger women who have many childbearing years remaining. To investigate this hypothesis Kenrick and his researchers simply read the section of newspapers that lists people getting married and their ages. As the theory predicts, he did find that, up to a point, the grooms were older than their brides. Of course, there are other possible explanations for this age difference, and these reasons have been discussed at length (Kenrick & Keefe, 1992). Nevertheless, this study illustrates nicely that archival data available to all of us, even in our daily newspaper, can form the basis for significant psychological research.



One of the most extensive examples of archival research formed the basis of *Homicide,* a book by Martin Daly and Margo Wilson (1988). These researchers were also investigating predictions made by the theory of sociobiology, also sometimes called selection thinking. In this case the archival data they examined were police reports of homicides. The theory predicts that in general, if people are going to kill other people, they should kill those who contribute least to their probability of reproductive success. The people they should be least likely to kill are their biological children, who carry their genetic material, and other people who contribute to the success of those children or future children, such as their faithful mates. So, for example, the theory predicts that parents are more likely to kill their stepchildren than their biological children and that men are most likely to kill their mates for suspicion of infidelity than for any other reason. The researchers carefully reviewed the homicide reports in police files for the city of Detroit and the country of Canada and discovered that nearly all of their predictions were confirmed. Children were 40 to 100 times more likely to be killed by stepparents than biological parents! Sexual jealousy was the motive in a large majority of cases in which men murdered their mates. Even some predictions that seem to run counter to common sense were supported by the data. For example, for adult children of a given age, those having older parents were more likely to kill them than those having younger parents. Sociobiological theory would predict this finding because the older parents are less likely to have children, who carry the family's genetic material, but the finding runs counter to several other theories of psychology. In Daly and Wilson's study, the archival records were so extensive that it was possible to code most of the data and turn them into numbers so that quantitative statistical analysis could be done.

There are several advantages of archival research. If you can find appropriate existing records, you do not have to spend time and effort collecting your own data. Also, in some cases the records provide data that

are much more extensive than you would be able to collect. Finally, some data available in the records would be impossible to collect by doing your own research. Psychologists are not allowed to provoke people into killing each other, or even encourage people to marry each other! Of course, there are some disadvantages. As is the case with both correlational observations and naturalistic observations, no variable has been independently manipulated, so only relationships, not causes, can be found. Additionally, in most cases the information contained in the records was not collected by trained scientists, so its reliability is probably unknown and perhaps suspect. Sometimes the records are also difficult to find or obtain, and even if they are available, they may be difficult to organize in a systematic way. Finally, in most cases there is simply no available record that will provide the information you need.

Qualitative Designs

The vast majority of research in psychology uses quantitative designs, such as experiments or correlational observations, because during the early history of psychology the scientific side of psychology fashioned itself in the image of the so-called hard sciences, such as physics and chemistry. The first fleeting attempts by the early introspectionists to use verbal reports as data rather than numerically measurable behavior were beaten down by the behaviorists, not to appear again for many decades. However, in recent years, some psychologists, particularly those in areas such as educational, clinical, and social psychology, have felt too constrained by these strict rules. They looked around for methods that would allow them to use verbal reports as data while maintaining some scientific rigor. What they found and adopted were some methods from anthropology and, more recently, sociology called qualitative research. Qualitative researchers use descriptive data: written descriptions of people, including opinions and attitudes, and of events and environments.

ETHNOGRAPHY

Imagine a cultural anthropologist who has traveled to a distant land wishing to investigate an exotic culture. How would the anthropologist proceed? So little would be known about this strange culture that setting up an experiment would certainly be out of the question. Even developing a questionnaire or a consistent set of interview questions would be difficult until some basic facts about the people were known. The initial goal of the anthropologist would probably be to talk to the people and describe them and their setting so that the culture would stop seeming strange and seem familiar. Those who do a type of qualitative research called **ethnography** are sometimes said to do the reverse, to study familiar cultures in order to

make them strange (Erickson, 1973). For example, suppose we were interested in studying the dynamics of a particular type of teaching technique in an elementary school. We have all been to elementary school, so we are pretty familiar with what goes on there. If we wanted to learn something new about the type of class we are studying, ethnographers would tell us, we should approach the task as if we had arrived from outer space and had seen a classroom for the first time, to train ourselves to view everything as strange.

We would probably begin by sitting down to interview the children and the teachers, trying to approach them with a completely open mind without having formed any hypotheses that might bias us about what happens in the class. These interviews would not be conducted in a haphazard way. Rather than relying on our memory, we would probably record the interviews and transcribe them verbatim into a written text. We might also take extensive notes about the behavior of the individuals in the class, the events that took place, and the setting or context within which the events occurred. Because ethnographers usually try to avoid interpreting their data, we would simply attempt to describe as accurately as possible the things the children and teachers said and did and the classroom environment. Ethnographers also sometimes act as participant observers. For example, in the classroom example, a teacher might be doing the research as a participant observer. The participant observer typically would be as unobtrusive as possible to avoid biasing the other participants' behavior—for example, by writing notes only during breaks.

The classroom example that we have been considering is also a case of naturalistic observation, a design that we will be examining next. However, not all ethnography or qualitative research has to occur in a natural setting. I have a colleague who is interested in the relationship between mothers and their daughters and in how mother–daughter relationships have changed from the past to the present. Her method of collecting data is to conduct extensive interviews in her laboratory with both mothers and daughters, record these interviews on tape, and then transcribe the tapes into written text. She is also interested in interpreting the data, rather than just describing them as a pure ethnographer would. Although the interviews are structured so that similar topics are discussed in each interview, she does not have a required set of questions that her interviewers must ask in a specific order. The interview is designed to allow some flexibility rather than simply being an oral questionnaire. Qualitative researchers claim that this flexibility is one of the strengths of their method, that the interaction with participants must allow the participants to describe their experiences, feelings, and attitudes in their own ways. These researchers believe that the experimental method, in which an experimenter is testing a limited hypothesis and collecting highly structured data, is so artificial and constrained that very little of the vast amount of available data is tapped. In fact, some qualitative researchers believe at a basic philosophical level that qualitative research is preferable because it has a humanistic

orientation; it treats the participants as human beings and fully taps into their humanity, whereas experiments treat participants as if they were objects (subjects) to be experimented on.

NATURALISTIC OBSERVATION

As noted in the previous section, some psychologists believe that research is best done by studying behavior in its natural setting, that the act of filling out a questionnaire or reporting for an experiment could distort the behavior of a participant. Suppose we were interested in whether consumption of alcohol was related to social aggressiveness. We could set up an experiment in which groups of research participants drank measured amounts of alcohol. They would then interact while the experimenter sat in the room and noted the amount of aggressive activity. How aggressive do you think the drinkers would be in this situation? They would probably resemble a church congregation more than a bar crowd.

To get an effective answer to our question, we would probably have to go to a bar and observe its customers. This technique in psychological research is called **naturalistic observation** because researchers observe behaviors under the conditions in which they naturally occur.[5] Naturalistic observations are required when we wish to investigate any behavior that we feel might be distorted by the artificiality of an experimental situation. Children, for instance, are typically inhibited by the presence of adults, particularly strangers. We would expect the behavior of children playing at home with their own toys to be far different from their behavior in a psychology lab with unfamiliar toys and a strange-looking psychologist present.

For a long time, comparative psychologists[6] and ethologists wondered whether any animal other than humans used tools, and naturalistic observation provided them with the beginnings of an answer. Initially, data collected by observing chimpanzees in zoos supported the general belief that other animals did not use tools. After a while, however, these researchers began to wonder whether zoo chimpanzees were not using tools because no tools were available in the zoo. They gave them tools like pliers and screwdrivers, but the chimps still didn't use them. Finally, a particularly bright investigator named Jane Goodall moved into the forest with the chimps. She lived with them and constantly observed their behavior for several years. One day she noticed that a particular chimp would take a branch, peel off the leaves to make it smooth, trim it to length, and dip it

[5] Naturalistic observations are also sometimes called field studies because the investigator goes into the field to collect data. (If I bite my tongue, maybe I can avoid the old saw about the farmer who was outstanding in his. . . .)

[6] A comparative psychologist is not someone who makes television commercials in which Brand X loses out to Brand Y. A comparative psychologist compares the behavior of animals, including humans, across species. Comparative psychologists contend that the rest of us are far too egocentric in our research; humans form only a small part of the animal kingdom.

into a termite hill and lick off the termites that were clinging to the stick. Although the stick is not as sophisticated as a human's tools, some investigators consider it an appropriate chimpanzee tool, and more recent laboratory work has confirmed the use of tools. Without naturalistic observation, researchers would still be sitting around watching zoo animals not using tools.

Some sciences other than psychology use naturalistic observation as their primary tool because they cannot achieve control over the variables they are investigating. Astronomers, for example, must pretty well investigate the universe as it occurs naturally. The same is usually true for archaeologists, paleontologists, ethnologists, and anthropologists. This limitation has not prevented these scientists from discovering important phenomena such as evolution. Because of problems with control, naturalistic observation in psychology is often used to suggest hypotheses that can later be more carefully investigated through experimentation in the laboratory. Used in this way, naturalistic observation can be a valuable research tool.

The major problem with naturalistic observation as a research technique may be obvious to you. Because investigators have no control over any of the variables they are observing, one variable may be changing systematically along with the primary one being observed. In the bar example, for instance, an investigator might observe that the more alcohol the customers drink, the more aggressive their social interactions become. However, the observer may not notice that as the evening wears on and more drinks are consumed, the number of bar patrons also increases. Maybe aggressiveness is related to crowding. Or perhaps the bartender is getting tired and brings the drinks at a slower rate. Maybe aggressiveness is related to frustration.

Thus, although naturalistic observation has an advantage in realism, it also has disadvantages in its lack of control. As with correlational observations, experimenters must be aware of potential confounding variables and must avoid making causal statements.

CASE HISTORY

A final research technique available to psychologists is another qualitative design called a **case history.** A case history is a detailed account of the events in a case; the case is usually a person's life, but it can be an incident such as the shutdown of a nuclear plant. Many of the data in clinical psychology come from case studies, dating back to Freud's reports of clinical cases. As is typical of qualitative designs, data for case histories are usually verbal. Suppose you were a therapist with a pair of conjoined ("Siamese") twins having multiple personalities as patients. You might be interested in exploring why Siamese twins develop dual personalities. You would immediately realize that trying to conduct an experiment to answer the question would be futile. Even if you could find enough Siamese twins to do an experiment, it is considered unethical to make Siamese twins mentally ill; it is also unethical to make non-Siamese twins mentally ill!

You might consider a correlational observation next. Perhaps you could correlate the number of personalities in Siamese twins with degree of childhood stress. Again, you would need to find a number of Siamese twins who had dual personalities. Because this task is virtually impossible and a correlational observation based on one data point is meaningless,[7] you would have to abandon this approach also.

The only option left would seem to be a case history outlining the factors in the lives of the Siamese twins that have contributed to their development. First, you would spend many hours interviewing the twins to establish a history of their life from birth to present. In addition, you would talk with their relatives and friends and examine any school, medical, and psychological records that were available. Because all this information would require far too much space to report, you would select what you felt were the most important aspects.

The case-history technique has built into it all the dangers that have been mentioned for the other methods, including unknown confounding variables and inability to establish causality. This method also has additional pitfalls. For one thing, the investigator is generally trying to reconstruct past events from the subjective reports of those who were associated with those events, and research has shown that people are terrible at recalling the past. One investigator found that mothers were inaccurate about recalling the details of their pregnancy and the birth of their child six months to a year after the experience. You can imagine the problems involved when the memories are 20 years old!

A second possible pitfall of the case-history method is the investigator's bias in selecting events to be reported. In a psychology course, I was once required to support a particular personality theory using events from the

[7] It is pretty difficult to establish a relationship between two variables with a single point. It is not difficult to establish a relationship with two points, however, because only one straight line can be drawn between them. Reporting a relationship based on two points is a lot like bragging. It's easy to do but no one pays any attention.

life of the major character in the novel *Crime and Punishment.* It was easy to select events that offered convincing support for my theory. However, I discovered that the other students in the class had used the same book to support three other personality theories, also in a convincing way. They had either chosen different events or given a different interpretation to the same events I had chosen. Even with the limited set of events described in a single book, bias was extremely important in determining the relationships we established. Is it any wonder that investigators can find support for their own pet theories from the nearly unlimited set of events in a person's life?

A number of books have been written that analyze the lives and personalities of famous historical figures, such as Richard Nixon, John Kennedy, and Sigmund Freud. Although they may make interesting speculative reading, these so-called **psychohistories** are subject to all the dangers inherent in a case history. In addition, most of the events the authors use as support for their theories are based on secondhand reporting in the public media. Thus, they are one more step away from the objective truth. (For example, one author concluded that Nixon was psychotic; another concluded that he was neurotic.)

A case-history approach has also been used in applied experimental settings for investigating infrequently occurring events. For example, it is basically impossible for a psychologist interested in the causes of aircraft accidents to set up appropriate experiments. What these investigators often do is reconstruct the events preceding an accident in as much detail as possible. By collecting enough of these critical incidents describing accidents and near-accidents, they hope to establish a pattern that will allow them to hypothesize the causes. These hypotheses can then be more thoroughly investigated under controlled experimental conditions.

One of the most defensible uses of the case study approach is in neuropsychology. Neuropsychologists and neuroscientists are interested in determining the function of various structures of the brain. One of the major ways to find out what a part of the brain does is to destroy it and find out how behavior changes. In humans there are obvious ethical problems with destroying brain tissue. Because brain tissue does not grow back, any such procedure would be permanently debilitating. One solution would be to find some unfortunate soul who has had brain tissue destroyed through accident or disease. From an introductory psychology course you may remember the case of Phineas Gage, a fellow who had a metal rod driven through his brain in a mining accident. This was one of the first cases that researchers used to understand the workings of the brain. Today there are many patients with various neurological problems whose behaviors have been extensively documented. These cases are used along with other data, such as data from animal research, to help us understand the functioning of the human brain. However, we should keep in mind that data from even these well-documented case studies do not come from experiments, so establishing causal relationships between these circumstances and behaviors should be done with extreme care.

The obvious advantage of the case-history approach is that it can be used when only one or very few cases can be examined. Some would also argue that an advantage is that behavior can be studied in all of its complexity in a natural context, whereas experiments study artificially simple behaviors in artificial settings. However, because it has the disadvantages mentioned earlier, including, in some cases, relying on potentially biased subjective reports retrieved from somebody's long-term memory, we should remain skeptical of conclusions drawn solely from a single case history.

Quantitative versus Qualitative Designs

Unfortunately, many investigators who have been trained exclusively in either quantitative research or qualitative research consider those who use the other approach to be misguided. Quantitative researchers argue that unless data can be converted into numbers, they can never be organized into the building blocks necessary for the construction of a scientific body of knowledge, that science cannot advance unless we can build theories that help us understand behavior. Such theories require a knowledge of the causes of behavior, and without experimentation—and to some extent correlational observation—no causation can be established. On top of these problems is the problem of the reliability of the data collected. Without being able to repeat research, we will never know whether our data are reliable. Some experimenters would say that qualitative researchers such as ethnographers do nothing but write descriptions of behaviors, a job for historians and novelists, not scientists.

On the other side of the debate are the qualitative researchers, some of whom would argue that experimentation deals with only tiny bits of unhumanlike behavior, and does so in artificial settings. They say that quantitative researchers will never be able to understand realistic human behavior in a holistic way. In addition, only qualitative research taps into the potential of the individuals being studied, using their insights and creativity to help guide the formation of our science. Some would go so far as to assert that there are ethical problems with experimentation in that it treats the people it claims to study as objects, rather than as humans. In the most extreme camp are qualitative researchers who completely reject traditional science and maintain that those quantitative researchers unwilling to accept qualitative designs are motivated by a desire to maintain political power and silence those who have traditionally been oppressed.[8]

A reasonable and moderate position would seem to be that as scientists we should use whatever type of design is needed to answer our ques-

[8] The most extreme qualitative researchers are the poststructuralists, who question the possibility of striving for an objective science. An interesting account of the origins of qualitative research can be found in Chapter 1 of *Ethnography and Qualitative Design in Educational Research,* by Margaret D. LeCompte and Judith Preissle (1993).

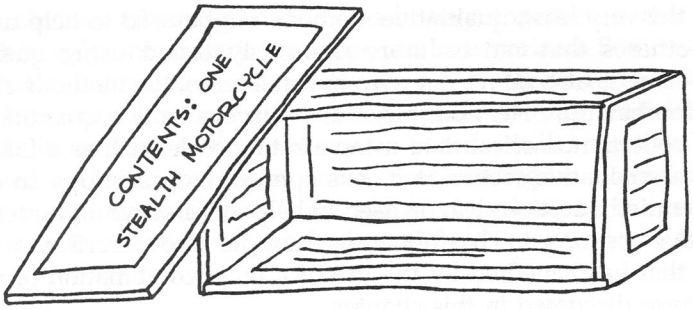
tions. At the very least, qualitative methods can be used to help us formulate hypotheses that can be more rigorously tested using quantitative designs. There is also no reason why, in some cases, the methods cannot be used in combination. For example, many surveys have a quantitative section that collects numerical data using a rating scale such as a Likert scale and also a qualitative section that asks open-ended questions. In this case the open-ended questions can be used to help understand and interpret the quantitative responses. The following example also describes a research question that has benefited by the use of a wide combination of methods that we have discussed in this chapter.

Using Methods in Combination

To illustrate how the various research techniques discussed in this chapter might be used to investigate a research hypothesis, consider the following situation. You are ready to pull your car onto the highway, quickly look both ways, start to step on the gas, and then pull up and say to yourself: "Whoa! There's a motorcycle coming. I almost didn't see it!" Or maybe you have been the motorcycle rider who had a car pull out in front of you as if the driver had never seen you. Why do you suppose this occurs? As we will discuss in Chapter 3, everyday observations and questions like this one can lead to the formation of a hypothesis for psychological research. A first step in forming a hypothesis is to examine the situation logically. What is the major difference between motorcycles and other vehicles such as cars and trucks?[9] Obviously, motorcycles are smaller and so may be less conspicuous than larger vehicles. But we are not the first to have thought of this idea. Once you have read Chapter 6, you will know how to find out if anyone else has investigated this issue. You would discover that many people have. Paul Olson of the University of Michigan Transportation Research Institute has reviewed some of this research and called our hypothesis the *motorcycle conspicuity hypothesis* (Olson, 1989). I will use some of the research he cites to illustrate the research techniques we might use to investigate this hypothesis.

First, although we have seen that the case-history method has many drawbacks, it can be useful in helping us form a hypothesis. In order to study the motorcycle conspicuity hypothesis, although it will be a bit different from the classic case-study method in which a single case is studied intensively, perhaps we can find people who have almost pulled into the path of a motorcycle and ask them what happened to cause their behavior. Is there a way to collect this type of data in a more systematic fashion? Fortunately, somebody has already done some of the work for us, the police. In this case an accident report is a bit like a short case study. If you collected accident reports for motorcycle–car accidents and read them, you

[9] I know, motorcycles are a lot more fun. Wrong answer!



would find that drivers who violated motorcyclists' right of way often claim not to have seen them or not to have seen them in time to avoid the collision. This is the kind of statement we would expect if the conspicuity hypothesis were true. In interpreting these findings we should keep in mind the limitations of the case-study approach. Whereas in this instance we have gained some confidence by having many cases, we should remember that the data rely on people's memory, were collected by people not trained in research, and are self-reports by drivers who have just been involved in an accident and for whom the responses may have legal ramifications.

Could we use naturalistic observation to investigate our hypothesis? If we had years to waste, we could sit on a street corner and wait for a motorcycle accident to happen that we could observe. Again, here we are lucky in that accident reports also contain information from people who have observed motorcycle accidents and from police officers, who have observed the consequences of the accidents. We can do archival research and look at the statistical data from various types of motorcycle–car accidents, comparing them with car–car crashes to determine the differences. If we did this we would find that, in general, cars and motorcycles are involved in the same kinds of collisions with about the same relative frequency, except in the case of the motorcycle going straight and the car turning left in front of the motorcycle. We should keep in mind that as in the case of all naturalistic observation, these data are at best correlational observations. An experimenter did not manipulate anything and then measure a change in behavior. Perhaps we could interpret the statistics as support for the conspicuity hypothesis, but it is weak support. Why are motorcycles less conspicuous only under this set of circumstances? Perhaps the automobile drivers would not have seen the motorcycles no matter how conspicuous they were because the drivers were looking left in the direction they were turning instead of forward at the motorcycle.

Would it be possible for us to use the experimental method to investigate our hypothesis? As you will see in Chapter 10, quasi-experimental techniques can be used in some cases where a full-fledged experiment is not possible. One example of such a technique would be to look at acci-

dent statistics for each of the years prior to an event that had changed motorcycle conspicuity and then after. Fortunately for us, in 1967 a number of states began requiring daytime use of headlights on motorcycles. If you take measures a number of times before such an event and a number of times after, a quasi-experimental design called an interrupted time-series is created. This design is not as rigorous as an experiment but is certainly more rigorous than a correlational observation. Using such a method, some early investigators estimated the reduction in daytime collisions to range from about 4% to 20%. However, more recent investigators have concluded that the effect of daytime headlight operation on motorcycle crashes is minuscule or nonexistent. It is also the case that when an effect of headlight use on motorcycles has been found, headlight use on cars, for which there was never a claim of conspicuity problems, may be equally effective in reducing crashes. Thus, the headlight data are inconclusive.

It is also possible to do formal experiments to investigate drivers' behavior with respect to motorcycles. In one such study observers estimated when an approaching vehicle would pass in front of them based on a two-second observation when the vehicle was about 100 meters away. There were no differences found for motorcycles, cars, and trucks. Differences were found when observers judged the last moment that they could safely pull out in front of a vehicle; they were willing to accept shorter gaps, on average, for motorcycles. However, no experiments have been done to specifically test the conspicuity hypothesis.

The research reviewed here that was cited by Olson (1989) illustrates nicely the various research techniques that can be used to investigate a single hypothesis. It also illustrates some of the advantages and disadvantages of the various techniques. The case study and naturalistic observation tend to be more realistic but may be lacking in rigor and precision. In contrast, formal experiments may be highly rigorous but can often be criticized as being unrealistic. Table 1-1 lists some of the advantages and disadvantages of the designs that we have examined.

Just so I do not leave you hanging in the air, what does Olson conclude from his review? He thinks that the conspicuity hypothesis lacks support. The most likely alternative would seem to be that because motorcycles are smaller, they are more easily blocked out by objects such as other cars, windshield posts, or trees and shrubs. It may be that drivers often fail to see motorcycles not because they are inconspicuous, but because they are hidden.

Summary

As scientists of human behavior, psychologists have a number of research designs available to them, all of which aim to establish relationships between events and to fit these relationships into an orderly body of knowledge. Among the **quantitative designs** is the **experimental method,** which

TABLE 1-1
A Summary of the Advantages and Disadvantages of Using Various Research Designs

Design	*Advantages*	*Disadvantages*
Experimental method	Precise control possible Causal conclusions possible Precise measurement possible Theory testing possible	Artificial setting typical Intrusiveness typically high Complex behaviors difficult to measure Unstructured exploratory research difficult
Correlational observation	Relationships between variables can be found Precise measurement usually possible Intrusiveness usually low	Causal conclusions impossible Control of variables difficult Many participants required
Questionnaires	Data collection efficient Attitude or opinion can be measured	Causal conclusions impossible Self-reports difficult to verify Unbiased sample selection difficult Response rates low when mailed
Archival research	No additional data collection required Rare behaviors can be studied Nonmanipulable events can be studied	Appropriate records often not available Data collected by nonscientists Data usually correlational at best
Ethnography	Unfamiliar situations can be described Complex behaviors can be described Intrusiveness low Participants treated humanistically	Control of variables impossible Precise measurement difficult Investigator bias possible Causal conclusions impossible
Naturalistic observation	Realistic setting helps generalization Intrusiveness low	Control of variables impossible Data collection inefficient Investigator bias possible Causal conclusions impossible
Case history	Rare cases can be studied Complex behavior can be intensively studied	Control of variables impossible Data often based on fallible memories Investigator bias highly likely Causal conclusions impossible

is the primary focus of this book. It requires that a particular circumstance be manipulated and some aspect of behavior measured. From an experiment it is possible to say that the manipulation of the circumstance *caused* any change found in the behavior.

Sometimes when an experimental approach cannot be used, it is necessary to use **correlational observations,** in which variables are observed and their relationships evaluated. The results of such a study cannot be used to establish causal relationships, because none of the variables is under the control of the investigator. Correlational observations are often carried out using a **survey** in the form of a questionnaire or interview. Correlational data can also be obtained by doing **archival research** using data contained in public or private records, such as census data or court records.

Some investigators are now doing research that employs **qualitative designs.** Qualitative researchers use descriptive data: written descriptions of people, including opinions and attitudes, and of events and environments. **Ethnography** uses interviews and sometimes participatory observations to gather descriptive data. One form of qualitative research uses **naturalistic observation,** in which the data are gathered in realistic settings. A final qualitative design used when the potential number of observations is limited is the **case history,** in which detailed accounts of the events in a person's life or in a historical incident are described and analyzed.

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