CHAPTER

6

Introduction to Research Design

What You Should Know!

A research design is essentially a plan that maps out the course of action for a research project. Before choosing a research design, it is important to recognize the goals of the study. For example, is the study attempting to determine the causes of homicide? All of the choices regarding research design are driven by the research question—specifically, what is the researcher trying to find or determine? After completing this chapter, the reader should be able to:

1. Define empiricism and discuss how it relates to criminal justice research.
2. Identify and discuss the three criteria for causality.
3. Contrast idiographic and nomothetic causal explanations.
4. Contrast necessary and sufficient cause.
5. Compare experimental and quasiexperimental research designs.
6. Discuss the three elements of experimental research design.
7. Describe the classical experiment research design.
8. Compare the classical experiment research design to the pretest-posttest, protest only, and factorial research designs.
9. Describe the four levels of measurement: nominal, ordinal, interval, and ratio.
10. Identify the questions that can be used to help correctly identify a variable's level of measurement.

Empirical Observation

Thinking back to an introductory course in criminology and criminal justice or a course in criminological theory, students may realize they have already received an introduction to empiricism. Cesare Lombroso, the founder of the Positive School of Criminology, used empiricism in his study of criminals. Lombroso's study of criminals focused on observing and measuring physical characteristics, such as facial features. Earlier scholars also used empirical techniques. For example, Quetelet and Guerry compared the crime rates of geographic areas in France.

Empiricism is defined as seeking answers to questions through direct observation, specifically sensations and experiences, to arrive at conclusions about the world in which we live (Jeffery, 1990). The use of the scientific method, with its focus on structured inquiry rather than casual observation, is what makes empiricism important. This emphasis on trying to see things as they are rather than idealistically is the basis on which positive criminology is founded. Rather than just quoting an "eye for an eye," empirical techniques can be used to gather and evaluate data as to the effectiveness of correctional programs, to decide which patrol strategy is more cost effective, or to determine whether extralegal factors influence conviction rates.

Causality

In applying empirical observation to criminal justice research, the focus is on causal relationships. Simply stated, what behaviors or events lead to other behaviors or events? When trying to answer that question, one seeks to determine causality. One of the main questions in criminal justice and criminological research is what "causes" people to commit crime? By determining the causes of criminal behavior, the criminal justice system could develop interventions to decrease or prevent crime.

Idiographic and Nomothetic Causal Explanations

The examination of numerous explanations to describe why a single event occurred is known as *idiographic explanation*. Historians tend to use this method to explain the occurrence of events, such as explaining why the terrorist attacks on September 11, 2001 occurred. Police officers investigating a homicide are searching for an idiographic explanation. They are trying to determine why a single homicide occurred and not trying to determine why all homicides occur. When researchers in criminal justice and criminology aim to determine why behaviors (such as homicide) or events occur in general, rather than to explain a single event, they are using *nomothetic explanations* (Berg, 2008; Bergman, 2009; Gavin, 2008).

Rather than trying to provide a total picture of every influence in a causal relationship, nomothetic explanation focuses on one or a few factors that could provide a general understanding of the phenomena being studied. Nomothetic

explanations of causality are based on probabilities. In other words, what factors may increase or decrease the likelihood of behaviors or events? For example, city officials who want to determine how to reduce vandalism in areas of tourism determine that increasing surveillance, such as increasing the presence of police, decreases occurrences of new vandalism.

The Criteria for Causality

In investigating to determine if there is a causal relationship between the events or issues that being studied, three criteria must be observed (Adler & Clark, 2007; Dunn, 2009): (1) time order—the independent variable (the variable that is providing the influence) must occur before the dependent variable (the variable that is being acted on); (2) association—a relationship between the independent and dependent variable must be observed; and (3) elimination—the apparent relationship is not explained by a third or external variable.

For example, one sees individual A struck by person B. Person A then falls down. Using the criteria for causality, one would conclude that the striking (independent variable) led to the falling (dependent variable). It occurred before the falling and was clearly related to that which was witnessed. If no other event (a third variable, such as a second blow struck by person C) occurred, then it is reasonable to assume that the criteria for causality have been met.

Necessary and Sufficient Cause

In investigating causality, one must meet the previously mentioned criteria (time order, association, and elimination of the impact of an external variable), but there is no requirement to demonstrate a perfect association. In other words, every time changes occur in the independent variable, changes may not occur in the dependent variable because the relationship is based on probabilities or likelihoods. In probabilistic models, such as those used in most inferential research, one often finds exceptions to the rule. *Necessary cause* refers to a condition or event that must occur for another event to take place. For example, to collect a paycheck, one must be employed. The cause must be present for the effect to occur.

When the presence of a condition ordinarily causes the effect to occur, this is known as a *sufficient cause*. The cause usually, but not always, creates the effect. Playing golf in a thunderstorm may not result in being struck by lightning every time (the authors still do not recommend it), but the conditions are sufficient for the lightning strike to occur. In social science research, it is preferred to identify a necessary cause for an event but to do so is often impossible. Instead, one is more likely to identify causes that are sufficient.

Experimental Research Designs

Although it is most often used in the natural sciences, research requiring a true experimental design occasionally may be attempted by social scientists.

Though it is more likely for criminal justice and criminological researchers to use quasi-experimental research designs, it is important to understand experimental research designs. Typically, experimental research designs are used in assessing cause-and-effect relationships in which a specific group experiences something and this group is compared to another group that did not experience the something. The classical experiment is considered the gold standard of experimental research designs and includes all three major components of experiments: (1) random assignment, (2) experimental and control groups, and (3) pretesting and posttesting (Campbell & Stanley, 1963; Maxfield & Babbie, 2009). Experimental research designs that are modifications of the classical experiment include the pretest-posttest, posttest-only, and factorial experiment research designs.

In classical experiment research designs, the first step is to determine which subjects will be assigned to the experimental or control groups using random assignment. Random assignment is essentially flipping a coin to determine the which group each subject will be placed. This process should result in experimental and control groups that are roughly equivalent. Subjects in the experimental group are exposed to the experimental stimulus, which is based on the hypothesis's independent variable (Campbell & Stanley, 1963; Maxfield & Babbie, 2009). For example, if the purpose of a study is to investigate the impact of an intervention designed to increase the empathy of violent offenders toward crime victims, then the hypothesis would be that exposure to the intervention would increase empathy of violent offenders toward crime victims. After violent offenders who were serving time in prison were selected to participate in the study, they would be randomly assigned to the experimental or control group.

The subjects in the experimental group participate in the empathy intervention, but the subjects in the control group do not. The inclusion of the control group allows for the elimination of the impact of external variables, which is one of the criteria for determining causality. The structure of the classical experiment research design also addresses the time order element of the causal criteria. The experimental research designs can be used to address the issue of time order because one has the ability to control when the experimental group is exposed to the experimental stimulus. Additionally, one can control how much exposure occurs by determining how often the duration occurs and how long the subject is exposed to the experimental stimulus. Borrowing a term from medicine, this is known as "determining the dosage."

Both the experimental group and the control group complete pretesting and posttesting. The pretest and posttest are typically the same measure designed to assess changes in the dependent variable. Continuing with the example of the empathy intervention, the subjects (violent offenders) in the experimental group would complete the same survey designed to assess the level of empathy

Figure 6-1 Classical Experiment Research Design

would also undergo pretesting and posttesting even though these subjects were not exposed to the experimental stimulus (empathy intervention). The inclusion of pretesting and posttesting in the experimental research design allows for assessment of the changes in the level of empathy before and after the intervention within the experimental group and control group as well as comparing the impact of the intervention between the experimental and control groups.

In the classical experiment research design, one can see that all elements of the experimental research designs are present, including random assignment, control and experimental groups, and pretesting and posttesting. In **Figure 6-1**, O represents observations, and X represents the experimental stimulus. The experimental group is displayed on the first line with O X O, indicating an observation (pretest), experimental stimulus, and then the second observation (posttest). The control group is displayed on the second line with O O, indicating an observation (pretest) and then a second (posttest) but no experimental stimulus. The third line shows the time order, with t_1 representing the first time period, t_2 representing the second, and t_3 representing the third.

The other experimental research designs—pretest-posttest, posttest-only, and factorial experimental research designs—are variations of the classical experiment with elements either subtracted or added. The pretest-posttest experimental research design (**Figure 6-2**) differs from the classical experiment research design in that it does not contain a control group, which also negates the need for random assignment. This experimental design allows for the comparison between pretest (before exposure to the experimental stimulus) and posttest (after exposure) (Campbell & Stanley, 1963). Using the empathy intervention example, the pretest-posttest design would allow for comparisons between before and after the intervention. Therefore, one could not determine if the same changes would have occurred without the intervention since the results of a control group's pretest and posttest are not

Figure 6-2 Pretest-Posttest Research Design

Figure 6-3 Posttest-Only Research Design

available to compare to the results of the experimental group. Furthermore, the exclusion of the control group from the pretest-posttest research design means that the presence of external variables cannot be eliminated in the analysis. For example, a victim of a violent crime may have been a guest speaker at the prison between the pretest and posttest, which could impact the results since the effect of this event may have had an impact on empathy in place of or in addition to intervention itself.

The posttest-only experiment research design (**Figure 6-3**) differs from the classical experiment research design in that there is no pretest. Subjects are still randomly assigned to the experimental and control groups but only receive the posttest. In the posttest-only research design, comparisons can be made between the experimental and control groups, which allows for the elimination of the impact of external variables. However, the exclusion of the pretest does not allow assessment of the impact of the experimental stimulus, since a baseline observation is not available (Campbell & Stanley, 1963; Maxfield & Babbie, 2009). Researchers may argue for the use of the posttest-only research design if they perceive the pretest as having an impact on the behavior of the subjects and convoluting the results. For example, subjects in the experimental and control group may consciously or subconsciously change their reported behavior on the posttest due to perceiving the desired results of the study from taking the pretest. However, the value of the pretest in being able to compare the results to the experimental and control group posttest results typically outweighs the concern of the unintended impacts of the pretest.

Unlike the pretest-posttest and posttest-only experiment research designs, the factorial experiment research design (**Figure 6-4**) adds to the classical experiment research design. Rather than having one experimental stimulus, the

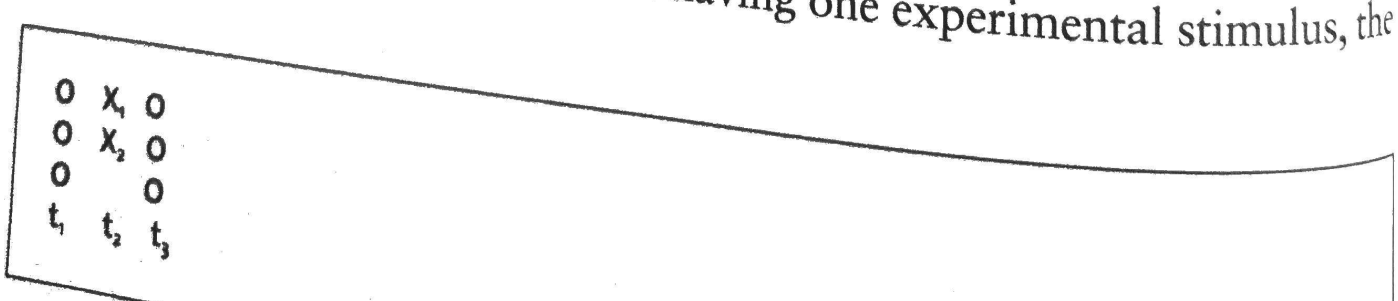

Figure 6-4 Factorial Experiment Research Des

factorial design has two or more experimental stimuli. The experimental stimuli may differ based on dosage (Campbell & Stanley, 1963; Maxfield & Babbie, 2009). For example, the subjects in the first experimental group (X_1) for the empathy study may receive a single, hourlong exposure to the experimental stimulus (the intervention), and the subjects in the second experimental group (X_2) may receive one two-hour session per week for 11 weeks. The type of experimental stimuli can also differ, such as one being a therapy session and another as simple as watching a video. Even though the factorial experiment research design can contain an unlimited number of experimental stimuli, one should keep in mind what the primary goal of the research is and focus the experimental stimuli on the primary goal.

The primary advantage of the experimental design is its ability to isolate the experimental variation and assess its impact over time. Individual experiments can be limited in scope and require little time, money, and number of subjects. In addition, it is often possible to replicate the results: Because an experiment is a controlled environment, the procedures can be replicated and the results compared. The major disadvantage is artificiality. Processes that occur in a controlled setting may not actually occur in the natural setting. Violent offenders randomly assigned to participate in the empathy intervention may not decide to participate on their own so the usefulness of the results are called into question.

With respect to criminal justice and criminology, this type of research is often expensive and logistically difficult to perform. One of the most difficult issues is obtaining consent when the research involves human test subjects. However, sometimes consent is easier to obtain if the experiment could prove useful to the subjects. For example, assume a new drug has been created that could suppress sexual desires. A group of convicted pedophiles are asked if they will participate in a study in which part of the group will receive the new drug, whereas the other half are given a placebo. After a certain number of weeks, both groups are tested for sexual response to certain stimuli, and the results are compared.

Another major problem in conducting true experimental research is the difficulty in being able to maintain and control the environment in which the experiment is conducted. The environment in which criminal justice and criminology research is conducted is often far from stable and is filled with possible interfering variables. As a result of the control and consent issues, along with costs and other logistical problems, it is rare to see a criminologist conduct true experimental research. These difficulties have not stopped some efforts to conduct this form of research. Some examples found in criminal justice include the Kansas City Preventive Patrol Experiment, the Minneapolis Domestic Violence study, and San Diego's one- versus two-person patrol units.

FROM THE REAL WORLD

For one year starting in 1972, the Kansas City Police Department implemented the Kansas City Preventive Patrol Experiment to determine the impact of police patrols on the occurrence of crime. In the study, three areas were selected, and different levels of routine patrols were implemented. In one area there were no routine patrols, and officers only answered service calls. In a second area, the levels of routine patrols were not changed, and this area acted as the control group. In a third area, the levels of routine patrols were more than doubled or even tripled. It was hypothesized that the higher levels of routine patrols would decrease the occurrence of crime. However, the results indicated little impact of the routine patrols on the occurrence of crime (Kelling, Pate, Dieckman, & Brown, 1974).

Reality dictates that few experimental research projects are possible in criminal justice and criminology. The limitations, however, can be addressed to some degree with a quasi-experimental design, which retains some, but not all, elements of the experimental research design.

Quasi-Experimental Research Design

Unlike the true experimental design in which the researcher has almost complete control over relevant factors, the quasi-experimental design offers only some control. The quasi-experimental research design allows for the approximation of conditions similar to an experiment. However, this research design does not allow for the random assignment of subjects to experimental and control groups, nor does it include the ability to control or manipulate the experimental stimulus. Random assignment in particular is difficult to implement in criminal justice or criminological research due to ethical and legal concerns.

Although easier to implement than the true experimental design, the quasi-experimental design has its difficulties, making it less appealing to most social scientists. The main difficulty lies in the interpretation of the results, specifically being able to separate the effects of a treatment from the effects caused by the initial inability to make comparisons between the average units in each group. Since random assignment is not performed within quasi-experiments, the groups are not truly equivalent. Quasi-experimental research design is most commonly used in evaluation research to assess new approaches in the criminal justice system and to solve problems with direct applications to the criminal justice system. The empathy intervention was used as an example of an experimental research design. However, the assessment of the empathy intervention would be more likely to be completed using a quasi-experimental research design. Subjects choose whether to participate and then changes in the level of empathy before and after the empathy intervention are compared between subjects who participate and subjects who do not participate. One issue with this

example is that the subjects who choose to participate may be different from those who do not participate. Specifically, they may be more likely to display empathy in the first place.

Overall, there are a number of research designs from which to choose. The design chosen depends largely on what the researcher is seeking to discover, explain, or describe. Other considerations when choosing a research design include economics, logistics, and time. Ultimately, the researcher must decide which design allows for the best results.

Quantitative Levels of Measurement

Experimental and quasi-experimental research is typically quantitative. Quantitative data have variables with various levels of measurement, including nominal, ordinal, interval, and ratio. Based on the previously mentioned definition of quantitative research, *measurement* is viewed as the assignment of numerical values or categorical labels to a phenomenon for the purpose of analysis. Determining what level of measurement to use can often be a confusing part of conducting quantitative research. The four levels of measurement range from low (nominal is the simplest variable) to high (ratio is the most complex variable).

Nominal Level Variables

The simplest level of measurement is the nominal level. At this level, measurement is categorical with no specified order within the categories of the variable. An example of a nominal level variable is month of birthday, with the categories of January through December. The categories are mutually exclusive. In other words, the categories do not overlap. A single item cannot fit into more than one of the variable categories. For example, a variable describing vehicles with the categories two-door, four-door, truck, sedan, minivan, and SUV would have overlap between the categories, such as a two-door truck. Since there is overlap between the categories, they are not mutually exclusive. The way to fix this problem would be to specify separate categories; for example, the single vehicle variable would become two variables, the first being the number of doors and the second being the vehicle type.

Ordinal Level Variables

The next level of measurement is the ordinal level. This level moves beyond being merely categorical by assigning a rank or a placement of order to the categories of a variable. As in the nominal level variables, the categories in an ordinal level variable are mutually exclusive. Although in using this level of measurement, numbers may be assigned for ranking purposes (e.g., on a scale of 1–10), these numbers are not scores, but are simply viewed as a demonstration of where the respondent believes the item to fall. For example, in looking at the difference between the seriousness of criminal offenses in which murder is labeled as a 9, robbery a 5, and theft a 1, there is a four-unit difference between

each type, but one cannot explain what that difference truly represents. Another example is that the types of prisons may be broken down into the categories of minimum, medium, and maximum.

Most often ordinal measures are found in attitudinal surveys, perceptual surveys, quality of life studies, or service studies. For example, individuals could be given a list of occupations that respondents could be asked to rank in order of how stressful they perceive each to be, from most stressful (10) to least stressful (1). Although they would write any number between 1 and 10, the listed order would only tell what the individuals perceive. There is no way to determine how much difference there is in the perceived stressfulness between each occupation. A common type of ordinal level variable is a Likert scale, which consist of five categories. For example, students may be asked to respond to the statement "Research methods will play a vital role in my career in the field of criminal justice" by choosing one of five provided responses, including "strongly disagree," "disagree," "neutral," "agree," and "strongly agree."

Interval Level Variables

The third highest level of measure is interval, which has scores instead of categories. With scores, there is an expected equality in the distance between choices on the continuum. The use of scores rather than categories allows the use of more sophisticated techniques during data analysis. There is no absolute zero or starting point for interval data. Because numbers assigned have an arbitrary beginning, the usefulness of the information may be limited. For example, the difference between an IQ of 135 and 150 is the same 15-unit difference as between 150 and 165. However, there is no distinction as to what the difference means. One can comment on the differences but cannot explain what that difference means. To be able to do so requires ratio level data. For practical purposes, interval level variables typically are treated as ratio level variables for the purpose of analysis.

Ratio Level Variables

The highest level of measurement is ratio. This level is primarily characterized by an absolute beginning point of zero, and the differences between scores are equal and can be explained. Two of the more common ratio level variables are age and income. For an age variable, the respondent would provide their exact age, typically in years. For an income variable, the respondent would provide their exact income, usually for a single year. An example of the absolute zero relevance for the ratio-level variable would be a subject that provides a 0 as a response to an income question because they were unemployed during the time period. With respect to research, ratio measures can be collapsed into ordinal measures, such as the individual scores of a ratio level income variable being collapsed into an ordinal level variable with the following categories: under $10,000, $10,000–$24,999, $25,000–$49,999, over $50,000.

Many people, including students, find it frustrating to accurately determine a variable's level of measurement. Sometimes, this situation is due to confusion on the part of the individual, but at other times the variable information is poorly worded. Asking the following question can help determine a variable's level of measurement. First, are the variable's possible outcome scores (numeric) or categories (named units or ranges of values)? If the variable's possible outcomes are scores, then the variable is ratio. If the variable's possible outcomes are categories, then the next question is: do the categories have an order? One way to check for order is to move a middle category to the top or bottom. If the categories look out of order or off, then the categories do have an order. If the categories have an order, then the variable is ordinal. If the categories do not have an order, then the variable is nominal. These questions should help guide the determination of a variable's level of measurement.

The level that is chosen has an important impact on how the data are collected and analyzed. Researchers can move down from a higher level of data to a lower level during data analysis, but they cannot move up to a higher level from a lower level.

Summary

This chapter provides an introduction to research design. Research design is based on empiricism with the goal of establishing causality (or more likely, association). The basis for research design is experimental research, including classical, pretest-posttest, posttest-only, and factorial experiment research designs. Even though experiments are difficult to implement in criminal justice and criminological research, understanding the basics are important since it provides the basis of quasi-experiments as well as the cross-sectional and longitudinal research designs (discussed in the next chapter). Experimental research is largely quantitative; thus, identifying the variable level of measurement, including nominal, ordinal, interval, and ratio, is important.

APPLICATION EXERCISES

1. In your position within the research staff of a large federal prison, you have been assigned to study the impact of educational and vocational programs on the recidivism of inmates. Provide the definitions for the key components of the study, including educational programs, vocational programs, and recidivism.
2. The warden of the prison would like to know if educational programs and/or vocational programs "cause" a decrease in recidivism. Describe to the warden the criteria for establishing causality.
3. Describe experimental research design and quasi-experimental research design to the warden.