CHAPTER 2

THEORY, MODELS, AND RESEARCH QUESTIONS

Like architects, researchers build models to represent the real world.

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LEARNING OBJECTIVES

After reading this chapter, you should be able to

- Recognize how theories and models are useful in guiding research
- Understand and explain the following basic concepts: variable, variation (cross-sectional and longitudinal), sign of a relationship (positive and negative), and hypothesis
- Identify the independent and dependent variables, as well as the unit of analysis, in a particular theory
- Understand the causal mechanisms that connect independent variables to dependent variables—and how they can be represented in a model as intervening variables
- Develop a logic model to represent the causal mechanisms underlying a program or intervention—and use logic models to identify weaknesses as well as ways to improve program effectiveness
- Generate and focus a research question for applied research

Overview: Theories and models emerge in response to questions about how the world works—and how we might change it. In this chapter, you will learn how to use a theory to explain an outcome of interest, how to use a model to express a theory, and how theories and models are essential to understanding and conducting research. You will learn the building blocks of a model—variables, relationships, and causal mechanisms. And you will gain practice using causal diagrams to work out a logic model of how and why a program or intervention is expected to work, providing insight for program design and evaluation. Finally, you will learn how to generate and focus a research question to motivate your own investigation.

Community Policing Comes to Portland[1]

As in many cities, crime remains a pressing social problem in Portland, Oregon—especially in poor and minority neighborhoods. So Portland has looked to *community policing* as a possible solution. Assistant Chief of the Portland Police Bureau (PPB) Chris Davis explains the idea of community policing this way: "It's engaging people who actually live in a neighborhood about what they see being a problem, and how they think we can best solve the problem." To engage the community, PPB police officers make regular house visits, attend community meetings and events, and patrol on foot or on bike rather than in squad cars. This kind of *community engagement* not only helps the police better understand the needs of the community but also encourages community members to have more trust in—and thus more willingness to cooperate

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Community policing enhances safety by building trust.

[1]This example is based on an article by A. Zielinski (2019).

BOX 2.1

BROKEN WINDOWS THEORY AND FIGHTING CRIME IN NEW YORK CITY[2]

"One unrepaired broken window is a signal that no one cares," wrote George L. Kelling and James Q. Wilson in a 1982 *Atlantic* article, "and so breaking more windows costs nothing." Thus, going after small, seemingly petty disorders such as vandalism, graffiti, or public drunkenness may help prevent more serious crime from occurring. "We decided to apply this concept to crime in the subways," recalls William Bratton, then chief of New York City's transit police. "Fare evasion was the biggest broken window in the transit system. We were going to fix that window and see that it didn't get broken again." When Mr. Bratton became commissioner of the city's regular police force in 1993, he began a "quality of life" initiative that took aim at the very "broken windows" Kelling and Wilson wrote about: vandalism, graffiti, panhandling, loitering, and public drinking.

Crime in New York City fell dramatically throughout the 1990s and beyond. Many police chiefs and criminologists credited the broken windows theory for New York's success and sought to replicate it in other cities. Others, however, doubted the theory and pointed to other factors—the end of the crack epidemic, demographic change, and the growing economy at the time—for the drop in crime in New York City and other urban areas. The broken windows theory has also been increasingly criticized for encouraging stop-and-frisk practices and other forms of aggressive policing, especially in minority communities. In Box 2.5, we discuss criticism of the broken windows theory and some possible reasons this theory has gone wrong.

with—the police. That is the basic *theory* of how and why community policing aims to reduce crime and improve other outcomes. Initial results seem promising: According to the PPB's statistics, reported offenses have been trending down in the neighborhood since the advent of community policing. Knowing what drives crime—which theories are true—can help Portland and other cities make better policy decisions in the future.

What Is a Theory?

In everyday conversation, the words *theory* or *theoretical* often suggests something hypothetical, imaginary, or impractical. But in applied social research, a **theory** refers to something more specific and useful: a causal explanation, guided by reasoning or evidence, of how some aspect of the social world works. Because the social world is enormously complicated, however, we often need to break it down into smaller pieces in order to better study and explain it. Thus, theory in applied social research is often a causal explanation of how a particular corner or limited part of the social world works, or what Merton (1967) termed *middle-range theory* and Glaser and Strauss (1965) referred to as *substantive theory*. This is the kind of theory we focus on in this chapter.

[2]This example is based on an article by D. W. Miller (2001). "Broken windows" was the opening example of a theory in the first and second editions of this book.

Theories can describe a large-scale occurrence, such as the start of a war between nations, or a relatively small-scale event, such as the ability of a child to sound out a word. A theory is practical because it provides insight on how to change the world. If we know what causes war, perhaps we can find a way to prevent it. If we know what makes a child recognize parts of a word, perhaps we can help children read better.

Of course, a theory is not necessarily correct—it must stand up to questioning and empirical testing. King, Keohane, and Verba (1994) define "a social science theory [as] a reasoned and precise speculation about the answer to a research question, including a statement about why the proposed answer is correct" (p. 19). That may seem circular, especially if you don't yet feel able to formulate a good research question. In fact, practical or policy questions, such as how to enhance trust of the police in a high-crime community, prompt us to seek plausible answers, in other words, to both formulate research questions *and* develop theories.

The notion of a theory can mean different things to different people in the social sciences. We think it's best to first illustrate the purposes and usefulness of theory in the more pragmatic way that we've defined it. Later in the chapter, we return to other views about the role of theory in the social sciences.

Theories Tell Causal Stories

Inherent in a theory is the notion of *causation*, meaning that changing something results in something else changing as a consequence. Thus, a theory proposes a causal process or mechanism that produces an outcome of interest. According to the theory of community policing, engagement with residents of a neighborhood, such as making house visits or participating in neighborhood events, *causes* crime to go down because officers gain local knowledge and because residents become more willing to trust the police and cooperate. A theory provides a causal story of *how* and *why* things happen.

Of course, proving causation—proving that the story is true—can be difficult. The chapters of Part IV in this book are all about how to prove causation.

A Cause, One of Many. The theory of community policing holds that police-community engagement causes crime to decline. But what we really mean is that it is *a* cause of changes in crime—*one of many* causes. Alternative explanations of crime might focus on poverty, social control, the weather (crimes happen more often in warmer months), the share of the population that is young, and a host of other factors. For example, the broken windows theory of crime (Box 2.1) focuses on disorder (petty rule breaking) as a cause of more serious crime. Indeed, most policy and social outcomes have many causes. But the fact that an outcome has many different causes does not undermine a theory that focuses on just one particular cause. Social phenomena are complex, and we cannot study everything all at the same time.

The many causes and other contingencies involved, however, mean that theories in social and policy research are *probabilistic*—they predict how things are *likely* to turn out, on average. But they do not guarantee a predicted outcome every time. This is because the other causes will be at work, too, in a given setting, often in conflicting and complex ways. So even if our theory may be correct, police-community engagement will not necessarily reduce crime the same way in every location—or maybe it will not be effective at all, in some places. It may lead to a reduction in crime in most neighborhoods, but not all; the strategy may work in Portland but not Chicago. Its failure to work

everywhere does not mean the theory is wrong; it could just be that other factors exert larger effects in some situations.

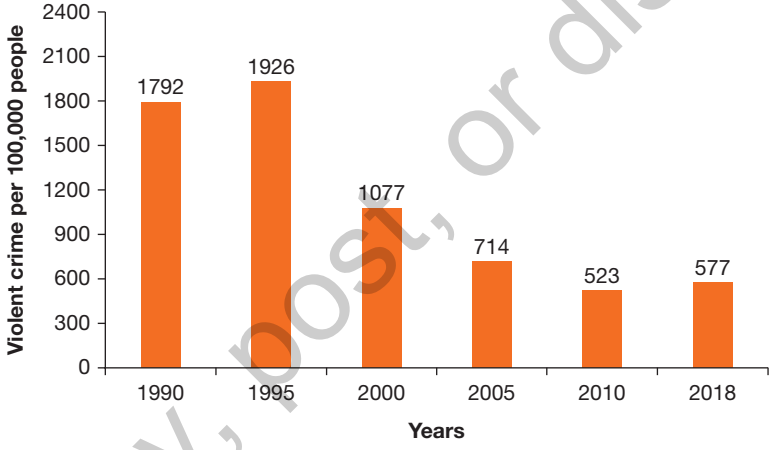
Theories Explain Variation

Theories aim to explain *variation*—the changes or fluctuations in an event or behavior, such as crime. Figure 2.1 shows the variation in the violent crime rate in Portland from 1990 to 2018, and you can see that it goes up and down. This kind of variation *over time* is referred to as **longitudinal variation**.

A theory could also explain variation *across* individuals, organizations, cases, or places at the same point in time. For example, we could look at U.S. cities similar to Portland in size and see that some are higher and others lower in crime in the same year (say 2018), as in Figure 2.2. This is referred to as **cross-sectional variation**.

▼ FIGURE 2.1

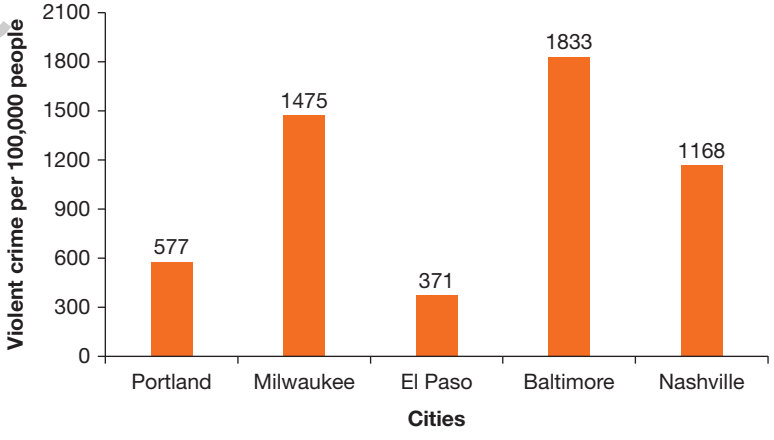
Longitudinal Variation: Violent Crime Rate in Portland, 1990 to 2018



Source: U.S. Federal Bureau of Investigation (2019).

▼ FIGURE 2.2

Cross-Sectional Variation: Crime Rates in Selected U.S. Cities in 2018



Source: U.S. Federal Bureau of Investigation (2019).

Explaining the causes of variation—why crime rises and falls over time or why some cities have more crime at the same time that others have less—is what theory in social and policy research is mostly about. And if we have a good theory to explain the causes of such variation, perhaps we can find ways to influence it and thus, for example, help lower crime.

Theories Identify Key Variables

The theory behind community policing directs our attention to a key concept or variable—community members' trust of the police as a possible factor in the prevention of crime (another variable). Theories tell us what variables matter in the explanation of a given outcome or behavior. Perhaps we hadn't considered community trust of the police as a distinct concept before—or as an especially important factor in the prevention of crime. Further development of the theory will lead us to focus on how and why everyday face-to-face interactions between police and residents could increase trust, as well as why trust of the police may help reduce crime. In this way, a theory helps us identify and take notice of key variables that we should measure or observe.

Theories Generate Testable Hypotheses

Good theories should have *observable implications* (King et al., 1994). In other words, they help generate **hypotheses**—predictions of what will happen if our theory is correct. The hypotheses can be compared with the facts, making the theory potentially *falsifiable* (a critical feature of a scientific theory, according to Popper, 1959). A vague statement, a claim that is impossible to verify, or a truism does not qualify as a scientific theory.

In our example of the theory of community policing, we should expect to see *less* crime in neighborhoods where the police are actively engaged with the community and *more* crime in neighborhoods that do not have much police-community engagement, on average. Or better: We would predict that if we took specific steps to enhance police-community engagement in a neighborhood, the crime rate would go down. A hypothesis is thus a prediction of what will happen—an observable implication of a theory—that we could compare with facts and data.

So a theory—even if it makes logical sense—is not necessarily true. A theory proposes one possible way that things work. Empirical observations must still be made to test this theory against reality—and alternative theories must be tested as well. Only after our theory survives the gauntlet of empirical testing and competition from other theories do we begin to develop confidence that it might truly describe and explain reality.

QUESTION

Life expectancy is a basic indicator of the health and well-being of a country's population. What does it mean to talk about cross-sectional variation between countries in life expectancy? What does it mean to talk about longitudinal variation in life expectancy for a country or region?

Theories (in Applied Research) Focus on Modifiable Variables

As we've noted, there are many causes of a complex outcome such as crime. Many of these we cannot influence, but some we can. For example, perhaps police officers have been

content to ride around in their patrol cars and avoid interacting with neighborhood residents under the belief that their main job is to respond to 911 calls. With training and leadership, however, the officers could well change their behavior and begin walking (or biking) the neighborhood, attending community events, and interacting more regularly with residents. Thus, police-community engagement is a *modifiable variable*, meaning a variable that can be changed or influenced by policy or practice. Theories in applied social and policy research tend to focus on modifiable variables because they offer the most useful guidance for reforms or interventions.

In contrast, other causes of crime may be largely *nonmodifiable*, such as a downturn in the national economy, the weather, popular culture, or an increase in the number of teenagers in the population. It still helps to know how these factors influence crime and thus be able to predict when to expect the next jump (or drop) in crime. But from the standpoint of public policy or police practice, at least, these remain largely *nonmodifiable variables*. Still, basic research in sociology or criminology, for example, might well develop and test theories of how such general cultural, economic, and demographic patterns and trends in society influence crime. So theories can and do focus on nonmodifiable variables as well.

QUESTION

A theory serves a number of purposes in social and policy research. What are some of these purposes of a theory?

Theories Are Positive, Not Normative

In general, researchers try to make scientific theories *positive*—describing how things are; and they try to avoid theories being *normative*—describing how things should be. For example, theories about the causes of crime do not convey the wishes or dreams of their promoters for how people *ought* to behave, in some ideal sense, or how society should function. Rather, the debates about the correct theory of crime focus on what variables and processes actually *do* produce crime in the real world.

But be aware that scientific theories are not value free. Different theories focus on different causes that imply quite different policy alternatives—foster better police-community relations (community policing) or get tough with petty criminals (broken windows policing). Therefore, the motivations driving the promoters of a theory, like the motivations for much that is human, do involve beliefs and values. But a scientific theory must stand up to the test of empirical observation and competition from other theories.

Where Do Theories Come From?

A theory can come from any number of sources. In applied research, theories often come from practitioners such as police chiefs and patrol officers who in their daily rounds notice patterns of behavior that give them clues as to what might cause a social problem such as crime. Their working theories then become the basis for intervention or reform. Sometimes, theory emerges from attempts to tie together diverse strands of empirical evidence in a field of research, such as criminology. Prior studies may contribute individual pieces of empirical evidence concerning the factors associated with crime, but much is gained when a theory emerges that fits the pieces together into a coherent whole.

Qualitative research, such as participant observation or in-depth interviews (discussed in Chapter 3), often becomes another very important source of theory. Qualitative research provides insight into the processes and mechanisms at work in a particular social setting, such as a high-crime neighborhood. Insights may suggest variables, such as trust of the police, that help prevent crime and that can become the targets of policy intervention.

Academic disciplines shape the kind of theory used by researchers. For example, economic theories often center on individuals making rational choices to optimize their well-being; sociological theories often focus on how institutions or social structures in society condition the actions of individuals; and psychological theories often focus on conscious and unconscious processes of thought and emotion that influence our behavior. Indeed, most disciplines have foundational perspectives or schools of thought that establish frameworks for theory development—sometimes referred to as *theoretical paradigms* or *grand theories*. Some examples include rational choice theory, structural functionalism, social learning theory, symbolic interactionism, critical theory, public choice theory, and feminist theory (A. Rosenberg, 2012; Seidman, 2012). But again, we focus in this chapter on the more practical, middle-range (or substantive) theories that attempt to explain causal processes in specific settings.

Induction and Deduction. As we saw in Chapter 1, theories can come from a process of *induction*—building up theory from scattered pieces of empirical evidence and experience. Theories can also come from a process of *deduction*—starting from initial ideas or logical principles and then testing these with empirical observations. In practice, theories often come from a mix of both thought processes. When testing a theory, however, the distinction between induction and deduction is especially important: *You cannot test a theory using the same data or set of facts that inductively produced the theory.* Testing a theory with the same facts that generated the theory (such as results of a survey or set of observations) amounts to a sure thing—a test whose answer you know already in advance. It does not permit you to be wrong (it is not *falsifiable*). So you need a new set of data or facts, another study, to test an inductive theory. Because a deductive theory starts first with ideas or logical principles, before a researcher collects data, you do not have the same problem. But, of course, you still need to go out and gather a set of data or facts to test your deductive theory.

QUESTION

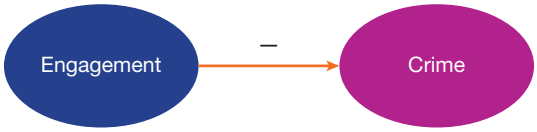
You notice the sidewalk you're on has more litter than the sidewalk across the street. You see a trash can across the street, but not on your side, and conclude that this may explain the difference in litter. Is this induction or deduction? What would you need to do to test your theory?

What Is a Model?

A **model** serves to articulate and communicate a theory. It's a representation that is specific and clear, in the same way that a miniature model of a building represents clearly and precisely what an architect plans to build. Models may at first seem like unnecessary abstractions, but in fact they help a great deal to make sense of complex phenomena, and

▼ FIGURE 2.3

Causal Diagram for the Theory of Community Policing



they force us to think clearly. In this way, models can be very useful for such things as making predictions or deciding how to analyze data.

A model is typically either graphical (a picture) or an equation. In this book, we will mostly use graphical models to express theory, specifically, causal diagrams. A **causal diagram** depicts the structure of causal relationships between variables. Figure 2.3 is a causal diagram that expresses the theory behind community policing. It expresses the idea, presented earlier, that police *engagement* with the community can help reduce *crime*. We will make use of causal diagrams often in this book. In previous editions, we used the term *path diagram* (or *path model*), traditional terms for this kind of diagram. But as Box 2.2 explains, the causal inference literature and related terminology have evolved, and, as result, we now prefer to use the term *causal diagram* throughout the book. (See Box 2.2 about the history of path models and causal diagrams.)

Variables and Relationships

A model, such as the causal diagram in Figure 2.3 of the theory of community policing, is made up of two components: variables (the ovals) and causal relationships (the arrows). The minus sign (–) indicates the sign of the relationship, which we have more to say about shortly.

A **variable** is something that can take on different values or assume different attributes—it is something that *varies*. Figures 2.1 and 2.2 demonstrate that the crime rate takes on different values over time and across cities—so it is a variable. Our theory aims to explain this variation, the highs and the lows, by way of another variable—police-community engagement. Variables must be able to move—to *vary*—in both directions: up and down.

BOX 2.2

PATH MODELS, CAUSAL DIAGRAMS, AND DAGS

Path models (or path diagrams) were first developed by Sewell Wright back in the 1920s to trace genetic influences (Pearl, 2018, Chapter 2). Over the years, path models became widely used throughout the social sciences to develop and test theories of what causes what. But *path model* is a somewhat older term that has come to be replaced by *causal diagram*, which we have now switched to using throughout this edition of the book. Moreover, path models are associated with path analysis, which is a particular statistical technique (as explained in Chapter 10). Causal diagrams, in contrast, are a more general conceptual tool that is not tied to any one method of data analysis. In more recent years, a particular subset of causal diagrams, directed acyclic graphs (or DAGs), have been rigorously developed and applied to causal research. We return to DAGs in Part IV on causation.

In our model, the arrow pointing from engagement to crime portrays a causal relationship between engagement and crime, meaning that changes in police engagement with the community will *cause* changes in crime (according to the theory). The arrow shows the flow of influence from cause to effect. A **causal relationship** refers to how change in one variable produces or leads to change in another variable. Encouraging police officers to walk the neighborhood and get to know residents, according to the theory of community policing, leads to less crime.

The direction of the arrow is extremely important. In our example, the direction means that implementing community policing reduces crime, according to the theory. If the arrow went the other way, increasing crime would cause a city to reduce police-community engagement, according to the theory. Different arrow directions mean very different theories.

Unit of Analysis, or Cases

The variables in a model describe something—people, places, or things. *Crime*, for example, is a variable that could describe the level of crime in neighborhoods or in cities or in countries—or even the level of crime experienced by households or individuals. The people, places, or things described by the variables in a model are referred to as the **unit of analysis**, or sometimes (more simply) as **cases**. The unit of analysis is not visible in the causal diagram but rather implied by the theory underlying the model.

Looking at actual data helps to illustrate the idea of the unit of analysis. For example, in Figure 2.2, cities are the unit of analysis. Table 2.1 shows the very same data as they might appear in a data set: Cities are the rows (the unit of analysis), and crime rate is the column (the variable). Many data sets are arranged in this way, with the rows as cases and the columns as variables.

Table 2.2 illustrates what the variable *Crime* might look like if the unit of analysis were *individuals*: Each row is a different individual, and the column is the variable *Crime* (in this case, committing a violent crime or not). When explaining variation over time (longitudinal variation), the unit of analysis must include the time period also. For example, in Figure 2.1, the unit of analysis would be the *city-year*.

Some models—called *hierarchical models* or *multilevel models*—describe relationships between variables at different units of analysis. For example, a model of crime might use the person as the unit of analysis for committing a crime but use the neighborhood as the unit of analysis for police-community engagement. Crime choices are made (at least in part) by individuals, but community policing practices happen at the more aggregated level of a neighborhood.

▼ TABLE 2.1

Crime Data With Cities as the Unit of Analysis

City	Crime (Violent crimes per 100,000 people)
Portland	577
Milwaukee	1,475
El Paso	371
Baltimore	1,833
Nashville	1,168

Note: These are the same data that are plotted in Figure 2.2

Source: U.S. Federal Bureau of Investigation (2019).

▼ TABLE 2.2

Data With Individuals as the Unit of Analysis

Individual*	Crime (Committed a violent crime: 1 = yes, 0 = no)
Luis	0
Ellen	0
Jim	1
Sara	0

*Real data would generally contain ID numbers and no names to protect the anonymity of those studied. See the discussion of the ethics of administrative data in Chapter 6.

QUESTION

Suppose we have a theory about lawyers, in which lawyers are the unit of analysis (cases). Can *lawyer* be a variable? Explain why or why not.

Independent and Dependent Variables

In the model shown in Figure 2.3, community *Engagement* is the **independent variable**, and *Crime* is the **dependent variable**. The independent variable is the *cause*, the dependent variable the *effect*. A good way to remember is that the dependent variable is the one that "depends on" changes in the independent variable. By convention, the independent variable is often symbolized by *X*, while the dependent variable is often symbolized by *Y*. Here is a helpful little diagram for thinking clearly about independent and dependent variables:

X	→	*Y*
"Cause"		"Effect"
Independent		Dependent

Various terms are used by different researchers to describe independent and dependent variables. For example, sometimes the independent variable is called the *explanatory variable*, and the dependent variable is called the *response variable*. In the health sciences and program evaluation, the independent variable is often a *treatment* or *program* and the dependent variable an **outcome**. In Figure 2.3 and other causal diagrams in the book, we will always use one color for the independent variables and another color for the dependent variables, to help with interpretation.

Practice identifying the independent and dependent variables implied in each of the following statements:

- In an effort to reduce traffic accidents, the city government lowered the posted speed limit on all of its streets and thoroughfares.
- Researchers have found a link between climate change and civil unrest (including war), particularly in developing countries.
- Allowing employees a flexible schedule increases productivity, according to management experts.
- A news article reports that students who frequently use Instagram get lower grades in college.

So which is which? In the first statement, the speed limit is the independent variable, and traffic accidents are the dependent variable. Lowering the speed limit is a policy change or intervention (a manipulable variable), and often this can serve as a clue to the independent variable. In the second statement, climate change is the independent variable and civil unrest the dependent variable. Here there is no clear intervention or manipulable variable (although perhaps climate change can be mitigated by public policy—or so we hope). But it is clear that the cause-effect arrow can point in only one

direction: Wars, riots, and other civil disturbances cannot influence the climate. So it must be that climate change is the possible cause (independent variable) and civil unrest the effect (dependent variable). The third statement has no reference to research but makes clear that flexible schedules are the cause (independent variable) and productivity the effect (dependent variable). In the fourth statement, the news article implies that Instagram use is the independent variable and grades the dependent variable, but here the causal order is more ambiguous (perhaps students turn to Instagram for consolation after getting low grades). Stating or implying that *X* is the independent variable and *Y* the dependent variable does not necessarily make *X* the cause and *Y* the effect in the real world, a topic we will cover in depth in Chapter 11.

BOX 2.3

EQUATIONS AS MODELS

In this book, we mostly use causal diagrams for our models, but models also often take the form of equations. By convention, as noted previously, *Y* often symbolizes the dependent variable, and *X* often symbolizes the independent variable. An equation modeling a causal relationship can have many forms but a simple one will often look something like this:

$$Y = a + bX$$

where *a* and *b* are called parameters, which can be specific numbers, such as 5.4 or –9.

For example, if *Y* is annual earnings and *X* is years of education, the parameter *b* could represent average earnings increase per year of education. See Chapters 8 and 13.

QUESTION

Can you turn the saying "practice makes perfect" into a relationship between variables, using the example of hospitals and heart surgery?

Sign of a Relationship

The plus or minus sign along the arrow in a model indicates the **sign** of the relationship: whether or not the two variables (cause and effect) move or covary in the same or opposite direction. The sign of a relationship is also known as the *direction* of a relationship. However, we are using the term sign, in order not to cause confusion with the causal direction of a relationship, which is represented by arrows in a causal diagram.[3]

[3]This is a change from prior editions of the book, in which we used the term *direction of a relationship*, rather than *sign*. We switched terms to avoid confusion with the direction of the causal arrow.

Because our theory holds that engagement causes crime to decrease, there is a **negative (–) relationship**, and a minus sign (–) shown in Figure 2.3. A negative relationship means that engagement and crime move in the *opposite* direction. If police-community engagement goes up, crime goes down. And if engagement goes down, crime goes up. In a **positive (+) relationship**, by contrast, the independent and dependent variables move in the *same* direction. For example, we might have a theory that poverty in a city increases crime. Greater poverty results in more crime; lower poverty results in less crime: The same direction. Figure 2.4 illustrates the patterns we would expect to see from negative and positive relationships.

Specifying the *sign* of a relationship is critical. There is a big difference between saying police-community engagement affects crime in some way and saying that it will *reduce* crime. Specifying the sign of the relationship allows for observable implications—hypotheses that can be tested with data.

People often misinterpret what the sign of a relationship is telling them. For example, some may interpret a plus sign as meaning that the variable at the end of the arrow "goes up." After all, plus means higher, right? But this would be mistaken: Plus means that the variables go in the *same* direction, whether up or down. And minus means the variables go in the opposite direction, whether up or down. So plus does *not* mean "goes up," and minus does *not* mean "goes down." Another misinterpretation: A plus sign does not necessarily refer to something "good"—no one wants high poverty and high crime. Similarly, a minus sign does not imply something "bad"—if more police-community engagement leads to less crime, that is certainly a good thing (despite being a negative relationship).

BOX 2.4

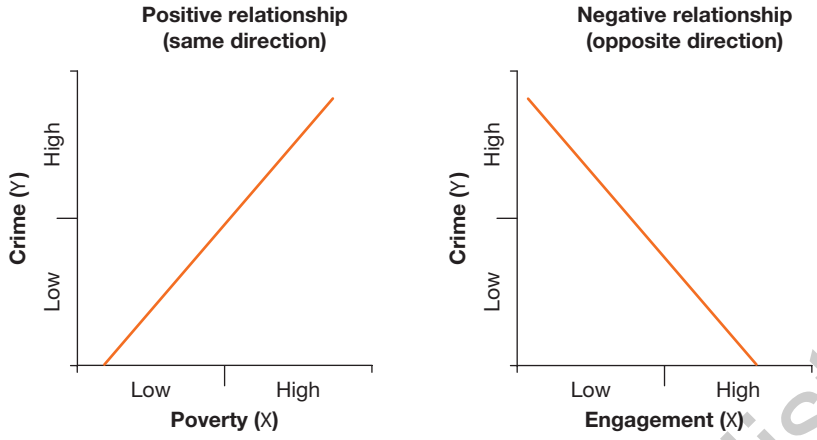
RELATIONSHIP SIGNS FOR (NOMINAL) CATEGORICAL VARIABLES

Theories can involve different kinds of variables, including variables with no numerical value, order, or direction (termed *nominal categorical variables* and described in the section on levels of measurement in Chapter 4). For example, suppose a city is divided into four districts—Northside, Southside, Westside, and Eastside—and we have a theory that something unique to each of the districts influences its crime rate. But describing the direction of a relationship with such a variable seems, at first, impossible. Which order of the districts is up? Clearly, we cannot really specify the sign of the relationship between district and crime as being either positive or negative.

However, a variable that has just two categories—such as being in Northside or not being in Northside (i.e., being in Southside, Westside, or Eastside)—does have an order to it: Up is being in Northside; down is being in the other districts. Such variables are called dummy (or indicator) variables. It can be a bit tricky sometimes to show nominal categorical variables in a causal diagram—but it becomes easier if they are made into dummy variables.

▼ FIGURE 2.4

Positive and Negative Relationships



Patterns of Association: Correlation

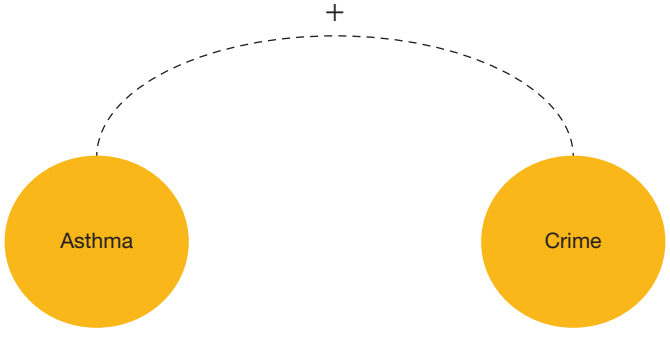
As noted earlier, theories tell causal stories and aim to explain variation. This is because causal relationships result in statistical patterns of association between variables, also referred to as *correlation* or covariation. If police-community engagement reduces crime, then high values of engagement will be associated with low values of crime, and, in turn, low engagement will be associated with high crime (at least on average and all else being equal). But correlations can appear for many reasons, not just because of a causal relationship between the variables.

In causal diagrams, a correlation is depicted by a dotted line with no arrows, as shown in Figure 2.5. There is no arrow because asthma and crime are only associated statistically, neighborhoods with high asthma rates tend to have high crime rates (a positive relationship), but there is no directional flow of cause and effect from one variable to the other. Asthma does not cause crime, nor does crime cause asthma.

In Chapter 11, we will learn how various underlying causes can result in correlations between variables. For example, poverty could drive both asthma and crime. In Part IV, we will learn much more about how to use and develop evidence to determine causal relationships. For now, just remember that causal relationships and correlations are not the same thing.

▼ FIGURE 2.5

Correlated Variables



QUESTION

What is the sign of the relationship between poverty and life expectancy? Do you think it is a causal relationship? What is a possible theory of why it might be causal?

Causal Mechanism

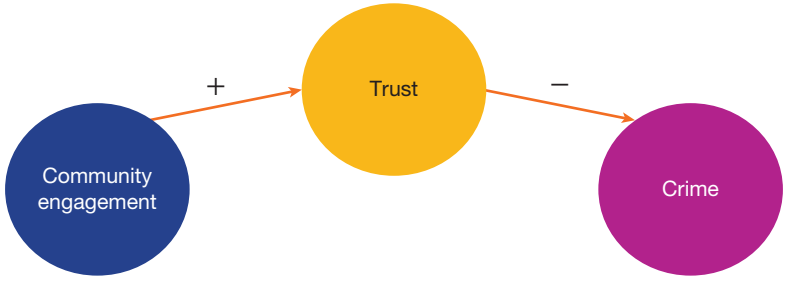
Because a theory is about causation, it is important to elucidate the **causal mechanism** at work—the hypothesized process or explanation of how change in the independent variable produces change in the dependent variable. In an important sense, causal mechanisms are the lifeblood of a theory. For example, police-community engagement produces lower crime by fostering more trust of the police and in turn more cooperation and sharing of local knowledge. Notice that in Figure 2.3 this causal mechanism doesn't appear in the model of community policing—although it is part of the theory. Much can be gained in model building by making the causal mechanism, or *mechanism* for short, explicit.

Intervening Variables (Mediators). To make the causal mechanism explicit, we can add **intervening variables**: variables that articulate a causal pathway from the independent to the dependent variable. Intervening variables are also known as **mediators**; they mediate (transmit) the causal effect of one variable to another. And in program evaluation, some important intervening variables are referred to as *intermediate outcomes*. Figure 2.6 shows one hypothesized mechanism of community policing: more police-community *engagement* results in more *trust* of police, which in turn helps to reduce crime. *Trust* is the intervening variable.

But notice that now the trust-crime link also involves an implicit mechanism: for example, that trust leads to more cooperation with the police, which helps the police prevent crime. So we might want to add a second intervening variable (*Cooperation*) to the causal pathway, as shown in Figure 2.7. But now the cooperation-crime link also implies some mechanism, although we may choose not to get that granular. In this way, most model builders attempt to strike a balance between including enough explicit mechanisms—in the form of intervening variables—to clearly articulate the theory, while leaving other mechanisms implicit. Moreover, some mechanisms are hard to represent with intervening

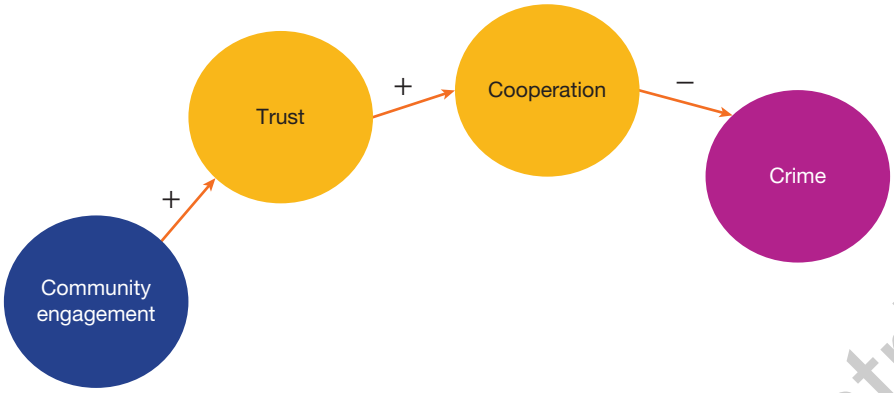
▼ FIGURE 2.6

Model With One Intervening Variable (Mediator)



▼ FIGURE 2.7

Model With Two Intervening Variables (Mediators)

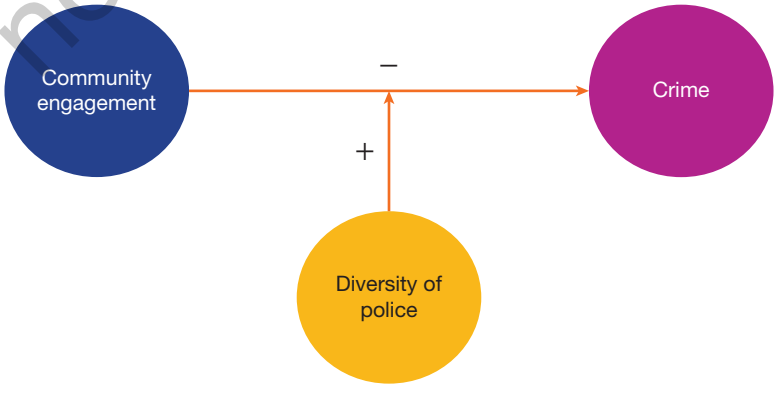


variables in a causal diagram, such as the mechanisms that explain how diverse producers and consumers, acting independently, determine and respond to supply and demand in a marketplace.

Moderators. Sometimes, a variable in a model is believed to influence not another variable but the link, or *causal relationship*, that ties cause to effect. For example, the racial diversity of the police force could shape how well community engagement works as a strategy to reduce crime. Having more Black and Hispanic police officers, for example, might make engagement more effective in Black and Hispanic neighborhoods. In this example, diversity of the police is said to *moderate* the effect of community engagement on crime—thus, *Diversity* is a **moderator variable**. In a causal diagram, a moderator variable is depicted by an arrow coming from the moderator and pointing toward the relationship (the middle of the arrow) that it influences, as shown in Figure 2.8. In this example, the influence of the moderator has a positive sign because it is presumed to enhance (increase) the magnitude of the causal effect of community engagement on crime.

▼ FIGURE 2.8

Model With a Moderator



BOX 2.5

WHAT WENT WRONG WITH BROKEN WINDOWS

The broken windows theory of crime became very influential in police departments across the United States, but it has come under increasing scrutiny and criticism (Vedantam et al., 2016). In particular, the theory became associated with policies such as zero-tolerance policing and stop-and-frisk practices that are especially harmful to young African American men. Some broken windows proponents contend that the theory was misunderstood and misapplied: "Order maintenance" is not the same as zero-tolerance policing or stopping and frisking people without clear cause (Thatcher, 2004). In other words, there was some vague and sloppy thinking about what the broken windows strategy really should have been and about how best to implement it.

Some critics suspect that the proponents of broken windows policing harbored a negative view of minority communities, while others viewed the disproportionate impact on minority young men as more of an unintended side effect. Thatcher (2004, p. 94) also describes broken windows as an example of the "dangers of strong causal reasoning," meaning that if the mechanisms underlying the theory contain many links (an elaborate indirect effect), one should not expect a big change in the outcome (Rein & Winship, 1999).

We can draw several lessons about theory development from this experience:

- Describe programs and interventions in concrete, specific terms, not vague ones that could be subject to a variety of interpretations.
- Look skeptically at every link in the mechanism—do not just assume it will work.
- Be wary of expecting large impacts from many links (an elaborate indirect effect), even if you have good evidence for some of the individual links.
- Develop theories (using causal diagrams) of how the program might result in potentially harmful side effects—don't just focus on the intended effects.

Logic Models: Mechanisms of Programs

In many areas of policy and practice, you will hear about **logic models** that describe how programs or interventions produce desired outcomes. Logic models—also referred to as *program theories*, *outcome-sequence charts*, or *theories of change*—are increasingly required by government agencies and foundations for program management, funding, and evaluation (W. K. Kellogg Foundation, 2004). Logic models are often described and communicated using causal diagrams to detail the mechanisms through which a program or intervention changes the outcome, which is our preference here. But you will also see logic models that appear as flow charts, connected text boxes, or in other graphical styles. In a logic model, the independent variable must be modifiable, some type of program, treatment, or intervention that an entity could assign or implement, like having police officers walk their beat rather than drive around in patrol cars. The dependent variable is the outcome of the program, like crime. So our causal diagram of community policing (with intervening variables) qualifies as a logic model. But let's consider another example to practice developing logic models and to learn more about their usefulness.

Do Smaller Classes Help Kids Learn?

iStock.com/liseg&gne

Smaller classes may improve learning in many different ways.

In Mississippi, Jackson Public Schools (JPS) began a class-size reduction program, committing $1.8 million in funds to hire 32 new teachers for 26 schools in Grades 1 through 3. According to JPS (2004), "Studies indicate that smaller classes reduce discipline problems and increase the time a teacher spends in instruction." Teacher Kescher Love explained, "That's because with fewer students teachers had more time to give to each student. Smaller classes are an important factor" (JPS, 2004). JPS hoped the program would increase the percentage of students passing its third grade "exit test" (required for them to move on to fourth grade). Initial anecdotal evidence appeared encouraging. According to Smith Elementary Principal Gailya Porter, "We saw our retentions [the number failing the exit test] in the third grade drop to only four students" (JPS, 2004).

You might recognize that underlying Jackson's class-size reduction program is a theory—a set of assumptions about how and why reducing the number of students per class in Grades 1 through 3 will improve third-grade exit test scores. Let's build a logic model to express the program's theory, first simply expressing the basic model and then elaborating the causal mechanisms through which it works.

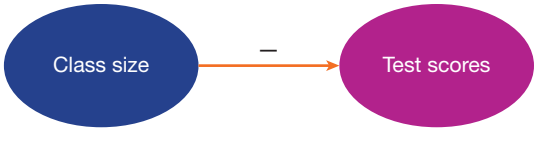
Figure 2.9 shows the simplest model: Class size is related directly to academic achievement, as measured by test scores.[4] A larger class reduces test scores; a smaller class increases test scores. Starting with the logic model in this simplistic form emphasizes the big picture: the program, outcome and the sign of the effect of the program on the outcome.

The simple model is consistent with the anecdotal evidence that the exit test scores improved after the program's implementation, but it is incomplete. We still don't know *how* the program accomplished its success—just that it did (or at least seemed to have done so). Perhaps we could find ways to make the program even more successful if we knew more about how class size influences test scores. Moreover, suppose that a more systematic evaluation reveals that the program, after all, does little to improve exit test scores—despite the initial, encouraging anecdotes from principals and others. What went wrong? Why isn't the program working as we hoped?

A more detailed model, a true *logic model* such as Figure 2.10, includes mechanisms that might help us unravel the mystery. Recall that JPS pointed to research and the experience of teachers to suggest that smaller class size leads to fewer discipline problems (i.e., more discipline) and, as a result, more time spent on instruction. Smaller class size also may result in more individual attention to students. These factors in turn help students do better on the exit test.

▼ FIGURE 2.9

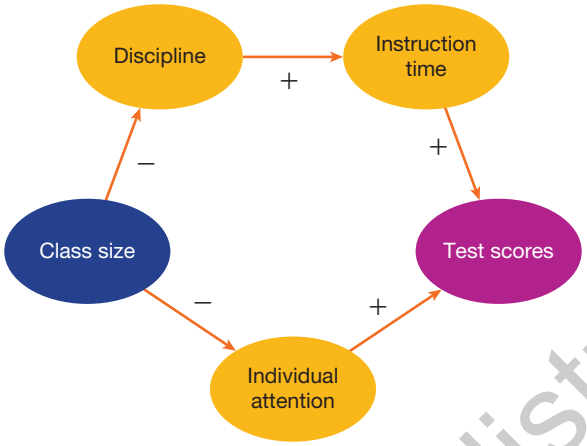
Causal Diagram of the Class-Size Reduction Program



[4]There are, of course, many ways to express educational achievement, and test scores may or may not be a good method, but this is not our focus quite yet. See Chapter 4 on measurement for more on this issue.

▼ FIGURE 2.10

Logic Model With Intervening Variables



Notice that the variables *Individual attention*, *Discipline*, and *Instruction time* in Figure 2.10 are intervening variables. They elucidate the causal mechanisms. If the program is not working, we can examine the various paths in Figure 2.10 to find out where things broke down. For example, smaller class size may in fact encourage better discipline and in turn more time spent on instruction, but perhaps the additional instruction time isn't doing anything to help improve exit test scores. A fresh look at how well the curriculum prepares kids for the exit test may be needed.

Signs in a Chain of Causal Relationships. From Figure 2.9, we know relationship *Class size* → *Test scores* is negative. Correspondingly, the mechanism in Figure 2.10 represented by the pathway *Class size* → *Discipline* → *Instruction time* → *Test scores* should also be negative. How do we check this? The first link (*Class size* → *Discipline*) is negative: higher class size, less discipline (more discipline problems); lower class size, more discipline. The next link (*Discipline* → *Instruction time*) is positive: more discipline, more instruction time; less discipline, less instruction time. The final link (*Instruction time* → *Test scores*) is also positive: more instruction time, higher test scores; less instruction time, lower test scores. Let's follow this whole chain for the proposed class-size reduction: lower class size results in more discipline (opposite), more discipline results in more instruction time (same), and more instruction time results in higher test scores (same). A good test is to now imagine moving the independent variable in the other direction: higher class size results in less discipline (opposite), less discipline results in less instruction time (same), and less instruction time results in lower test scores (same).

This exercise can be done mathematically too. The pathway *Class size* → *Discipline* → *Instruction time* → *Test scores* includes one negative and two positive relationships. Multiplying a negative by a positive and again by another positive results in a negative ($-1 \times 1 \times 1 = -1$). Thus, this compound mechanism is (overall) a negative relationship. This is a good way to test the logic of the mechanisms in a logic model.

QUESTION

Speed bumps are a traffic safety intervention aimed at protecting pedestrians. What is an intervening variable (or mediator) that explains how speed bumps work to improve pedestrian safety?

Naming Variables

Variables vary—they can both increase or decrease. So it is confusing to think about or name variables in a logic model as if they changed in only one direction, such as "increased" or "less." For example, we might say that *smaller class size* leads to *higher test scores*. Good enough—and it works alright to put things this way in a sentence. But it would be a mistake to translate these words directly to a causal diagram, like this:

Smaller class size → Higher test scores

At first glance, this might make sense, but we still need to specify the sign of the relationship. Is it still negative—higher levels of *smaller class size* leading to lower levels of *higher test scores*? As you can tell, this question is not at all clear grammatically or logically. So to clear things up, use variable names that do not imply variables go only in one direction:

Class size → Test scores

Specifying the sign of the relationship now makes sense—*smaller* class size leads to *higher* test scores, or, alternately, *larger* class size leads to *lower* test scores. It's a negative relationship. We just need to add a minus sign (–) to the arrow connecting class size to test scores to complete the picture.

Class size $\xrightarrow{-}$ Test scores

What About Other Causes of the Outcome?

We've illustrated the presumed *mechanisms*—the sequence of intervening variables through which class size is expected to affect test scores. This is of particular interest if we want to understand or illustrate the logic of the program, if we need to fine-tune the program, or if we seek to evaluate how well the program works. However, test scores have lots of other causes besides just class size, and we could add them to our model.

For example, say Jackson third graders are increasingly coming from families of lower socioeconomic status (SES), resulting in lower test scores. Since this change in student SES may result in more students failing the exit tests, scores might come down despite the class-size reduction program. At the same time, suppose Jackson is also putting an emphasis on recruiting good, experienced third-grade teachers from nearby districts, part of the same push to do better—but quite a different approach than class-size reduction. The new teachers might well be helping more kids pass the exit test, again apart from the effects of the class-size reduction program.

▼ FIGURE 2.11

Logic Model Showing Other Causes and Intervening Variables

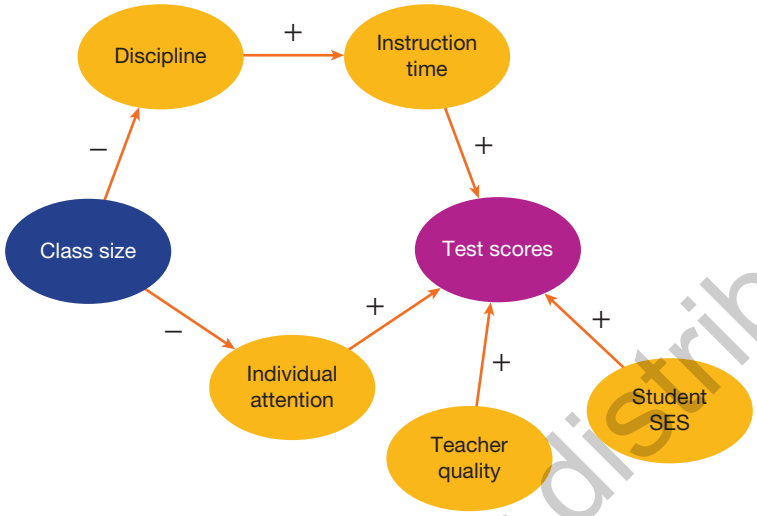


Figure 2.11 shows these additional factors at work, factors that, along with class-size reduction, influence exit test scores. Our focus remains on the mechanisms in the logic model: how class size affects test scores. The other causes are not part of these mechanisms and therefore not central to the logic model. Sometimes, however, including them can be valuable in thinking about the program or planning the analysis.

Usefulness of a Logic Model

Logic models serve several useful purposes for both research and practice. A good logic model identifies important, sometimes previously unrecognized variables to track. It thus contributes a great deal to the task of establishing relevant *performance measures*, or *performance indicators*, to monitor or evaluate the program. The community policing logic model (see Figure 2.6) suggests that a key intervening variable is the extent to which community members trust the police. So perhaps surveying residents to gauge their level of trust would provide an important performance measure or indicator.

But even if measuring a key intervening variable is not possible (too difficult or expensive, perhaps), including it in a logic model can still be useful for examining assumptions and potential weak links in the program theory. Consider again the notion of trust as a mechanism. Why does police-community engagement increase trust? Why does trust reduce crime? Articulating the mechanism by adding intervening variables encourages us to give our logic model more thought and to ask critical questions.

Brainstorming Using Logic Models to Design and Improve Interventions[5]. When you design or seek to improve a program, it's often a good idea to use logic models as a brainstorming technique to find weak links and other potential problems. For this purpose, don't aim for a pretty picture to put in a slick proposal. Rather, use hand-drawn models on large pieces of paper where you can easily add new variables and paths or make changes. And expect to go through many, many iterations.

[5]Thank you to Dahlia's co-instructor, Gregorio Morales, for bringing a public sector practitioner's perspective and providing ideas about how brainstorming with logic models can help practitioners design and improve programs.

When you use a logic model for brainstorming, it helps to start at the outcome and work backwards. What variables do you need to change in order to influence the outcome? And how can you change those variables? Keep asking why, like a curious child, until you have really pinpointed a mechanism. Try inserting intervening variables and adding branches to the model until each link of the mechanism becomes obvious. (You can and often should provide less detail later for presentation purposes.) Through this kind of initial, detailed probing of your model, you can see better what might go wrong and how to make your program more successful. Another important point is to make your variables as concrete as possible to avoid ambiguity and muddled thinking. Variables such as "knowledge," "improvement," or "service quality" are often too vague and can mean different things to different people. Ask questions to probe what your variables really mean, and try to make vague labels more concrete. Knowledge of what? Improvement in what? What does service quality really mean in this context? (See the discussion of conceptualization in Chapter 4 for more advice.)

When brainstorming, focus on the people or things that the program is expected to change—not on program implementation. If a program is going to improve test scores, then most of the intervening variables in your logic model should be about the students who need to take the test: their situations, their attitudes, and their behaviors. The intervening variables should not be primarily about what the administrators implementing the program will do internally, such as obtaining funding or hiring staff. In other words, think of the logic model as similar to the perspective of student-centered teaching, patient-centered care, or client-centered practice. Sometimes, however, implementation and process can be important to the mechanism, especially when such factors causally influence outcomes. (See Box 2.7 for logic models that also show implementation or process.)

BOX 2.6

CHINA LAUNCHES NATIONWIDE AIDS PREVENTION PROGRAM

BEIJING—The Red Cross Society of China (RCSC) launched a three-year nationwide AIDS prevention and care program here on Friday, aiming to reduce vulnerability to HIV and its impact in the country.

The initiative comes in response to an escalating nationwide HIV epidemic, said Yang Xusheng, director of the HIV Prevention Office with the RCSC.

"It's clear the spread of the virus, increasingly through sexual transmission, is being fuelled by a continuing lack of awareness about the disease," Yang said.

The program will try to increase awareness of the disease through various activities, including education and community mobilization that will cover a population of 27 million people through 2010, said Jiang Yiman, RCSC vice president.

He said the program would also provide home-based support and care to 90,000 HIV infected people and their family members.

The program is aimed at preventing further infection of the disease and reducing discrimination to HIV carriers in the society.

Source: China launches nationwide AIDS prevention program. (2008, March 28). *China Daily*. Retrieved July 23, 2009, from http://www.chinadaily.com.cn/china/2008-03/28/content_6574756.htm.

Tips for Creating a Logic Model

It might help to lay out several more specific tips on how to develop a logic model for a program, using an AIDS prevention program in China as an example (see Box 2.6).

Tip 1: Start with a single dependent (*Y*) variable or outcome. Real-world programs often have several outcomes, but it helps to focus on one at a time. The AIDS-prevention program in China, for example, aims both to prevent further infection *and* to care for those who have the disease (and also suffer from discrimination). These different outcomes might well be influenced by different variables, so each may require a somewhat different logic model. Even if the mechanisms interact somewhat, it helps to start with one dependent variable at a time. We focus on the incidence of AIDS as the outcome.

Tip 2: Next, add a single independent (*X*) variable representing the program. Many real-world programs have more than one component—in effect, more than one independent variable. The AIDS-prevention program in China involves some form of mass-media campaign (such as radio ads and billboards) but also a more grassroots, community-based effort. It is likely that these two components or treatments operate in much different ways. Even if they interact somewhat, it helps to start with a single component of the program and focus on its mechanism before adding other program components.

Tip 3: Put the program (the *X* variable) on the left side of the diagram and the outcome (the *Y* variable) on the right. Draw the program and the outcome each in one place and one place only in the diagram. Leave space in between for the intervening variables. For example,

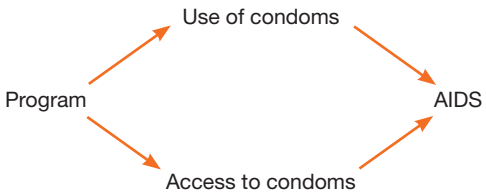
Program AIDS

Tip 4: Add *intervening variables* to the model. Think carefully about whether the intervening variables represent distinct pathways (separate branches) or steps along the same causal pathway chain. For example, say the community-based component of the AIDS-prevention program involves *distributing condoms* and also holding education sessions to build *knowledge* of the disease. We might at first draw it like this:

Program → Knowledge of AIDS → Access to condoms → AIDS

But that is not correct. *Knowledge of AIDS* does not cause *Access to condoms* (or vice versa). Rather, each is a separate channel or path through which the program influences risk.

Tip 5: On the other hand, if something really is an intervening variable (along the causal pathway), don't draw it as a separate causal pathway branch. For example, if the program's distribution of condoms increases access to condoms, and this in turn increases the use of condoms, then access and use are not separate causal pathways. In other words, don't draw the diagram like this:



(INCORRECT)

Rather, these intervening variables are steps along the same causal pathway, like this:

Program → Access to condoms → Use of condoms → AIDS

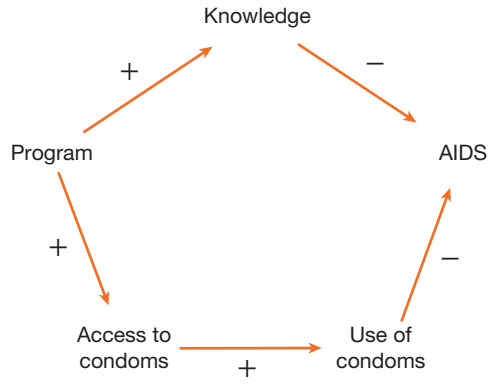
(CORRECT)

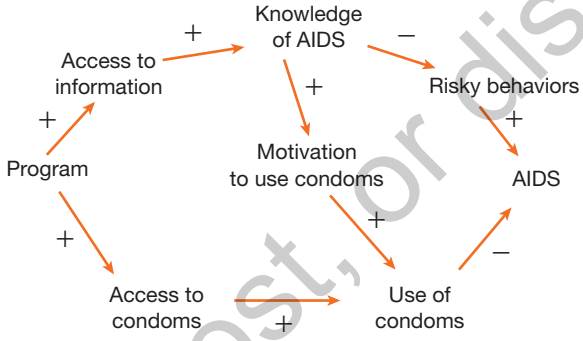
Tip 6: To make your theory really convincing, look at each link in isolation and make sure that you can explain every link in your theory. If a link between one variable and another is not obvious or does not make intuitive sense, then you may need to add intervening variables to explain the connection. You want your model to be largely self-explanatory for it to be truly convincing to a funder or policy maker. For example, it is not completely obvious how knowledge about AIDS reduces incidence of the disease. To make it obvious, one would specify knowledge of how risky sexual behavior increases the chance of getting AIDS and then a reduction in risky sexual behavior.

Knowledge of AIDS → Risky behavior → AIDS

Tip 7: As explained earlier in this chapter, avoid variables that include a direction term. For example, do not name the variable "Increased knowledge of AIDS" but rather just "Knowledge of AIDS." Express the sign (direction) of the relationship between variables by adding + or – signs next to the arrows.

Tip 8: Finally, be aware that different levels of detail in a logic model are appropriate for different purposes. When you are trying to show the big picture of a complex, multicomponent program that aims to influence many outcomes, it will be necessary to simplify the logic model and leave out some detail. You see below a streamlined version of the program logic model, suitable for a proposal, and below that a more detailed version, what would emerge from an effort by program developers to figure out if and how the program would actually work.





We stressed earlier that theories must stand up to empirical evidence. Ideally, each link in your logic model would have empirical evidence backing it. In reality, you are unlikely to be so lucky. Still, clearly spell out each important link in your theory, as described in Tip 6, so that you can assess its plausibility. When possible and appropriate for your audience, describe what evidence exists to support your theory, as well as where evidence is lacking.

Multiple Mechanisms in a Logic Model

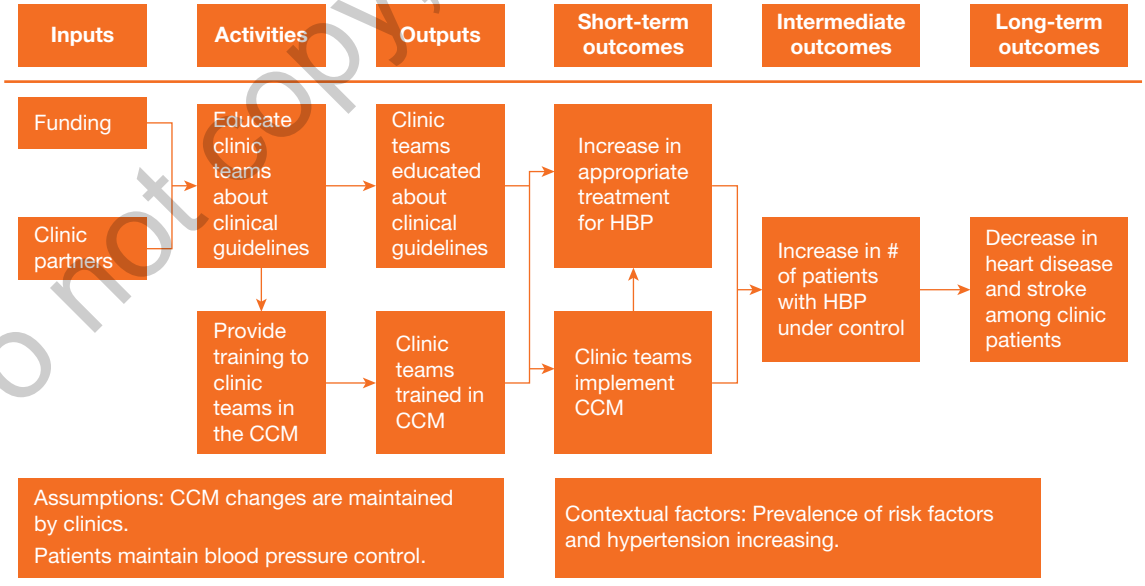
From the example of the AIDS prevention program, you might be wondering which sets of intervening variables should be considered part of the same mechanism and which should be considered part of a different mechanism. To begin with, we should point out that a mechanism must include at least one complete path from the independent variable to the dependent variable. That is, it must connect the program to the outcome. Beyond this basic point, however, there is some ambiguity and different possible interpretations. Knowledge about AIDS and access to condoms could be considered quite different pathways or mechanisms that lead to the outcome. On the other hand, knowledge and access can be seen as a combined behavioral mechanism that, together, influences use of condoms, which in turn influences AIDS. So it's a matter of judgment and interpretation, often depending on context and purpose. Moreover, causal mechanisms in the real world are complex and sometimes overlapping.

BOX 2.7

IMPLEMENTATION-ORIENTED LOGIC MODELS WITH INPUTS, ACTIVITIES, AND OUTPUTS

All logic models need to contain the mechanism through which a program works. But many logic models also focus on the *implementation* of the program by including program inputs, activities, and outputs. *Inputs* are the financial, human, and material resources required by the program. *Activities* include training, counseling, marketing, and other tasks that make up the work of implementing the program. And *outputs* are the immediate products of these activities, such as people trained, brochures distributed, vaccinations given, or citations issued. Outputs are distinct from outcomes, the ultimate results that we care about. Sometimes it helps to further separate outcomes into short-term outcomes, intermediate outcomes, and long-term outcomes.

The example below is from a Centers for Disease Control and Prevention guidebook. It illustrates a logic model for a high blood pressure (HBP) reduction program that emphasizes chronic care management (CCM). The model shows the program's inputs (funding and clinic partners), activities (education and training), and outputs (clinic teams being educated and trained) that in turn set in motion a causal sequence of outcomes. The immediate short-term outcomes are more appropriate treatment of patients and more chronic care management. This leads to the intermediate outcome of more patients who keep their high blood pressure under control and, in turn, the long-term outcome of less heart disease and fewer strokes. Logic models such as this help managers to implement programs properly, showing what is needed to actually get the program up and running. But this picture of implementation is separate from and in addition to the mechanism, a causal theory of why the program, if fully implemented, will achieve the specified outcome. While implementation-oriented logic models are important, our focus in on the mechanism component of the logic model.



Source: Centers for Disease Control and Prevention, Division for Heart Disease and Stroke Prevention (n.d., p. 6).

Alternative Perspectives on Theory in Social Research

As we noted earlier, the term *theory* can mean different things to different people in the various disciplines and branches of the social sciences. We have focused on the kind of middle-range theories that applied researchers, especially quantitative researchers, emphasize. We now discuss some other kinds of theories.

Interpretivist Theory

Our view of theory has focused on variables and causal relationships. This view of theory is the norm for the vast majority of quantitative research and for some qualitative research, but qualitative research (the topic of the next chapter) often uses other types of theories. Moreover, our view of theory—middle-range theory—is associated with the scientific realism perspective of this book. This view largely assumes that the actions of people or other actors or entities (such as organizations) that are the focus of the study can be explained by a set of variables in a structure of causal relationships. And it focuses on averages and probabilistic relationships or tendencies. Sure, there are exceptions, but the theory focuses on the more general patterns.

Another approach to theory, which is sometimes referred to as **interpretivism**, puts more emphasis on unique individuals, organizations, or cases and relies for explanation more on the meaning and intentionality of human actions (A. Rosenberg, 2012). Interpretivist theories thus focus on the intersubjective understanding of people rather than on the empirical determinants of their objective behavior. Instead of articulating causal relationships among variables, interpretivist theory tries to comprehend people's purposes, values, and intentions. The role of theory is thus to make sense of people according to how they experience their world. We will have more to say about the interpretivist perspective in the next chapter, which deals with qualitative research. But note that interpretivism often remains compatible with the emphasis in this chapter on scientific realism and middle-range theory. Indeed, many of the variables in middle-range theories in the social sciences turn out to be things like motivations, attitudes, and behavioral intentions. In the theory of community policing, for example, trust of the police is an attitude that involves interpretation of police officers and their trustworthiness. In addition, a focus on individuals and cases (rather than variables) can be used to understand cause and effect, such as through the use of causal process tracing (discussed in Chapters 3 and 11).

Grand Theories

Both interpretivist theories and the middle-range theories generally aim to focus on one corner of the world, to explain particular people, contexts, or phenomena. In contrast, C. Wright Mills (1959) uses the term *grand theories*, or what some call theoretical paradigms, to refer to theories that attempt to provide an overarching framework that can explain many varied social phenomena. Grand theories tend be highly abstract and all-encompassing, often with a focus on a core set of explanatory factors that shape a broad range of social phenomena. There are many such grand theories or paradigms in the social sciences, including structural functionalism, symbolic interactionism, rational choice theory, sociobiology, Marxist historical materialism, Freudian psychoanalysis, critical theory, feminism, and postmodernism (A. Rosenberg, 2012; Seidman, 2012). The type of middle-range theory and model building we have emphasized in this chapter can sometimes draw inspiration from grand theories, for example in the choice of variables

to include in the model. But middle-range theories and models generally do not necessarily depend on a commitment to any particular grand theory. Some would argue, however, that the approach we have adopted in this chapter represents a kind of implicit grand theory that might be labeled *positivism* or *empiricism*. Certainly, there is no escaping having some larger paradigm or structure of beliefs and assumptions that guides social inquiry.

How to Find and Focus Research Questions

As we saw at the start of this chapter, theory can be defined as "a reasoned and precise speculation about the answer to a research question" (King et al., 1994)—but what is a research question? Roughly speaking, the **research question** should answer, at least partly, the question that motivated the researcher to do the study. But what exactly makes for a good research question, and how do you come up with one?

If you go by what you read in a research article or report, you get the sense of an orderly process: The research question follows directly from a review of the literature or theory in a field, and it precedes the collection and analysis of data. But this tidy picture masks a great deal of messy exploration, backtracking, and second-guessing that goes on behind the scenes. Often a researcher begins with only a vague sense of a question. It even happens that a researcher starts with one question, only to switch to another (more interesting or more answerable) question in midstream. Sometimes the data come first, for example when a researcher working with a survey conducted for one purpose realizes it can be used to study something else entirely. A study often looks like a neatly crafted object on the printed page, but it is typically constructed on a rather messy workbench.

This section on research questions is especially important if you need to begin your own study, perhaps as part of a research project or thesis, or if you are or will be working as a researcher or analyst. But it is also of interest if you mainly seek to understand and apply others' research to policy or practice. Understanding the processes and motivations that lead researchers to conduct a study can help you judge the findings and limitations of their research.

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Research looks neat on the printed page, but it is often produced on a messy workbench.

Applied Research Questions

In applied research, questions often arise from the practical concerns of policy makers and practitioners: Does community policing help reduce crime? Do smaller classes help kids learn? If we allow employees to work from home, will they be more (or less) productive? Will lowering the speed limit on roadways reduce traffic fatalities? Organizations and decision makers all over the world have many questions like these, and they often commission or sponsor research to answer them. More generally, society as a whole has many such practical questions, and therefore independent researchers (such as university students or professors) can use these practical problems as inspiration for the research questions guiding their own work.

But to be viable and useful for research, the practical question must be clarified and focused. One way to do this is to use the model-building tools we have been discussing in this chapter. In a study of a program or intervention, for example, the researcher needs to define the intervention (independent variable) and precisely what outcomes are expected (dependent variable), including perhaps unintended consequences. And the researcher must inquire about relevant intervening variables or mechanisms. Take, for example, the following question:

- Do smaller classes help kids learn?

In the case of Jackson Public Schools, we might need to focus this question a bit:

- Does the JPS class-size reduction program improve scores on the third-grade exit test? And if so, through what mechanisms (instruction time, individual attention) does class size influence test scores?

We might go on to add a question about unintended consequences:

- Does the JPS class-size reduction program reduce the resources available for other services (such as the library, art and music classes, or after-school programs)?

As this example illustrates, a single study can seek to answer more than one question. It also illustrates that formulating a research question and specifying a model are interlinked activities. Questions lead to theory and a model, but a theory and model also help refine and even reshape the original question or questions.

Questions You Ideally Want to Answer, and Those You Actually Can

Another important aspect of refining and clarifying your research question is to make it answerable. Often researchers find that the question they started with is not feasible, as a practical or ethical matter, and so they must settle for an answer to a related question—an approximation of sorts. Still, it is usually better to have an approximate answer than none at all.

Suppose you're interested in increasing voting among young adults in the United States. You want to know how interested they are in politics, and if this explains their voting behavior. Ideally, you would probably like to study a representative sample of young adults from across the country. But for practical reasons, you might have to settle for college students on your campus whom you can more easily interview. You might ask them in a survey about their interest in politics, but what about their voting behavior? You could ask them about the last election, but some students may have been too young to vote then (and besides, what you really want to know is how their *current* interest in politics predicts their *future* voting behavior). You could try to follow up with the students just after the next election, to see if they voted or not, but this would require waiting months if not years for data, plus the difficulties of recontacting people. So instead you add a question to your survey about their *intentions* to vote, or not, in the next election. In this way, your question has morphed into something answerable, if less grand: How interested are students on my campus in politics, and is this interest level related to their intention to vote in the next election?

Even the best researchers must make compromises. Consider another example that has been studied a great deal: Does divorce have long-term detrimental effects on children, psychologically or educationally? Because we cannot rewind the clock and see what would have happened to these children had their parents not divorced, this question is hard to answer directly. We could compare differences between those whose parents divorced and those whose parents did not, as in a study by Huurre, Junkkari, and Aro (2006). But because these groups may be different in important ways, this comparison answers a different, but still valuable, question. A study by Gruber (2004) used changes over time in state divorce laws to determine the long-term effects on children of making divorce easier. This approach solved the problems of the prior study, in ways we will learn about in Chapter 15. But this, too, is a slightly different question from our ideal question because we still aren't sure if the detrimental effects on children can be attributed to divorce itself or perhaps some other consequence of the changes in law. And Gruber's study was unable to consider some of the psychological outcomes observed by Huurre and colleagues (2006). Flexibility and compromise are required when translating your ideal question into a doable research question.

Know If Your Question Is Descriptive or Causal

Throughout this book, we emphasize the distinction between descriptive research (that answers "what is" questions) and causal research (that answers "what if" questions). We view this distinction as fundamental to understanding research. When coming up with your own research question, you should be clear about this distinction as well. Do you want to answer a *descriptive* question about voting behavior—*what is* the rate of young voter turnout, and has it changed over time?—or a *causal* question—*what if* we lowered the cost of voting (in terms of time, travel, and effort); would young voter turnout increase? These are very different kinds of questions requiring different research strategies.

Make Your Question Positive, Not Normative

We've seen already that theories are positive—about how the world really is—and not normative—about how we want the world to be. Similarly, your empirical research question will lead in a more productive direction if you frame it as a positive and not a normative question.

Again focusing on the idea of getting more young people to vote, suppose you come up with a research question such as this: *Why aren't more young people interested in politics and more willing to vote in elections?* This question implies a normative framework (that people *should* care about politics and *should* vote). We might well agree with these values, but a researchable question needs to be more positive. Like these, for example: *How interested are young people in politics? How often do they vote? And does interest in politics influence people's voting behavior?* These questions get at the same basic issue, but they are more positive, less normative, and thus more answerable by empirical research.

Generating Questions and Ideas

Although pressing social or practical problems often suggest questions, sometimes researchers must come up with their own ideas for research in a more abstract way. This occurs most often in academic research, such as a research paper for a course, a thesis, or a dissertation. What exactly should you do in these situations to come up with a good research question?

One approach is to review the scholarly literature in your field and look for anomalies or unanswered questions. In Chapter 17, we give some guidelines on how to find and review published research. Your coursework in your field or substantive area of interest—such as health policy, education, public administration, urban affairs, criminal justice, or international relations, to name a few fields—provides a good starting place for relevant research questions. But it's also important to tap into your own intellectual curiosity or professional experiences, which may have suggested anomalies or unanswered questions that you believe are worth exploring.

To discover an applied research question, in addition to surveying the scholarly literature, look at the relevant policy debates and practice discussions—in trade literature, news stories, professional conferences, social media, and everyday conversations. Such sources supply not only existing questions like "Do smaller classes help students learn?" but also highlight problems and new phenomena. For example, a researcher can combine concern about middle school students and electronic devices with knowledge of psychology to develop new research questions, such as "Does the plethora of electronic devices harm the development of concentration skills among middle school students?"

Reading widely outside your field can introduce you to new ideas or a new perspective on your area of interest. Find books or articles from other disciplines that interest you, especially those written for a more general audience. Newspapers, magazines, podcasts, videos (such as TED Talks), and blogs can also help you think broadly about your topic. Don't be afraid to use your own personal life experiences, as these can give you a unique perspective and motivation. In doing all of this, be sure to keep a notebook of your ideas for research. Jot down everything that comes to mind. Many experienced researchers have such a notebook (either paper or electronic), and they typically have a dozen ideas written down for every one idea that eventually turns into a full-blown study.

Heuristics. Andrew Abbott (2004) has identified certain *heuristics*—intellectual tricks or moves—that good researchers often use to generate interesting and productive research questions. To illustrate, let's say you are interested in the issue of declining voter turnout and political participation in modern democracies. Why do some people vote while others do not?

This is a well-worn question, but one heuristic you could use to liven it up is to make an *analogy*. What if you tried viewing voting as an economic transaction (Dubner & Levitt, 2005)? How much does it cost people to vote (in time, travel, effort)? Has the cost of voting gone up in recent years (more complications, higher opportunity costs)? And what is the payoff from voting (in terms of benefits from preferred politicians and policies)? Was the payoff better (patronage jobs, more competitive elections) in the past than it is now? As Abbott (2004) points out, this can also allow you to *borrow a method* (another heuristic move) from one discipline (economics) and apply it to the problems of another (political science).

Yet another heuristic move is to make a *reversal*—turn things around. "It might be worthwhile to stand this problem on its head," Dubner and Levitt (2005) of Freakonomics fame write, "and instead ask a different question: considering that an individual's vote almost never matters, why do so many people bother to vote at all?" This kind of reversal may make you think quite differently about the topic of voter turnout and political participation. Abbott's (2004) book provides many more such heuristics

(e.g., problematizing the obvious, changing context, stopping and putting in motion), but the larger point is to look for ways to free up your imagination so that you can think about a problem or an issue in a new light.

Conclusion: Theories Are Practical

According to Webster's dictionary, the adjective *theoretical* can mean "concerned primarily with theories or hypotheses rather than practical considerations" (Babylon, 2013). Many people have a similar connotation in mind when they hear the word *theory*. Practitioners often think that they do not want to become too theoretical or spend too much time thinking about theory. We hope that this chapter has convinced you that theories are practical. As we saw, Portland's assistant chief of police, Chris Davis, not the kind of person you'd think of as being lost in the clouds, helped focus a large urban police force on the theory of community policing. Theories come from police chiefs and criminologists who strive to prevent crime and save property and lives.

We have seen several ways in which a theory is practical. First, theories can help us understand the causes of a social problem or condition we care about. Understanding the causes of crime, for example, helps shed light on what police departments and other institutions in society might do to prevent it. We often welcome theories that help us explain and understand urgent social problems, giving us clues about what programs or interventions are most likely to work. Second, logic models can help us understand how a program or policy works—how it achieves or fails to achieve its intended result or outcome. Such understanding can be used to improve a program or policy if it isn't working well. In other words, it is often not enough to know *that* a program works or doesn't—we need to know *why* it works (or doesn't). Finally, we will see in Part IV that mechanisms are useful for assessing the generalizability of causal studies and for evaluating ways to estimate causal effects when we cannot run experiments.

For all these uses of theory, the causal diagram turns out to be an especially valuable tool. As we move on to later chapters of the book, we will continue to rely on causal diagrams as a tool for understanding social research, particularly in Part IV on causation.

▼ BOX 2.8

Critical Questions to Ask About Theory, Models, and Research Questions

- What is the theory being tested in a study? How was it developed?
- What is the independent variable? What is the dependent variable?
- What are the causal mechanisms that link the variables? How plausible are the mechanisms? Are there weak links?
- What is the unit of analysis (cases) described by the theory or model?
- What is the theory behind a program or intervention?
- Is there a logic model that describes how the program works? Does it make sense?
- What is the question that motivates the study? Is it an applied or policy question or a more academic question?

▼ BOX 2.9

Tips on Doing Your Own Research: Theory, Models, and Research Questions

- Use the advice in this chapter to identify and focus your research question. Try writing out the question in a clear, simple sentence or two.
- Is your research question mainly descriptive or mainly causal? If it is causal, can you state the main hypotheses (predictions) that stem from your theory?
- Create a causal diagram to represent your theory; clearly identify the independent variable, the dependent variable, and the key intervening variables (causal mechanisms). Also be sure to specify the directions of the relationships. Try showing and explaining your model to friends or colleagues—is it clear? Does it make sense to them (and to you)?
- What unit of analysis (cases) would you use to test the theory? Does your theory describe individual people, organizations, jurisdictions, something else?
- Think about possible sources of data to test your theory, as the feasibility of gathering and analyzing data often restricts the research question.
- After developing the model and considering the limitations on finding or gathering and analyzing data, go back to your research question. Does it correspond to the model? Is answering the research question really doable? Does the question need to be revised, refined, or restricted in any way?
- Try repeating the steps above for a related or even different research question—often you need to come up with several research ideas in order to find one that would be interesting and feasible for you to carry out.

EXERCISES

Find a Theory

2.1 Identify a widely known middle-range theory in your discipline or field of study. In public administration, for example, there is the theory of *public service motivation* (Perry & Wise, 1990). And in public health, there is the *health belief model* (Rosenstock, 1974). Use a causal diagram to represent a key relationship implied by the theory; your model should have an independent variable and a dependent variable (keep things simple, just to practice). Describe the causal mechanism—either in words or by including an intervening variable in the model. Reflect: How did translating the theory into a model help you understand the theory better?

Make a Theory

2.2 Make a basic theory to explain each of the following outcomes. Keep it simple—think of the most obvious and intuitive explanation. Use a causal diagram to represent your theory, which should have an independent variable (which you identify) and a dependent variable (which is the outcome itself). Supplement your model with a brief description in words, including the causal mechanism (this is very important).

- Traffic fatalities (on highways)
- Smoking (among teenagers)
- Litter (on sidewalks)
- Attendance (at a local art museum)

Identifying Independent and Dependent Variables

2.3 Identify the independent and dependent variables implicit in the following quotations:

a. "The key to a good, high-paying job is education."

b. "Oatmeal is an important part of a heart-healthy diet."

c. "Passing out condoms to teenagers just encourages sexual activity."

d. "To reduce youth violence, we need more after-school programs."

Positive and Negative Relationships

2.4 Identify the most likely sign (positive, negative) of the following relationships:

a. Age and health (of individuals)

b. Work experience and earnings (of individuals)

c. Traffic volume and air pollution levels (of cities)

d. Gender inequality and female life expectancy (of countries)

Unit of Analysis

2.5 This chapter discussed a class-size reduction program in Jackson, Mississippi. The most basic model of the program looked like this: *Class size* → *Test scores*. What are some possible units of analysis for this model? Specify an independent and dependent variable for each of the various units of analysis (as in Tables 2.1 and 2.2).

Identify Intervening Variables

2.6 Identify the intervening variables in a simple theory of each relationship:

a. Speeding tickets and traffic accidents

b. Price of college and attending college

c. Nicotine patches and smoking

d. Social distancing and spread of COVID-19

Identify Unit of Analysis and Mechanism

2.7 Consider the following description of a research study, presented in a *New York Times* article (Quenqua, 2015):

> Researchers who surveyed 6,200 lawyers about their jobs and health found that the factors most frequently associated with success in the legal field, such as high income or a partner-track job at a prestigious firm, had almost zero correlation with happiness and well-being. However, lawyers in public-service jobs who made the least money, like public defenders or Legal Aid attorneys, were most likely to report being happy. . . . The problem with the more prestigious jobs, said Mr. Krieger, is that they do not provide feelings of competence, autonomy or connection to others. . . . Public-service jobs do.

(a) What is the unit of analysis in this study?

(b) If *Having a public-service job* is the independent variable and *Happiness* is the dependent variable, draw a causal diagram showing *one* mechanism consistent with Krieger's view. (Note that *Having a public-service job*, versus a private-sector job, is a dummy variable, as described in Box 2.4.) Explain very briefly.

Developing a Mechanism

2.8 A media story (Ingmire, 2014) wrote about a working paper (P. J. Cook et al., 2015):

> High school students who were at risk for dropping out greatly improved their math test scores and school attendance with the help of intensive tutoring and mentoring, according to a study by the University of Chicago Urban Education Lab. The program's benefits were equivalent to closing nearly two-thirds of the average gap in math test scores between white and black students—the equivalent of what the average American high school student learns in math over three years. . . .
>
> One benefit of the Match tutoring approach is that it takes on the "mismatch" between a student's grade level and the actual skills he or she has developed. In disadvantaged urban settings such as Chicago, a student can be four to 10 years behind grade level in math, which is a key gateway to high school graduation, said Jens Ludwig, co-director of the Urban Education Lab and the McCormick Foundation Professor of Social Service Administration, Law and Public Policy. . . . "So much of the energy in education policy is in improving the quality with which grade-level material is taught in classrooms," Ludwig said. "But that's not going to help a ninth-grader who is struggling with third- or fourth-grade math problems."
>
> Create a causal diagram showing the mechanism through which the tutoring program would increase math test scores, according to the mismatch theory.

Logic Model of a Program (Project-Length Exercise)

2.9 Consider a policy or social program that actually exists or that you would like to propose. Choosing something that really interests you and that you know something about is best. Prepare a description of the theory of how your program works. Make sure that you include the following:

a. What are the outcomes (dependent variables) the program is designed to affect? If there are many outcomes, restrict your analysis to one outcome or to a few closely related outcomes.

b. What is the unit of analysis that the variables describe?

c. Describe your program in words. Be as precise and concrete as possible.

d. Using a causal diagram and a narrative description, describe your theory of how the program is supposed to work—the *mechanisms* through which the

program will affect the outcome. (There can be many mechanisms through which a program works or only one or two. If there are many, pick only a couple and just note that there are other mechanisms.)

Developing a Research Question

2.10 Choose a topic in your field or in an area of interest to you and try developing it into a research question using the following steps:

a. Jot down as many questions as you can think of related to your topic.

b. Pick the question that interests you the most.

c. Is your question primarily causal or descriptive? Edit your question if necessary to clarify this.

d. Make sure your question is positive (and not normative). Again, edit it accordingly (even though you may have a moral or political interest in the topic).

e. Try developing a simple theory, in the form of a causal diagram, to represent a plausible answer to your question. (Note: This step applies to only causal questions, not descriptive questions.)

f. Think about how you would answer your question. Fine-tune your question so that it is something you really could answer with the resources available to you.

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