	Male	Female
Pregnant		(pregnant female figures)
Not pregnant	(male figures)	(female figures)

FIGURE 4-2

Necessary Cause. Being female is a necessary cause of pregnancy, that is, you can't get pregnant unless you're female.

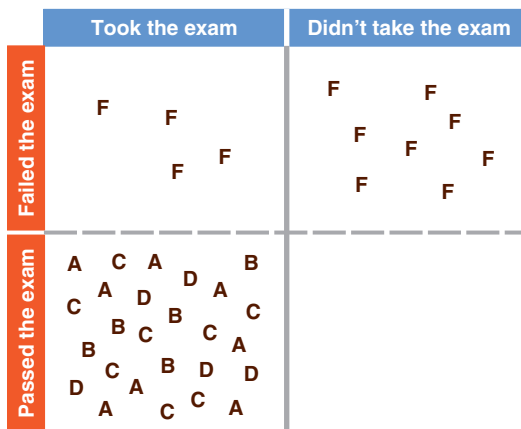|	Took the exam	Didn't take the exam
Failed the exam	F F F F F	F F F F F F F F F
Passed the exam	A C A B C A D A C B C B C A B C B D D D C A A A C C A	

FIGURE 4-3

Sufficient Cause. Not taking the exam is a sufficient cause of failing it, even though there are other ways of failing (such as answering randomly).

develop and (2) always results in delinquency. In such a case, you would surely feel that you knew precisely what caused juvenile delinquency.

Unfortunately, when analyzing the nomothetic relationships among variables, we never discover single causes that are absolutely necessary and absolutely sufficient. It is not uncommon, however, to find causal factors that are either 100 percent necessary (you must be female to become pregnant) or 100 percent sufficient (skipping an exam will cause you to fail it).

In the idiographic analysis of single cases, you may reach a depth of explanation from which it is reasonable to assume that things could not have turned out differently, suggesting that you have determined the sufficient causes for a particular result. (Anyone with all the same details of your genetic inheritance, upbringing, and subsequent experiences would have ended up going to college.) At the same time, there could always be other causal paths to the same result. Thus, the idiographic causes are sufficient but not necessary.

Units of Analysis

In social research, there is virtually no limit to what or whom can be studied, or the **units of analysis**. This topic is relevant to all forms of social research, although its implications are clearest in the case of nomothetic, quantitative studies.

The idea for units of analysis may seem slippery at first, because research—especially nomothetic research—often studies large collections of people or things, or aggregates. It's important to distinguish between the unit of analysis and the aggregates that we generalize about.

> **units of analysis** The what or whom being studied. In social science research the most typical units of analysis are individual people.

For instance, a researcher may study a class of people, such as Democrats, college undergraduates, or African American women under age 30. But if the researcher is interested in exploring, describing, or explaining how different groups of individuals behave as *individuals*, the unit of analysis is the individual, not the group. This is so even though the researcher then proceeds to generalize about aggregates of individuals, as in saying that more Democrats than Republicans favor legalizing marijuana.

Think of it this way: Having an attitude about marijuana is something that can be an attribute only of an individual, not a group; that is, there is no one group "mind" that can have an attitude. So even when we generalize about Democrats, we're generalizing about an attribute they possess as individuals.

In contrast, we may sometimes want to study groups, considered as individual "actors" or entities that have attributes as groups. For instance, we might want to compare the characteristics of different types of street gangs. In that case our unit of analysis would be gangs (not members of gangs), and we might proceed to make generalizations about different types of gangs. For example, we might conclude that male gangs are more violent than female gangs. Each gang (unit of analysis) would be described in terms of two variables: (1) What *gender* are the members? and (2) How *violent* are its activities? So we might study 52 gangs, reporting that 40 were male and 12 were female, and so forth. The "gang" would be the unit of analysis, even though some of the characteristics were drawn from the components (members) of the gangs.

Social researchers perhaps most typically choose individual people as their units of analysis. You might note the characteristics of individual people—gender, age, region of birth, attitudes, and so forth. You could then combine these descriptions to provide a composite picture of the group the individuals represent, whether a street-corner gang or a whole society.

For example, you might note the age and gender of each student enrolled in Political Science 110 and then characterize the group of students as being 53 percent men and 47 percent women and as having a mean age of 18.6 years. Although the final description would be of the class as a whole, the description would be based on characteristics that members of the class have as individuals.

The same distinction between units of analysis and aggregations occurs in explanatory studies. Suppose you wished to discover whether students with good study habits received better grades in Political Science 110 than did students with poor study habits. You would operationalize the variable *study habits* and measure this variable, perhaps in terms of hours of study per week. You might then aggregate students with good study habits and those with poor study habits and see which group received the best grades in the course. The purpose of the study would be to explain why some groups of students do better in the course than do others, but the unit of analysis would still be individual students.

Units of analysis in a study are usually also the units of observation. Thus, to study success in a political science course, we would observe individual students. Sometimes, however, we "observe" our units of analysis indirectly. For example, suppose we want to find out whether disagreements about the death penalty tend to cause divorce. In this case, we might "observe" individual husbands and wives by asking them about their attitudes toward capital punishment, in order to distinguish couples who agree and disagree on this issue. In this case, our units of observation are individual wives and husbands, but our units of analysis (the things we want to study) are couples.

Units of analysis, then, are those things we examine in order to create summary descriptions of all such units and to explain differences among them. In most research projects, the unit of analysis will probably be clear to you. When the unit of analysis is not clear, however, it's essential to determine what it is; otherwise, you cannot determine what observations are to be made about whom or what.

Some studies try to describe or explain more than one unit of analysis. In these cases, the researcher must anticipate what conclusions she or he wishes to draw with regard to which units of analysis. For example, we may want to discover what kinds of college students (individuals) are most successful in their careers after graduation; we may also want to learn what kinds of colleges (organizations) produce the most successful graduates.

Here's an example that illustrates the complexity of units of analysis. Murder is a fairly personal matter: One individual kills another individual. However, when Charis Kubrin and Ronald Weitzer (2003: 157) ask, "Why do these neighborhoods generate high homicide rates?" the unit of analysis in that question is "neighborhood." You can probably imagine some kinds of neighborhood (such as poor, urban) that would have high homicide rates and some (such as wealthy, suburban) that would have low homicide rates. In this particular conversation, the unit of analysis (neighborhood) would be categorized in terms of variables such as *economic level*, *locale*, and *homicide rate*.

In their analysis, however, Kubrin and Weitzer were also interested in different types of homicide: in particular, those that occurred in retaliation for some earlier event, such as an assault or insult. Can you identify the unit of analysis common to all of the following excerpts?

1. The sample of killings...
2. The coding instrument includes over 80 items related to the homicide.
3. Of the 2,161 homicides that occurred from 1985 [to] 1995...
4. Of those with an identified motive, 19.5 percent (n = 337) are retaliatory (Kubrin and Weitzer 2003: 163).

In each of these excerpts, the unit of analysis is *homicide* (also called *killing* or *murder*). Sometimes you can identify the unit of analysis in the description of the sampling methods, as in the first excerpt. A discussion of classification methods might also identify the unit of analysis, as in the second excerpt (80 ways to code the homicides). Often, numerical summaries point the way: 2,161 homicides; 19.5 percent (of the homicides). With a little practice you'll be able to identify the units of analysis in most social research reports, even when more than one is used in a given analysis.

To explore this topic in more depth, let's consider several common units of analysis in social research.

Individuals

As mentioned earlier, individual human beings are perhaps the most typical units of analysis for social research. We tend to describe and explain social groups and interactions by aggregating and manipulating the descriptions of individuals.

Any type of individual can be the unit of analysis for social research. This point is more important than it may seem at first. The norm of generalized understanding in social research should suggest that scientific findings are most valuable when they apply to all kinds of people. In practice, however, social researchers seldom study all kinds of people. At the very least, their studies are typically limited to the people living in a single country, though some comparative studies stretch across national boundaries. Often, however, studies are quite circumscribed.

Examples of classes of individuals that might be chosen for study include students, gays and lesbians, autoworkers, voters, single parents, and faculty members. Note that each of these terms implies some population of individuals.

Groups

Social groups can also be units of analysis in social research. That is, we may be interested in characteristics that belong to one group, considered as a single entity. If you were to study the members of a criminal gang to learn about criminals, the individual (criminal) would be the unit of analysis; but if you studied all the gangs in a city to learn the differences, say, between big gangs and small ones, between "uptown" and "downtown" gangs, and so forth, you would be interested in gangs rather than their individual members. In this case, the unit of analysis would be the gang, a social group.

Here's another example. Suppose you were interested in the question of access to computers in different segments of society. You might describe families in terms of total annual income and according to whether or not they had computers. You could then aggregate families and describe the mean income of families and the percentage with computers. You would then be in a position to determine whether families with higher incomes were more likely to have computers than were those with lower incomes. In this case, the unit of analysis would be families.

As with other units of analysis, we can derive the characteristics of social groups from those of their individual members. Thus, we might describe a family in terms of the age, race, or education of its head. In a descriptive study, we

might find the percentage of all families that have a college-educated head of family. In an explanatory study, we might determine whether such families have, on average, more or fewer children than do families headed by people who have not graduated from college. In each of these examples, the family is the unit of analysis. In contrast, had we asked whether college-educated individuals have more or fewer children than do their less-educated counterparts, then the individual would have been the unit of analysis.

Organizations

Formal social organizations can also be the units of analysis in social research. For example, a researcher might study corporations, by which he or she implies a population of all corporations. Individual corporations might be characterized in terms of their number of employees, net annual profits, gross assets, number of defense contracts, percentage of employees from racial or ethnic minority groups, and so forth. We might determine whether large corporations hire a larger or smaller percentage of minority-group employees than do small corporations. Other examples of formal social organizations suitable as units of analysis include church congregations, colleges, army divisions, academic departments, and supermarkets.

Figure 4-4 provides a graphic illustration of some different units of analysis and the statements that might be made about them.

Social Interactions

Sometimes social interactions are the relevant units of analysis. Instead of studying individual humans, you can study what goes on between them: telephone calls, kisses, dancing, arguments, fistfights, e-mail exchanges, chat-room discussions, and so forth. As you saw in Chapter 2, social interaction is the basis for one of the primary theoretical paradigms in the social sciences, and the number of units of analysis that social interactions provide is nearly infinite.

social artifact Any product of social beings or their behavior. It can be a unit of analysis.

Even though individuals are usually the actors in social interactions, there is a difference between (1) comparing the kinds of people who subscribe to different Internet service providers (individuals being the unit of analysis) and (2) comparing the length of chat-room discussions on those same providers (the discussion being the unit of analysis).

Social Artifacts

Another unit of analysis is the **social artifact**, or any product of social beings or their behavior. One class of artifacts includes concrete objects such as books, poems, paintings, automobiles, buildings, songs, pottery, jokes, student excuses for missing exams, and scientific discoveries.

As these examples suggest, just as people or social groups imply populations, each social object implies a set of all objects of the same class: all books, all novels, all biographies, all introductory sociology textbooks, all cookbooks, all press conferences. In a study using books as the units of analysis, an individual book might be characterized by size, weight, length, price, content, number of pictures, number sold, or description of its author. Then the population of all books or of a particular kind of book could be analyzed for the purpose of description or explanation: what kinds of books sell best and why, for example.

Social interactions form another class of social artifacts suitable for social research. For example, we might characterize weddings as racially or religiously mixed or not, as religious or secular in ceremony, as resulting in divorce or not, or by descriptions of one or both of the marriage partners (such as "previously married," "Oakland Raider fan," "wanted by the FBI"). When a researcher reports that weddings between partners of different religions are more likely to be performed by secular authorities than are those between partners of the same religion, the weddings are the units of analysis, not the individuals involved.

Other social interactions that might be units of analysis include friendship choices, court cases, traffic accidents, divorces, fistfights, ship launchings, airline hijackings, race riots, final exams, student demonstrations, and congressional hearings. Congressional hearings, for instance, could be characterized by whether or not they occurred during an election campaign,
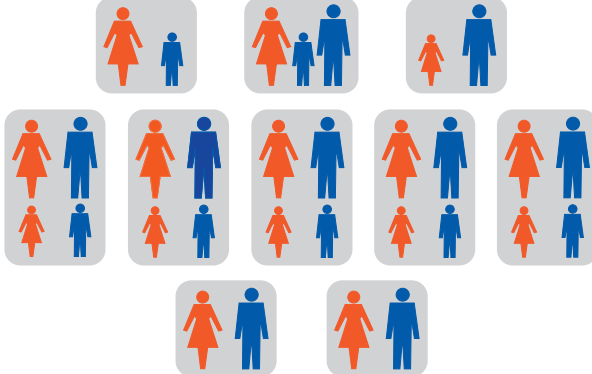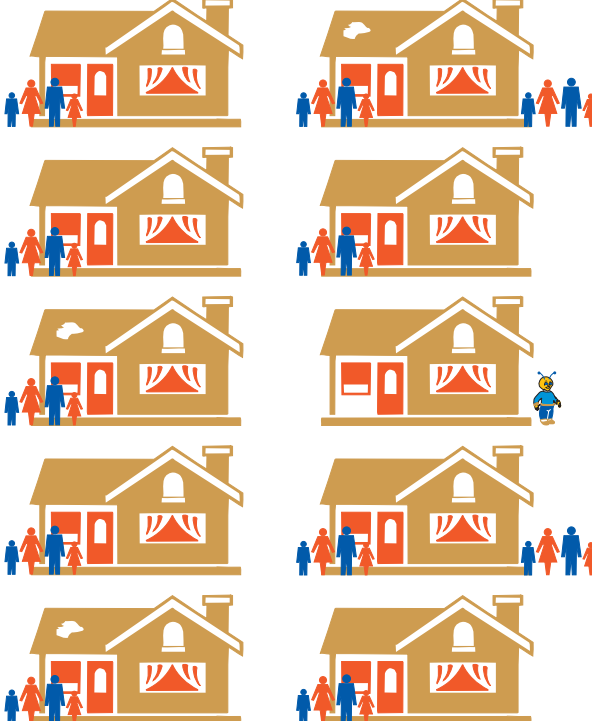
Units of Analysis	Sample Statements
Individuals	60% of the sample are women 10% of the sample are wearing an eye patch 10% of the sample have pigtails
Families	20% of the families have a single parent 50% of the families have two children 20% of the families have no children The mean number of children per family is 1.3
Households	20% of the households are occupied by more than one family 30% of the households have holes in their roofs 10% of the households are occupied by aliens Notice also that 33% of the families live in multiple-family households with family as the unit of analysis

FIGURE 4-4

Illustrations of Units of Analysis. Units of analysis in social research can be individuals, groups, or even nonhuman entities.

Identifying the Unit of Analysis

The unit of analysis is an important element in research design and in data analysis. However, students sometimes find it elusive. The easiest way to identify the unit of analysis is to examine a statement regarding the variables under study.

Consider the following statement: "The average household income was $40,000." *Income* is the variable of interest, but who or what *has* income? Households. We would arrive at the given statement by examining the incomes of several households. To calculate the mean (average) income, we would add up all the household incomes and divide by the number of households. Household is the unit of analysis. It is the unit being analyzed in terms of the variable, *income*.

One way of identifying the unit of analysis is to imagine the process that would result in the conclusion reached. Consider this research conclusion: "Twenty-four percent of the families have more than one adult earning at least $30,000 a year." To be sure, adults are earning the income, but the statement is about whether families have such adults. To make this statement, we would study several families. For each, we would ask whether they had more than two adults earning in excess of $30,000; each family would be scored as "yes" or "no" in that respect. Finally, we would calculate the percentage of families scored as "yes." The family, therefore, is the unit of analysis.

whether the committee chairs were running for a higher office, whether these chairs had received campaign contributions from interested parties, and so on. Notice that even if we characterized and compared the hearings in terms of the committee chairs, the hearings themselves—not the individual chairpersons—would be our units of analysis. See "How to Do It: Identifying the Unit of Analysis" for more.

Units of Analysis in Review

The examples in this section should suggest the nearly infinite variety of possible units of analysis in social research. Although individual human beings are typical objects of study, many research questions can be answered more appropriately through the examination of other units of analysis. Indeed, social researchers can study just about anything that bears on social life.

Moreover, the types of units of analysis named in this section do not begin to exhaust the possibilities. This has been a topic of discussion and elaboration for some time. Morris Rosenberg (1968: 234–48), for example, speaks of individual, group, organizational, institutional, spatial, cultural, and societal units of analysis. John Lofland and colleagues (2006: 122–32) speak of practices, episodes, encounters, roles and social types, social and personal relationships, groups and cliques, organizations, settlements and habitats, subcultures, and lifestyles as suitable units of study. The important thing here

is to grasp the logic of units of analysis. Once you do, only your imagination limits the possibilities for fruitful research.

Categorizing possible units of analysis may make the concept seem more complicated than it needs to be. What you call a given unit of analysis—a group, a formal organization, or a social artifact—is irrelevant. The key is to be clear about what your unit of analysis is. When you embark on a research project, you must decide whether you're studying marriages or marriage partners, crimes or criminals, corporations or corporate executives. Otherwise, you run the risk of drawing invalid conclusions because your assertions about one unit of analysis are actually based on the examination of another. We'll see an example of this issue as we look at the ecological fallacy in the next section.

Faulty Reasoning about Units of Analysis: The Ecological Fallacy and Reductionism

At this point, it's appropriate to introduce two types of faulty reasoning: the ecological fallacy and reductionism. Each represents a potential pitfall regarding units of analysis, and either can occur in doing research and drawing conclusions from the results.

The Ecological Fallacy

In this context, *ecological* refers to groups or sets or systems: something larger than individuals.

The **ecological fallacy** is the assumption that something learned about an ecological unit says something about the individuals making up that unit. Let's consider a hypothetical illustration of this fallacy.

Suppose we're interested in learning something about the nature of electoral support received by a female political candidate in a recent citywide election. Let's assume we have the vote tally for each precinct so we can tell which precincts gave her the greatest support and which the least. Assume also that we have census data describing some characteristics of these precincts. Our analysis of such data might show that precincts with relatively young voters gave the female candidate a greater proportion of their votes than did precincts with older voters. We might be tempted to conclude from these findings that young voters are more likely to vote for female candidates than are older voters—in other words, that age affects support for the woman. In reaching such a conclusion, we run the risk of committing the ecological fallacy because it may have been the older voters in those "young" precincts who voted for the woman. Our problem is that we've examined *precincts* as our units of analysis but wish to draw conclusions about *voters*.

The same problem would arise if we discovered that crime rates were higher in cities having large African American populations than in those with few African Americans. We would not know whether the crimes were actually committed by African Americans. Or if we found suicide rates higher in Protestant countries than in Catholic ones, we still could not know for sure that more Protestants than Catholics committed suicide.

In spite of these hazards, social researchers very often have little choice but to address a particular research question through an ecological analysis. Perhaps the most appropriate data are simply not available. For example, the precinct vote tallies and the precinct characteristics mentioned in our initial example might be easy to obtain, but we may not have the resources to conduct a post-election survey of individual voters. In such cases, we may reach a tentative conclusion, recognizing and noting the risk of an ecological fallacy.

Although you should be careful not to commit the ecological fallacy, don't let these warnings lead you into committing what we might call the "individualistic fallacy." Some people who approach social research for the first time have trouble reconciling general patterns of attitudes and actions with individual exceptions. But generalizations and probabilistic statements are not invalidated by such exceptions. Your knowing a rich Democrat, for example, doesn't deny the fact that most rich people vote Republican—as a general pattern. Similarly, if you know someone who has gotten rich without any formal education, that doesn't deny the general pattern of higher education relating to higher income.

The ecological fallacy deals with something else altogether—confusing units of analysis in such a way that we base conclusions about individuals solely on the observation of groups. Although the patterns observed among variables at the level of groups may be genuine, the danger lies in reasoning from the observed attributes of groups to the attributes of the individuals who made up those groups, when we have not actually observed individuals. "Applying Concepts in Everyday Life: Red Families and Blue Families" illustrates some of the complexities presented by different units of analysis.

Reductionism

A second type of potentially faulty reasoning related to units of analysis is reductionism. **Reductionism** involves attempts to explain a particular phenomenon in terms of limited and/or lower-order concepts. The reductionist explanation is not altogether wrong; it is simply too limited. Thus, you might attempt to predict this year's winners and losers in the National Basketball Association by focusing on the abilities of the individual players on each team. This is certainly neither stupid nor irrelevant, but the success or failure of teams involves more than just the individuals on them; it involves coaching, teamwork, strategies, finances, facilities, fan loyalty, and so forth. To understand why some teams do better

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ecological fallacy Erroneously basing conclusions about individuals solely on the observation of groups.

reductionism A fault of some researchers: a strict limitation (reduction) of the kinds of concepts to be considered relevant to the phenomenon under study.

Applying Concepts in Everyday Life

Red Families and Blue Families

During recent American political campaigns, concern for "family values" has often been featured as a hot-button issue. Typically, conservatives and Republicans have warned of the decline of such traditional values, citing divorce rates, teen pregnancies, same-sex marriage, and such. This is, however, a more complex matter than would fit on a bumper sticker.

In their analysis of conservative "red families" and liberal "blue families," Naomi Cahn and June Carbone report:

> Red family champions correctly point out that growing numbers of single-parent families threaten the well-being of the next generation, and they accurately observe that greater male fidelity and female "virtue" strengthen relationships. Yet red regions of the country have higher teen pregnancy rates, more shotgun marriages, and lower average ages at marriage and first birth.

> *(2010: 2)*

Reviewing the Cahn–Carbone study, Jonathan Rauch headlines the question, "Do 'Family Values' Weaken Families?" and summarizes the data thusly:

> Six of the seven states with the lowest divorce rates in 2007, and all seven with the lowest teen birthrates in 2006, voted blue in both elections. Six of the seven states with the highest divorce rates in 2007, and five of the seven with the highest teen birthrates, voted red. It's as if family strictures undermine family structures.

> *(Rauch 2010)*

Assuming that young people are going to have sex, Cahn and Carbone argue that the "traditional family values" that oppose sex education, contraception, and abortion will result in unplanned births that will typically be dealt with by forcing the young parents to marry. This, in turn, may interrupt their educations, limit their employment opportunities, lead to poverty, and result in unstable marriages that may not survive. This interpretation of the data may be completely valid, but can you recognize a methodological issue that might be raised? Think about the ecological fallacy.

The units of analysis used in these analyses are the 50 states of the union. The variables correlated are (1) overall voting patterns of the states and (2) family-problem rates in the states. States voting Republican overall have more problems than those voting Democratic overall. However, the data do not guarantee that Republican families or teenagers in Republican families have more problems than their Democratic counterparts. The ecological data suggest that that's the case, but it is possible that Democrats in Republican states have the most family problems and Republicans in Democratic states have the least. It is unlikely but it is possible.

To be more confident about the conclusions drawn here, we would need to do a study in which the family or the individual was the unit of analysis.

Sources: Naomi Cahn and June Carbone, *Red Families v. Blue Families: Legal Polarization and the Creation of Culture* (New York: Oxford University Press, 2010); Jonathan Rauch, "Do 'Family Values' Weaken Families?" *Dallas Morning News*, May 2010, http://www.dallasnews.com/opinion/commentary/2010/05/28/Jonathan-Rauch-Do-family-9089.

than others, you would make *team* the unit of analysis, and the *quality of players* would be one variable you would probably want to use in describing and classifying the teams.

Thus, different academic disciplines approach the same phenomenon quite differently. Sociologists tend to consider sociological variables (such as *values, norms,* and *roles*), economists ponder economic variables (such as *supply and demand* and *marginal value*), and psychologists examine psychological variables (such as *personality types* and *traumas*). Explaining all or most human behavior in terms of economic factors is called *economic reductionism;* explaining all or most human behavior in terms of psychological factors is called *psychological reductionism;* and so forth. Notice how this issue relates to the discussion of theoretical paradigms in Chapter 2.

For many social scientists, the field of **sociobiology** is a prime example of reductionism, suggesting that all social phenomena can be explained in terms of biological factors. Thus, for example, Edward O. Wilson, sometimes referred to as the father of sociobiology, sought to explain altruistic behavior in human beings in terms of our genetic makeup (1975). In his neo-Darwinian view, Wilson suggests that humans have evolved in such a way that individuals sometimes need to sacrifice themselves for the benefit of the whole species. Some people might

> **sociobiology** A paradigm based on the view that social behavior can be explained solely in terms of genetic characteristics and behavior.

explain such sacrifice in terms of ideals or warm feelings between humans. However, genes are the essential unit in Wilson's paradigm, producing his famous dictum that human beings are "only DNA's way of making more DNA."

Reductionism of any type tends to suggest that particular units of analysis or variables are more relevant than others. Suppose we ask what caused the American Revolution. Was it a shared commitment to the value of individual liberty? The economic plight of the colonies in relation to Britain? The megalomania of the founders? As soon as we inquire about *the* single cause, we run the risk of reductionism. If we were to regard shared values as the cause of the American Revolution, our unit of analysis would be the individual colonist. An economist, though, might choose the thirteen colonies as units of analysis and examine the economic organizations and conditions of each. A psychologist might choose individual leaders as the units of analysis for purposes of examining their personalities.

Like the ecological fallacy, reductionism can occur when we use inappropriate units of analysis. The appropriate unit of analysis for a given research question, however, is not always clear. Social researchers, especially across disciplinary boundaries, often debate this issue.

The Time Dimension

So far in this chapter, we've regarded research design as a process for deciding what aspects we'll observe, of whom, and for what purpose. Now we must consider a set of time-related options that cuts across each of these earlier considerations. We can choose to make observations more or less at one time or over a long period.

Time plays many roles in the design and execution of research, quite aside from the time it takes to do research. Earlier we noted that the time sequence of events and situations is critical to determining causation (a point we'll return to in Part 4). Time also affects the generalizability of research findings. Do the descriptions and explanations resulting from a particular study accurately represent the situation of ten years ago, ten years from now, or only the present? Researchers have two principal options for dealing with the issue of time in the design

of their research: cross-sectional studies and longitudinal studies.

Cross-Sectional Studies

A **cross-sectional study** involves observations of a sample, or cross section, of a population or phenomenon that are made at one point in time. Exploratory and descriptive studies are often cross-sectional. A single U.S. Census, for instance, is a study aimed at describing the U.S. population at a given time.

Many explanatory studies are also cross-sectional. A researcher conducting a large-scale national survey to examine the sources of racial and religious prejudice would, in all likelihood, be dealing with a single time frame—taking a snapshot, so to speak, of the sources of prejudice at a particular point in history.

Explanatory cross-sectional studies have an inherent problem. Although their conclusions are based on observations made at only one time, typically they aim at understanding causal processes that occur over time. This is akin to determining the speed of a moving object from a high-speed, still photograph.

Yanjie Bian, for example, conducted a survey of workers in Tianjin, China, to study stratification in contemporary urban Chinese society. In undertaking the survey in 1988, however, he was conscious of the important changes brought about by a series of national campaigns, such as the Great Proletarian Cultural Revolution, dating from the Chinese Revolution in 1949 (which brought the Chinese Communists into power) and continuing into the present.

> These campaigns altered political atmospheres and affected people's work and nonwork activities. Because of these campaigns, it is difficult to draw conclusions from a cross-sectional social survey, such as the one presented in this book, about general patterns of Chinese workplaces and their effects on workers. Such conclusions may be limited to one period of time and are subject to further tests based on data collected at other times.
>
> *(1994: 19)*

cross-sectional study A study based on observations representing a single point in time.