examination of how people feel about corruption. Here are just a few of the dimensions you might examine:

- Do people think there is corruption in government?
- How much corruption do they think there is?
- How certain are they in their judgment of how much corruption there is?
- How do they feel about corruption in government as a problem in society?
- What do they think causes it?
- Do they think it's inevitable?
- What do they feel should be done about it?
- What are they willing to do personally to eliminate corruption in government?
- How certain are they that they would be willing to do what they say they would do?

The list could go on and on—how people feel about corruption in government has many dimensions. It's essential to be clear about which ones are important in our inquiry; otherwise, you may measure how people feel about corruption when you really wanted to know how much they think there is, or vice versa.

Once you've determined how you're going to collect your data (for example, survey, field research) and have decided on the relevant range of variation, the degree of precision needed between the extremes of variation, and the specific dimensions of the variables that interest you, you may have another choice: a mathematical-logical one. That is, you may need to decide what level of measurement to use. To discuss this point, we need to take another look at attributes and their relationship to variables.

Defining Variables and Attributes

An attribute, you'll recall, is a characteristic or quality of something. *Female* is an example. So is *old* or *student.* Variables, on the other hand, are logical sets of attributes. Thus, *sex* is a variable composed of the attributes *female* and *male.* What could be simpler?

Although people sometimes use the terms, *sex* and *gender*, interchangeably, they mean different things. "Sex" is the proper name of the variable composed of the physical attributes female and male, while "gender" is a social-identity and behavioral variable composed of the attributes, feminine and masculine. *Femininity* represents those qualities we traditionally associate with women, and *masculinity* represents those qualities we traditionally associate with men. However, women and men often feel, act on, and are perceived as having qualities associated with the other sex. Although the distinctions between these two concepts are sometimes blurred, even in social research reports, my intention is to stick to their technical meanings in this textbook.

In any case, the conceptualization and operationalization processes can be seen as the specification of variables and the attributes composing them. Thus, in the context of a study of unemployment, *employment status* is a variable having the attributes *employed* and *unemployed;* the list of attributes could also be expanded to include the other possibilities discussed earlier, such as *homemaker.*

Levels of Measurement

All variables are composed of attributes, but as we are about to see, the attributes of a given variable can have a variety of different relationships to one another. In this section, we'll examine four levels of measurement: nominal, ordinal, interval, and ratio.

Nominal Measures

Variables whose attributes are simply different from one another are called *nominal measures.* Examples include *gender, religious affiliation, political party affiliation, birthplace, college major,* and *hair color.* Although the attributes composing each of these variables—as *male* and *female* compose the variable *gender*—are distinct from one another, they have no additional structures. **Nominal measures** merely offer names or labels for characteristics.

Imagine a group of people characterized in terms of one such nominal variable and physically grouped by the applicable attributes. For example, say we've asked a large gathering of people to stand

together in groups according to the states in which they were born: all those born in Vermont in one group, those born in California in another, and so forth. The variable is *state of birth;* the attributes are *born in California, born in Vermont,* and so on. All the people standing in a given group have at least one thing in common and differ from the people in all other groups in that same regard. Where the individual groups form, how close they are to one another, or how the groups are arranged in the room is irrelevant. What matters is that all the members of a given group share the same state of birth and that each group has a different shared state of birth. All we can say about two people in terms of a nominal variable is that they are either the same or different.

Ordinal Measures

Variables with attributes we can logically rank-order are *ordinal measures.* The different attributes of ordinal variables represent relatively more or less of the variable. Variables of this type are *social class, conservatism, alienation, prejudice, intellectual sophistication,* and the like. In addition to saying whether two people are the same or different in terms of an ordinal variable, you can also say one is "more" than the other—that is, more conservative, more religious, older, and so forth.

In the physical sciences, *hardness* is the most frequently cited example of an ordinal measure. We may say that one material (for example, diamond) is harder than another (say, glass) if the former can scratch the latter and not vice versa. By attempting to scratch various materials with other materials, we might eventually be able to arrange several materials in a row, ranging from the softest to the hardest. We could never say how hard a given material was in absolute terms; we could only say how hard in relative terms—which materials it is harder than and which softer than.

Let's pursue the earlier example of grouping the people at a social gathering. This time imagine that we ask all the people who have graduated from college to stand in one group, all those with only a high school diploma to stand in another group, and all those who have not graduated from high school to stand in a third group. This manner of grouping people satisfies the nominal-variable quality of being different, as discussed earlier. In addition, however, we might logically arrange the three groups in terms of the relative amount of formal education (the shared attribute) each had. We might arrange the three groups in a row, ranging from most to least formal education. This arrangement would provide a physical representation of an **ordinal measure**. If we knew which groups two individuals were in, we could determine that one had more, less, or the same formal education as the other.

In this example, it is irrelevant how close or far apart the educational groups are from one another. The college and high school groups might be 5 feet apart, and the less-than-high-school group 500 feet farther down the line. These actual distances don't have any meaning. The high school group, however, should be between the less-than-high-school group and the college group, or else the rank order will be incorrect.

Interval Measures

For the attributes composing some variables, the actual distance separating those attributes does have meaning. Such variables are **interval measures**. For these, the logical distance between attributes can be expressed in meaningful standard intervals.

For example, in the Fahrenheit temperature scale, the difference, or distance, between 80 degrees

nominal measure A nominal variable has attributes that are merely different, as distinguished from ordinal, interval, or ratio measures. *Sex* is an example of a nominal measure. All a nominal variable can tell us about two people is if they are the same or different.

ordinal measure A level of measurement describing a variable with attributes we can rank-order along some dimension. An example is *socioeconomic status* as composed of the attributes *high, medium, low.*

interval measure A level of measurement describing a variable whose attributes are rank-ordered and have equal distances between adjacent attributes. The Fahrenheit temperature scale is an example of this, because the distance between 17 and 18 is the same as that between 89 and 90.

and 90 degrees is the same as that between 40 degrees and 50 degrees. However, 80 degrees Fahrenheit is not twice as hot as 40 degrees, because the zero point in the Fahrenheit scale is arbitrary; zero degrees does not really mean lack of heat. Similarly, minus 30 degrees on this scale doesn't represent 30 degrees less than no heat. (This is true for the Celsius scale as well. In contrast, the Kelvin scale is based on an absolute zero, which does mean a complete lack of heat.)

About the only interval measures commonly used in social science research are constructed measures such as standardized intelligence tests that have been more or less accepted. The interval separating IQ scores of 100 and 110 may be regarded as the same as the interval separating scores of 110 and 120 by virtue of the distribution of observed scores obtained by many thousands of people who have taken the tests over the years. But it would be incorrect to infer that someone with an IQ of 150 is 50 percent more intelligent than someone with an IQ of 100. (A person who received a score of 0 on a standard IQ test could not be regarded, strictly speaking, as having no intelligence, although we might feel he or she was unsuited to be a college professor or even a college student. But perhaps a dean . . . ?)

When comparing two people in terms of an interval variable, we can say they are different from each other (nominal), and that one is more than the other (ordinal). In addition, we can say "how much" more.

Ratio Measures

Most of the social science variables meeting the minimum requirements for interval measures also meet the requirements for ratio measures. In **ratio measures**, the attributes composing a variable, besides having all the structural characteristics mentioned previously, are based on a true zero point. The Kelvin temperature scale is one such measure. Examples from social science research include *age, length of residence in a given place, number of organizations belonged to, number of times attending religious services during a particular period of time, number of times married,* and *number of Arab friends.*

Returning to the illustration of methodological party games, we might ask a gathering of people to group themselves by age. All the one-year-olds would stand (or sit or lie) together, the two-year-olds together, the three-year-olds, and so forth. The fact that members of a single group share the same age and that each different group has a different shared age satisfies the minimum requirements for a nominal measure. Arranging the several groups in a line from youngest to oldest meets the additional requirements of an ordinal measure and lets us determine if one person is older than, younger than, or the same age as another. If we space the groups equally far apart, we satisfy the additional requirements of an interval measure and can say how much older one person is than another. Finally, because one of the attributes included in age represents a true zero (babies carried by women about to give birth), the phalanx of hapless party goers also meets the requirements of a ratio measure, permitting us to say that one person is twice as old as another. (Remember this in case you're asked about it in a workbook assignment.) Another example of a ratio measure is *income,* which extends from an absolute zero to approximately infinity, if you happen to be the founder of Microsoft.

Comparing two people in terms of a ratio variable, then, allows us to conclude (1) whether they are different (or the same), (2) whether one is more than the other, (3) how much they differ, and (4) what the ratio of one to another is. Figure 6-1 summarizes this discussion by presenting a graphic illustration of the four levels of measurement.

ratio measure A level of measurement describing a variable with attributes that have all the qualities of nominal, ordinal, and interval measures and in addition are based on a "true zero" point. *Age* is an example of a ratio measure.

Implications of Levels of Measurement

Because it's unlikely that you'll undertake the physical grouping of people just described (try it once, and you won't be invited to many parties), I should draw your attention to some of the practical

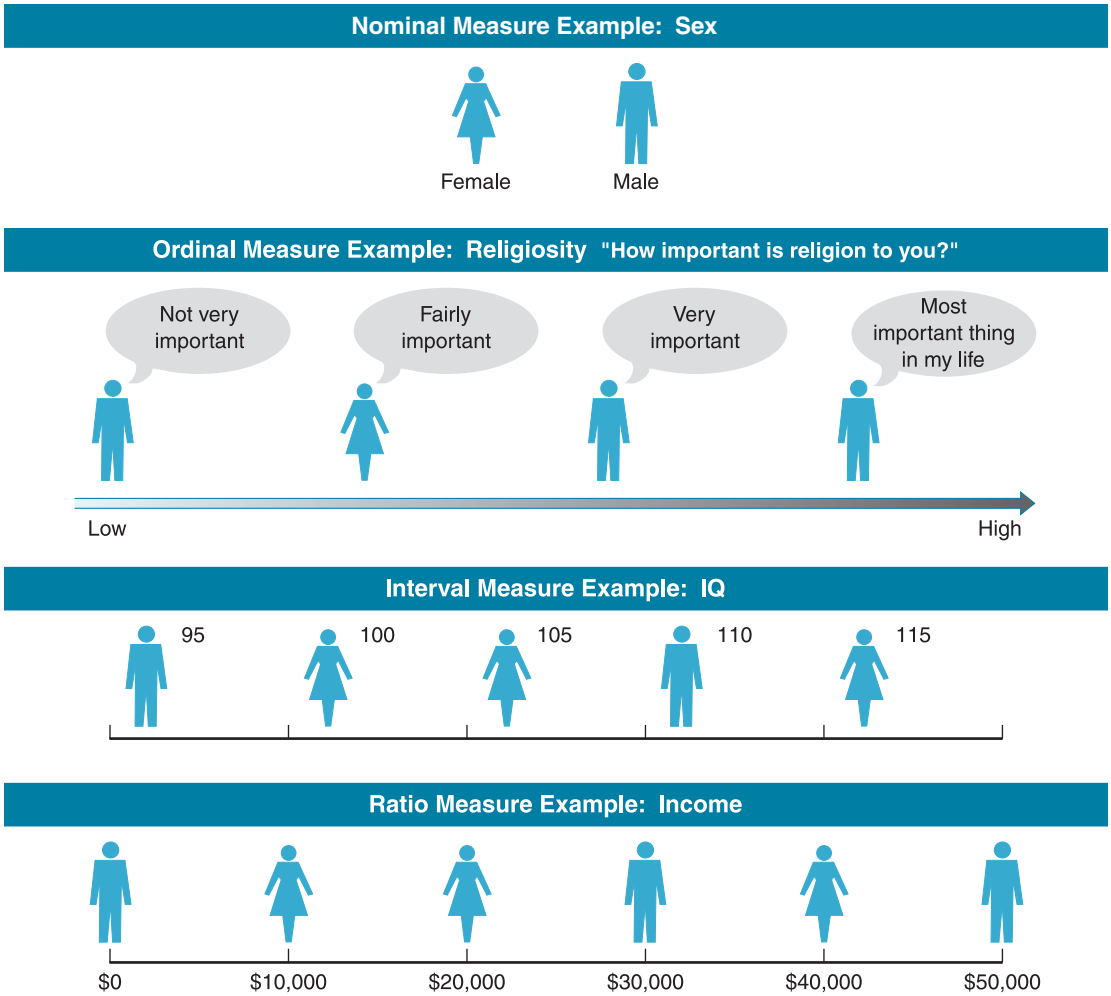

FIGURE 6-1

Levels of Measurement. Often you can choose among different levels of measurement—nominal, ordinal, interval, or ratio—carrying progressively more amounts of information.

implications of the differences that have been distinguished. These implications appear primarily in the analysis of data (discussed in Part 4), but you need to anticipate such implications when you're structuring any research project.

Certain quantitative analysis techniques require variables that meet certain minimum levels of measurement. To the extent that the variables to be examined in a research project are limited to a particular level of measurement—say, ordinal—you should plan your analytic techniques accordingly. More precisely, you should anticipate drawing research conclusions appropriate to the levels of measurement used in your variables. For example, you might reasonably plan to determine and report the mean age of a population under study (add up all the individual ages and divide by the number of people), but you should not plan to report the mean religious affiliation, because that is a nominal variable, and the mean requires ratio-level data. (You could report the modal—the most common—religious affiliation.)

At the same time, you can treat some variables as representing different levels of measurement. Ratio measures are the highest level, descending through interval and ordinal to nominal, the lowest level of measurement. A variable representing a higher level of measurement—say, ratio—can also be treated as representing a lower level of measurement—say, ordinal. Recall, for example, that age is a ratio measure. If you wished to examine only the relationship between age and some ordinal-level variable—say, self-perceived religiosity: high, medium, and low—you might choose to treat age as an ordinal-level variable as well. You might characterize the subjects of your study as being young, middle-aged, and old, specifying what age range composed each of these groupings. Finally, age might be used as a nominal-level variable for certain research purposes. People might be grouped as being born during the Depression or not. Another nominal measurement, based on birth date rather than just age, would be the grouping of people by astrological signs.

The level of measurement you'll seek, then, is determined by the analytic uses you've planned for a given variable, keeping in mind that some variables are inherently limited to a certain level. If a variable is to be used in a variety of ways, requiring different levels of measurement, the study should be designed to achieve the highest level required. For example, if the subjects in a study are asked their exact ages, they can later be organized into ordinal or nominal groupings.

Again, you need not necessarily measure variables at their highest level of measurement. If you're sure to have no need for ages of people at higher than the ordinal level of measurement, you may simply ask people to indicate their age range, such as 20 to 29, 30 to 39, and so forth. In a study of the wealth of corporations, rather than seek more precise information, you may use Dun & Bradstreet ratings to rank corporations. Whenever your research purposes are not altogether clear, however, *seek the highest level of measurement possible*. As we've discussed, although ratio measures can later be reduced to ordinal ones, you cannot convert an ordinal measure to a ratio one. More generally, you cannot convert a lower-level measure to a higher-level one. That is a one-way street worth remembering.

The level of measurement is significant in terms of the arithmetic operations that can be applied to a variable and the statistical techniques using those operations. The accompanying table summarizes some of the implications, including ways of stating the comparison of two incomes.

Level of Measurement	*Arithmetic Operations*	*How to Express the Fact That Jan Earns $80,000 a Year and Andy Earns $40,000*
Nominal	$= \neq$	Jan and Andy earn *different* amounts.
Ordinal	$> <$	Jan earns *more* than Andy.
Interval	$+ -$	Jan earns *$40,000 more* than Andy.
Ratio	$\div \times$	Jan earns *twice* as much as Andy.

Typically a research project will tap variables at different levels of measurement. For example, William Bielby and Denise Bielby (1999) set out to examine the world of film and television, using a nomothetic, longitudinal approach (take a moment to remind yourself what that means). In what they referred to as the "culture industry," the authors found that *reputation* (an ordinal variable) is the best predictor of screenwriters' future productivity. More interestingly, they found that screenwriters who were represented by "core" (or elite) agencies were not only far more likely to find jobs (a nominal variable), but also jobs that paid more (a ratio variable). In other words, the researchers found that agencies' reputations (ordinal) were a key independent variable for predicting a screenwriter's career success. The researchers also found that being older (ratio), female (nominal), an ethnic minority (nominal), and having more years of experience (ratio) were disadvantageous for a writer's career. On the other hand, higher earnings from previous years (measured in ordinal categories) led to more success in the future. In Bielby and Bielby's terms, "success breeds success" (1999: 80).

Single or Multiple Indicators

With so many alternatives for operationalizing social science variables, you may find yourself