Elementary Statistics in Social Research

UPDATED TWELFTH EDITION

Jack A. Levin · James Alan Fox · David R. Forde

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Jack Levin
Northeastern University

James Alan Fox
Northeastern University

David R. Forde
University of North Florida

Pearson

330 Hudson Street, NY, NY 10013

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Preface

New to this Edition

- A sample test of mean and a nonparametric tests of differences have been added.
- New discussions on coefficient of variation, non-sampling errors, meta-analysis, elaboration, and effect size.
- Expanded discussions of non-sampling error, standard error, partial correlation, and multicollinearity.
- Expanded discussion on a number of critical concepts, such as the meaning of the standard error and multiple regression.
- Expanded number of end-of-chapter problems, with worked out solutions provided in the student and instructor supplements.
- Includes a special data subset from the 2010 General Social Survey for optional computer-based problems.
- Updated Examples and Exercises throughout the text

The updated twelfth edition of Elementary Statistics in Social Research provides an introduction to statistics for students in sociology, criminal justice, political science, social work, and related fields. This book is not intended to be a comprehensive reference work on statistical methods. On the contrary, our first and foremost objective is to be understandable to a broad range of students, particularly those who may not have a strong background in mathematics.

Through several editions, Elementary Statistics in Social Research has undergone refinements and improvements in response to instructor and student feedback. For this revision, we have added several new techniques, including meta-analysis (Chapter 1), coefficient of variation (Chapter 4), one sample test of means and effect size (Chapter 7), Mann-Whitney *U* test and Kruskal-Wallis test (Chapter 9), logistic regression (Chapter 11), and elaboration (Chapter 12). We have expanded the discussion of several topics, including non-sampling error, standard error, partial correlation, and multicollinearity. We have updated examples and exercises throughout the text. Finally, the supplementary computer exercises in this edition utilize a subset of the 2010 General Social Survey (GSS) available for download from http://www.pearsonhighered.com. For those instructors who do not teach with computer software, however, this feature can be easily excluded.

This edition continues to contain a number of pedagogical features. Most notably, detailed step-by-step illustrations of statistical procedures continue to be located at important points throughout the text. In addition, this edition of the text offers guidance in the form of "hands-on" activities introduced at key points. These activities allow the student to walk through examples of important concepts at their own pace. Tips and solutions are offered to help the student understand each step in the process. We have again attempted to provide clear and logical explanations for the rationale and use of statistical methods in social research. And, as in the earlier editions, we have included a number of end-of-chapter questions and problems.

Following a detailed overview in Chapter 1, Chapters 2 through 4 introduce the student to the most common methods for describing and comparing data. Chapters 5 and 6 serve a transitional purpose. Beginning with a discussion of the basic concepts of probability, Chapters 5 and 6 leads the student from the topic of the normal curve as an important descriptive device to the use of the normal curve as a basis for generalizing from samples to populations. Continuing with this decision-making focus, Chapters 7 through 9 contain several well-known tests of significance. Chapters 10 through 12 include procedures for obtaining correlation coefficients and an introduction to regression analysis. Finally, Chapter 13 gives students the opportunity to learn, through examples, the conditions for applying statistical procedures to various types of research problems.

The text provides students with background material for the study of statistics.

We realize that students sometimes get lost in the trees of statistics, without seeing the forest. To counter this tendency, Appendix A, "The Social Research Process in Practice" offers additional scenarios that carry the student through the entire research process based on hypothetical data.

In addition, a set of statistical tables, a review of basic mathematics, and a list of formulas are located in appendixes at the end of the book. Students will also find a glossary of terms and answers to the end-of-chapter problems at the end of the book.

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- **Instructor Manual:** Includes chapter outline and summary, learning objectives, key terms and class activities.
- **Test Bank:** Includes additional questions beyond the REVEL in multiple choice, short answer response and truth and false formats.
- **MyTest:** Create custom quizzes and exams using the Test Bank questions. You can print these exams for in-class use. Visit: http://www.pearsonhighered.com/mytest

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Jack Levin

James Alan Fox

David R. Forde

Elementary Statistics in Social Research

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Chapter 1

Why the Social Researcher Uses Statistics

Learning Objectives

1.1 Illustrate research strategies employed by social researchers to test their hypotheses on the nature of social reality

1.2 Relate the importance of testing hypotheses about the nature of social reality given that we may be misled by our preconceptions

1.3 Report the steps of systematically testing our ideas about the nature of social reality

1.4 Illustrate how social researchers use numbers to categorize, rank, and score their data depending upon the level of measurement

1.5 Demonstrate how statistics is used as a tool for description and decision making in the data-analysis stage of social research

Introduction

A little of the social scientist can be found in all of us. Almost daily, we take educated guesses concerning the future events in our lives in order to plan for new situations or experiences. As these situations occur, we are sometimes able to confirm or support our ideas; other times, however, we are not so lucky and must face the sometimes unpleasant consequences.

Consider some familiar examples:

- We might invest in the stock market;
- Vote for a political candidate who promises to solve domestic problems;
- Play the horses;
- Take medicine to reduce the discomfort of a cold;
- Throw dice in a gambling casino;
- Try to anticipate the questions on a midterm; or
- Accept a blind date on the word of a friend.

Sometimes we win; sometimes we lose. Thus, we might make a sound investment in the stock market, but be sorry about our voting decision; win money at the craps table, but discover we have taken the wrong medicine for our illness; do well on a midterm, but have a miserable blind date; and so on. It is unfortunately true that not all of our everyday predictions will be supported by experience.

1.1: The Nature of Social Research

Objective: Illustrate research strategies employed by social researchers to test their hypotheses on the nature of social reality

Similar to our everyday approach to the world, social scientists attempt to explain and predict human behavior. They also take "educated guesses" about the nature of social reality, although in a far more precise and structured manner. In the process, social scientists examine characteristics of human behavior called **variables**—characteristics that differ or vary from one individual to another (for example, age, social class, and attitude) or from one point in time to another (for example, unemployment, crime rate, and population).

Not all human characteristics vary. It is a fact of life, for example, that the gender of the person who gave birth to you is female. Therefore, in any group of individuals, gender of mother is the *constant* "female." A biology text would spend considerable time discussing why only females give birth and the conditions under which birth is possible, but a social scientist would consider the mother's gender a given, one that is not worthy of study because it never varies. It could not be used to explain differences in the mental health of children because all of their mothers are females.

In contrast, a mother's age, race, and mental health are variables: In any group of individuals, they will differ from person to person and can be the key to a greater understanding of the development of the child. A researcher therefore might study differences in the mental health of children depending on the age, race, and mental health of their mothers.

In addition to specifying variables, the social researcher must also determine the *unit of observation* for the research. Usually, social scientists collect data on individual persons. For example, a researcher might conduct interviews to determine if the elderly are victimized by crime more often than younger respondents. In this case, an individual respondent is the unit to be observed by the social scientist.

However, researchers sometimes focus their research on *aggregates*—that is, on the way in which measures vary across entire collections of people. For example, a researcher might study the relationship between the average age of the population and the crime rate in various metropolitan areas. In this study, the units of observation are metropolitan areas rather than individuals.

Whether focusing on individuals or aggregates, the ideas that social scientists have concerning the nature of social reality are called *hypotheses*. These hypotheses are frequently expressed in a statement of the relationship between two or more variables: at minimum, an *independent variable* (or presumed cause) and a *dependent variable* (or presumed effect). For example, a researcher might hypothesize that socially isolated children watch more television (TV) than children who are well integrated into their peer groups, and he or she might conduct a survey in which both socially isolated and well-integrated children are asked questions regarding the time they spend watching television (social isolation would be the independent variable; TV-viewing behavior would be the dependent variable). Or a researcher might hypothesize that the one-parent family structure generates greater delinquency than the two-parent family structure and might proceed to interview samples of delinquents and nondelinquents to determine whether one or both parents were present in their family backgrounds (family structure would be the independent variable; delinquency would be the dependent variable).

Thus, not unlike their counterparts in the physical sciences, social researchers often conduct research to increase their understanding of the problems and issues in their field. Social research takes many forms and can be used to investigate a wide range of problems.

Among the most useful research methods employed by social researchers for testing their hypotheses are:

- the experiment;
- the survey;
- content analysis;
- participant observation;
- secondary analysis; and
- meta-analysis.

For example, a researcher may conduct an experiment to determine if arresting a wife batterer will deter this behavior in the future, a sample survey to investigate political opinions, a content analysis of values in youth magazines, a participant observation of an extremist political group, or a secondary analysis of government statistics on unemployment. Each of these research strategies is described and illustrated in this chapter.

1.1.1: The Experiment

Unlike everyday observation (or, for that matter, any other research approach), the **experiment** is distinguished by the degree of *control* a researcher is able to apply to the research situation. In an experiment, researchers actually manipulate one or more of the independent variables to which their subjects are exposed. The manipulation occurs when an experimenter assigns the independent variable to one group of people (called an *experimental group*), but withholds it from another group of people (called a *control group*). Ideally, all other initial differences between the experimental and control groups are eliminated by assigning subjects on a random basis to the experimental and control conditions.

For example, a researcher who hypothesizes that frustration increases aggression might assign a number of subjects to the experimental and control groups at random by flipping a coin ("heads" you're in the experimental group; "tails" you're in the control group), so that in all likelihood the groups do not differ initially in any major way. The researcher might then manipulate frustration (the independent variable) by asking the members of the experimental group to solve a difficult (frustrating) puzzle, whereas the members of the control group are asked to solve a much easier (nonfrustrating) version of the same puzzle. After all subjects have been given a period of time to complete their puzzle, the researcher might obtain a measure of aggression by asking them to administer "a mild electrical shock" to another subject (actually, the other subject is a confederate of the researcher who never really gets shocked, but the subjects presumably do not know this). If the willingness of subjects to administer an electrical shock is greater in the experimental group than in the control group, this difference would be attributed to the effect of the independent variable, frustration. The conclusion would be that frustration does indeed tend to increase aggressive behavior.

In 2011, Levin and Genovesi sought to investigate aspects of serial murder that contribute to its widespread fascination. In a regular classroom setting, the researchers randomly distributed to 232 male and female students various versions of a review of a motion picture featuring a serial killer's biography.

The following independent variables were experimentally manipulated:

- Killer's body count (half of the subjects read that 3 victims were murdered; half read that 30 victims were murdered);
- Torture (one-third read that the killer's torture was sexual; one-third read that the killer's torture was physical; one-third read that the killer shot his victims without any torture); and
- Victims' gender (one-half read the victims were female; one-half read the victims were male).

After reading a version of the review, fascination was measured, on a four-point rating scale, by asking all students to indicate "How badly do you want to see this movie when it is released to the public?" Greater fascination was indicated by a greater desire to view the film.

Results suggest that female subjects were significantly more fascinated than their male counterparts, but no significant differences were found for either body count or victims' gender. Moreover, torture—whether sexual or physical—was significantly more fascinating than killing alone, at least for male subjects. Findings provide only partial support for the interpretation that females are motivated more than males by a protective fascination with serial murder. The appeal of media-depicted torture may, in part, be a result of treating the sadistic and cruel punishment of victims as "forbidden fruit." Not coincidentally, those relatively few cases of serial murder motivated by money or terror almost never receive the tremendous amount of public and media attention given to sadistic serial killers; that is, those who torture their victims.

1.1.2: The Survey

As we have seen, experimenters actually have a direct hand in creating the effect that they seek to achieve. By contrast, **survey** research is *retrospective*—the effects of independent variables on dependent variables are recorded *after*—and sometimes long after—they have occurred. Survey researchers typically seek to reconstruct these influences and consequences by means of verbal reports from their respondents in self-administered questionnaires, face-to-face interviews, telephone interviews, or online surveys.

Surveys lack the tight controls of experiments: Variables are not manipulated, and subjects are not assigned to groups at random. As a consequence, it is much more difficult to establish cause and effect. Suppose, for instance, in a survey measuring fear of crime, that a researcher finds that respondents who had been victims of crime tend to be more fearful of walking alone in their neighborhoods than those who had not been victimized. Because the variable *victimization* was not manipulated, we cannot make the logical conclusion that victimization *causes* increased fear. An alternative explanation that the condition of their neighborhoods (poverty, for example) produces both fear among residents and crime in the streets is just as plausible.

At the same time, surveys have advantages precisely because they do not involve an experimental manipulation. As compared with experiments, survey research can investigate a much larger number of important independent variables in relation to any dependent variable. Because they are not confined to a laboratory setting in which an independent variable can be manipulated, surveys can also be more *representative*—their results can be generalized to a broader range of people. Let's look at few survey examples.

Example 1

In 2000, two Stanford University researchers interested in assessing the social consequences of Internet use conducted surveys with a national sample of the adult population, including both Internet users and nonusers. Norman Nie and Lutz Erbing contacted 4,113 respondents in 2,689 households around the country and asked them to report how many hours they spend on the Internet and in various social activities.

Results obtained by Nie and Erbing consistently indicated that regular Internet users (defined as those who spend at least five hours per week on the Web) are more isolated than nonusers. More specifically, of regular Internet users, some 25% said that they spend less time with family and friends, 8% less time attending social events outside the home, and 25% less time shopping in stores. In addition, more than 25% of workers who are also regular Internet users reported that the Internet has increased the amount of time they work at the office. About the only undeniably beneficial change associated with Internet use was the finding that 14% of regular Internet users spend less time commuting in traffic!

Example 2

At the August 2007 meeting of the American Sociological Association, Oregon State University's Scott Akins presented the results of a study in which he and his colleagues surveyed 6,713 adult residents of Washington State, including 1,690 persons who identified themselves as Hispanic. Members of their sample were questioned about their use of illicit drugs and their ethnic identity. They were asked to indicate

their marital status, educational level, socioeconomic status, and place of residence, urban versus rural.

Holding constant these other factors, Akins and his collaborators determined that illicit drug use increased among recent Hispanic immigrants as they remained longer in the United States and became more acculturated into American society. That is, to the extent that Hispanic immigrants became acculturated, they replaced their traditional cultural beliefs, language, and social patterns with those of their host society. Specifically, when asked whether they had used illicit drugs in the previous month, less than 1% of nonacculturated Hispanics indicated that they had. But 7.2% of acculturated Hispanics (not unlike 6.4% of white residents) responded in the affirmative when asked the same question about their drug use.

Example 3

The Gallup polling organization employs a survey approach. On an annual basis, Gallup surveys a random sample of adult Americans regarding their views of the honesty and ethics of numerous occupations from accountants to telemarketers. During the dates November 28 to December 1, 2011, Gallup conducted telephone interviews with 1,012 adults, aged 18 and older, representing the residents of all 50 states and the District of Columbia. Gallup asked: "Please tell me how you would rate the honesty and ethical standards of people in these different fields—very high, high, average, low, or very low?"

Nurses topped the list, receiving a rating of very high or high ethical standards from some 84% of the sample. Pharmacists were in second place; 73% of the sample gave them high or very high ratings for honesty and ethics. At the other end of the spectrum, only 7% gave members of Congress and car salespeople a high or very high honesty rating, indicating their very low credibility among American adults. Even telemarketers got a slightly higher rating at 8%.

Members of Congress have long had low ratings for honesty and ethics, but never quite this low. In 2001, 22% rated their honesty as low or very low, in contrast to the results a decade later, when members of Congress received low or very low ratings from a large majority—some 64% of American adults.

1.1.3: Content Analysis

As an alternative to experiments and surveys, **content analysis** is a research method, whereby a researcher seeks objectively to describe the content of previously produced messages. Researchers who conduct a content analysis have no need directly to observe behavior or to question a sample of respondents. Instead, they typically study the content of books, magazines, newspapers, films, radio broadcasts, photographs, cartoons, letters, verbal dyadic interaction, political propaganda, or music.

In 2001, for example, James Alan Fox, Jack Levin, and Jason Mazaik performed a content analysis of celebrities depicted in *People* magazine cover stories. The researchers sought to determine how the celebrities chosen to be featured by the most popular celebrity magazine in the United States (circulation: 3,552,287 per issue) had changed over almost three decades. Using appropriate coding sheets, each of the more than 1,300 covers of issues of *People* from its inception in 1974 through 1998 was scrutinized for various characteristics of the celebrity and the overall tone of the cover presentation.

Results obtained by Fox, Levin, and Mazaik indicated that the basis for *People* celebrities appearing in a cover story has, over the decades, become dramatically more negative. In 1974, during its first year of publication, less than 3% of all celebrities were featured for negative reasons, such as drug or alcohol dependence, child abuse, or the commission of a violent crime. Instead, most celebrities were on the cover because they had accomplished a positive goal—either by overcoming a personal problem or by accomplishing a career objective. By 1988 and continuing as a pattern through the 1990s, however, there was a major reversal in tone, so that almost half of all cover stories focused not on celebrities' positive accomplishments, but on their untoward characteristics. Along with musicians, athletes, and political figures, *People* for the first time also featured murderers and rapists.

In the past, various forms of communication aimed at children—children's books, video games, educational software, films, television shows, commercials, music videos, comic strips, and magazines—have been shown to be dominated by males. More specifically, such media tend to under-represent female characters who are frequently portrayed in stereotypical ways. In 2009, Black, Marola, Littman, Chrisler, and Neace published a study examining gender images found on product packaging—specifically, on the cereal boxes sitting on the kitchen table each morning as children eat their breakfast. The researchers content analyzed a sample of 217 cereal boxes—every box in the cereal aisle of a major supermarket in the northeastern United States. Each of the 1,568 characters appearing on the sampled boxes was coded for gender (female or male), species (person, animal, object), age (child/adolescent, adult), and activity level (passive, active).

Results of the content analysis were similar to those obtained in studies of gender representations in other forms of communication. On cereal boxes, male characters outnumbered female characters by more than two to one. Moreover, males were more likely than females to be depicted as authority figures (that is, adults rather than children). Overall, female characters were underrepresented and portrayed as having lower status than their male counterparts.

1.1.4: Participant Observation

Another widely used research method is **participant observation**, whereby a researcher actively participates in the daily life of the people being studied, either openly in the role of a social researcher or covertly in an "undercover" role, observing events, interactions, and conversations as they happen, and questioning people over some period of time.

In 2005, sociologist Janese Free explored the influence of alternative schooling on at-risk youth. As a participant observer, Free spent approximately 750 hours over the course of a year at an alternative school in New England, volunteering as a classroom aide. The alternative school was a middle school for at-risk students who had been removed from conventional programs for reasons such as drug use, violence, truancy, or failing out of school.

Free was a semi-covert participant observer, meaning the teachers knew she was there to collect data for her research but the students did not. In her role as a "classroom aide," she participated in the students' daily activities at school (including classroom time, recess, gym, lunch duty), and in her role as a "researcher," she observed and recorded the students' behaviors and interactions in each of these settings. In an attempt to gather the most accurate data possible, Free recorded her observations in private (bathrooms, teacher's lounge, and her car) on small pieces of paper carried in her pocket so the students would not be aware they were being observed. These field notes were transcribed into documents and then analyzed by coding the data and looking for common themes.

One of the participant observer's guiding research questions was "How does attending an alternative school influence its students' development, both academically and behaviorally?"

Free identified six major influential factors (or "themes") influencing students' development, namely:

1. Alternative educational practices;
2. Dedication of teachers and staff;
3. School culture and environment;
4. Student home lives;
5. Student behaviors, violence, and arrests; and
6. School disciplinary responses.

Of these major influences, Free argued that alternative education practices and the dedication of teachers and staff were "enhancers" to student development, whereas the school culture and environment; student home lives; student behaviors, violence, and arrests; and school disciplinary responses were "inhibitors" to student development and progress.

1.1.5: Secondary Analysis

On occasion, it is possible for a social researcher not to gather his or her own data but to take advantage of data sets previously collected or assembled by others. Often referred to as *archival data*, such information comes from government, private agencies, and even colleges and universities. The social researcher is therefore not the primary or first one to analyze the data; thus, whatever he or she does to examine the data is called **secondary analysis**. This approach has an obvious advantage over firsthand data collection: It is relatively quick and easy but still exploits data that may have been gathered in a scientifically sophisticated manner. On the other hand, the researcher is limited to what is available, and has no say as to how variables are defined and measured.

The April 2008 issue of the *American Sociological Review* contains an article in which the effect of age on happiness is researched. The author, Yang Yang, a University of Chicago sociologist, conducted a secondary analysis of data from the National Opinion Research Center's General Social Survey (GSS), which reports the results of face-to-face interviews with a representative sample of as many as 3,000 respondents collected every year between 1972 and 2004. In order to measure their degree of happiness, the GSS asked respondents: "Taken all together, how would you say things are these days—would you say that you are very happy, pretty happy, or not too happy?"

What do you think Yang's survey resulted in?

Yang found that his respondents became happier with advancing age, supporting the notion that people mature and develop in positive ways as they grow older. Moreover, happiness was greater during periods of economic prosperity.

Generations also differed in terms of degree of happiness, with baby boomers—those born between 1946 and 1964—being the least happy of any generational group. Yang's results indicated also that among 18-year-old respondents, white women are the happiest overall, followed by white men, black women, and black men. However, these race and gender differences almost disappear as respondents mature into old age. Apparently, happiness continues to increase even into the eighth decade of life.

In this text, we occasionally make use of archival data sources. For example, we will present and analyze birth rates, homicide rates, unemployment figures, and income data drawn from various government agencies. Table 1.1 provides a list of useful government websites from which various kinds of data related to health, housing, population, crime, education, transportation, and the economy can be found and downloaded.

Table 1.1 Government Websites Containing Social Science Data

Website/Agency	Types of Data	URL
FEDSTATS	Links to data and reports from over 70 federal agencies	fedstats.sites.usa.gov
Bureau of the Census	Population, families, business, income, housing, voting	www.census.gov
Bureau of Justice Statistics (BJS)	Crime offenders, victims, justice system	www.bjs.gov
Bureau of Labor Statistics (BLS)	Employment, unemployment, prices, wages	www.bls.gov
Bureau of Transportation Statistics (BTS)	Travel, aviation, boating, trucking, roads, highways	www.rita.dot.gov/bts/
National Center for Health Statistics (NCHS)	Births, illness, injury, deaths, health care, nursing homes	www.cdc.gov/nchs/
National Center for Education Statistics (NCES)	Elementary, secondary, higher education	www.nces.ed.gov

1.1.6: Meta-Analysis

An especially important use of the existing literature for conducting research can be found in the approach known as **meta-analysis**. Rather than collect new data or depend on a few unrepresentative studies to draw a conclusion, an investigator combines the results obtained in a number of previous studies that have addressed the same hypothesis and subjects all of them collectively to a single statistical test. In conducting a meta-analysis, the researcher may, with the aid of a well-supported finding, be able to end a debate in the literature or confirm the validity of an important idea. The meta-analysis process essentially consists of a literature search in which the conclusions reached by previous investigators are ignored. Instead, the researcher re-examines the data collected previously and then calculates an estimate of what is called the *effect size*—a measure of the extent to which a relationship exists in the population.

Social interdependence, where students work together cooperatively to accomplish their learning objectives, is one of the most fertile areas of research in education. When students work interdependently, they are able to succeed academically only if other students in their group also succeed. In contrast to competitive or individualistic approaches, social interdependence has become a widely used instructional procedure from preschool through graduate school levels. It is therefore important to determine the effectiveness of social interdependence with respect to student achievement.

In 2000, Johnson, Johnson, and Stanne examined the education literature since 1970 and located 158 studies in which the comparative effect of a particular kind of social interdependence (that is, students working cooperatively) versus control methods (that is, students working alone in competition with classmates) was tested for its impact on academic achievement. Combining all of the data collected in these 158 studies, eight different forms of cooperative learning were determined by the researchers to have produced significantly higher student achievement than working alone. Based on the results of this meta-analysis, teachers should feel comfortable using a cooperative learning method in their classrooms. There is substantial evidence that social interdependence is effective.

1.2: Why Test Hypotheses?

Objective: **Relate the importance of testing hypotheses about the nature of social reality given that we may be misled by our preconceptions**

Social science is often referred to, quite unfairly, as the study of the obvious. However, it is desirable, if not necessary, to test hypotheses about the nature of social reality, even those that seem logical and self-evident. Our everyday commonsense observations are generally based on narrow, often biased preconceptions and personal experiences. These can lead us to accept without criticism invalid assumptions about the characteristics of social phenomena and behavior.

To demonstrate how we can be so easily misled by our preconceptions and stereotypes, consider what we "know" about mass murderers—those individuals who simultaneously kill at least four victims. According to popular thinking (and media portrayals), mass murderers are typically insane individuals who go berserk or run amok, expressing their anger in a spontaneous and impulsive outpouring of aggression. Moreover, they are usually regarded as total strangers to their victims, who are unlucky enough to be in the wrong place at the wrong time—at a shopping mall, on a commuter train, or in a fast-food restaurant.

The foregoing conception of mass murderers may seem clear-cut and obvious. Yet, compiling detailed information from FBI reports about 697 mass killers over the period from 1976 to 2009, Fox and Levin found instead that mass murderers are rarely insane and spontaneous—they know exactly what they are doing and are not driven to kill by voices of demons. Random shootings in a public place are the exceptions; most mass murders occur within families or among acquaintances. Typically, mass murderers target spouses and all of their children, or bosses and their co-workers. Far from being impulsive, most mass killers are methodical and selective. They usually plan their attacks and are quite selective as to the victims they choose to kill. In an office massacre, for example, a mass killer might choose to murder only those co-workers and

supervisors whom the murderer blames for losing an important promotion or getting fired.

Until recently, even criminologists all but ignored mass killings, perhaps believing that mass murder was merely a special case of homicide (albeit, by definition, yielding a larger body count), explainable by the same theories applied to single-victim incidents and therefore not deserving of special treatment. From this point of view, mass murder occurs in the same places, under the same circumstances, and for the same reasons as single-victim murder.

1.2.1: Contrary to Popular Belief

Comparing FBI reports of single-victim homicides with mass murders reveals quite a different pattern. The location of mass murder differs sharply from that of homicides in which a single victim is slain. First, mass murders do not tend to cluster in large cities as do single-victim crimes; rather, mass killings are more likely to occur in small-town or rural settings. Moreover, while the South (and the deep South in particular) is known for its high rates of murder, this does not hold for mass murder. In comparison to single-victim murder, which is highly concentrated in urban inner-city neighborhoods and in the deep South where arguments are often settled through gunfire, mass murder more or less reflects the general population distribution.

Not surprisingly, the firearm is the weapon of choice in mass-murder incidents, even more than in single-victim crimes. Clearly, a handgun or rifle is the most effective means of mass destruction. By contrast, it is difficult to kill large numbers of people simultaneously with physical force or even a knife or blunt object. Furthermore, although an explosive device can potentially cause the death of large numbers of people (as in the catastrophic 1995 bombing of the Oklahoma City federal building), its unpredictability would be unacceptable for most mass killers who target their victims selectively. In addition, far fewer Americans are proficient in the use of explosives, as compared with guns.

The findings regarding victim–offender relationships are perhaps as counterintuitive as the weapon-use results may be obvious. Contrary to popular belief, mass murderers infrequently attack strangers who just happen to be in the wrong place at the wrong time. In fact, almost 40% of these crimes are committed against family members, and almost as many involve other victims acquainted with the perpetrator (for example, co-workers). It is well known that murder often involves family members, but this is especially pronounced among massacres.

The differences in circumstance underlying these crimes are quite dramatic. Although about half of all single-victim homicides occur during an argument between the victim and the offender, it is relatively rare for a heated dispute to escalate into mass murder.

Some of the most notable differences between homicide types emerge in the offender data. Compared to those offenders who kill but one, mass murderers are especially likely to be male, are far more likely to be white, and are somewhat older (middle-aged). Typically, the single-victim offender is a young male and slightly more often black than white.

Victim characteristics are, of course, largely a function of the offender characteristics, indicating that mass killers generally do not select their victims on a random basis. For example, the victims of mass murder are usually white simply because the perpetrators to whom they are related or with whom they associate are white. Similarly, the youthfulness and greater representation of females among the victims of mass murder, as compared to single-victim homicide, stem from the fact that a typical mass killing involves the breadwinner of the household who annihilates the entire family—his wife and his children.

1.3: The Stages of Social Research

Objective: **Report the steps of systematically testing our ideas about the nature of social reality**

Systematically testing our ideas about the nature of social reality often demands carefully planned and executed research in which the following occur:

1. The problem to be studied is reduced to a testable hypothesis (for example, "One-parent families generate more delinquency than two-parent families").
2. An appropriate set of instruments is developed (for example, a questionnaire or an interview schedule).
3. The data are collected (that is, the researcher might go into the field and conduct a poll or a survey).
4. The data are analyzed for their bearing on the initial hypotheses.
5. Results of the analysis are interpreted and communicated to an audience (for example, by means of a lecture, journal article, or press release).

As we shall see, the material presented in this text is most closely tied to the data-analysis stage of research (number 4 above), in which the data collected or gathered by the researcher are analyzed for their bearing on the initial hypotheses. It is in this stage of research that the raw data are tabulated, calculated, counted, summarized, rearranged, compared, or, in a word, *organized*, so that the accuracy or validity of the hypotheses can be tested.

1.4: Using Series of Numbers to Do Social Research

Objective: **Illustrate how social researchers use numbers to categorize, rank, and score their data depending upon the level of measurement**

Anyone who has conducted social research knows that problems in data analysis must be confronted in the planning stages of a research project, because they have a bearing on the nature of decisions at all other stages. Such problems often affect aspects of the research design and even the types of instruments employed in collecting the data. For this reason, we constantly seek techniques or methods for enhancing the quality of data analysis.

Most researchers would agree on the importance of **measurement** in analyzing data. When some characteristic is measured, researchers are able to assign to it a series of numbers according to a set of rules. Social researchers have developed measures of a wide range of phenomena, including occupational prestige, political attitudes, authoritarianism, alienation, anomie, delinquency, social class, prejudice, dogmatism, conformity, achievement, ethnocentrism, neighborliness, religiosity, marital adjustment, occupational mobility, urbanization, sociometric status, and fertility.

Numbers have at least three important functions for social researchers, depending on the particular **level of measurement** that they employ. Specifically, series of numbers can be used to

1. *classify* or *categorize* at the nominal level of measurement,
2. *rank* or *order* at the ordinal level of measurement, and
3. assign a *score* at the interval/ratio level of measurement.

1.4.1: The Nominal Level

The **nominal level of measurement** involves naming or labeling—that is, placing cases into categories and counting their frequency of occurrence. To illustrate, we might use a nominal-level measure to indicate whether each respondent is prejudiced or tolerant toward Immigrants. As shown in Table 1.2, we might question the 10 students in a given class and determine that 5 can be regarded as (1) prejudiced and 5 can be considered (2) tolerant.

Table 1.2 Attitudes of 10 College Students toward Immigrants: Nominal Data

Attitude toward Immigrants	Frequency
1 = prejudiced	5
2 = tolerant	5
Total	10

A few other nominal-level measures in social research are:

- sex (male versus female);
- welfare status (recipient versus nonrecipient);
- political party (Republican; Democrat, and Libertarian);
- social character (inner-directed, other-directed, and tradition-directed);
- mode of adaptation (conformity, innovation, ritualism, retreatism, and rebellion); and
- time orientation (present, past, and future).

When dealing with nominal data, we must keep in mind that *every case must be placed in one, and only one, category*. This requirement indicates that the categories must be nonoverlapping, or *mutually exclusive*. Thus, a respondent's race classified as white cannot also be classified as black; any respondent labeled male cannot also be labeled female. The requirement also indicates that the categories must be *exhaustive*—there must be a place for every case that arises. For illustrative purposes, imagine a study in which all respondents are interviewed and categorized by race as either black or white.

How would you categorize a Chinese respondent if he or she were to appear?

Show Answer

In this case, it might be necessary to expand the original category system to include Asians or, assuming that most respondents will be white or black, to include an "other" category in which such exceptions can be placed.

The reader should note that nominal data are not graded, ranked, or scaled for qualities, such as better or worse, higher or lower, more or less. Clearly, then, a nominal measure of sex does not signify whether males are superior or inferior to females. Nominal data are merely labeled, sometimes by name (male versus female or prejudiced versus tolerant), other times by number (1 versus 2), but always for the purpose of grouping the cases into separate categories to indicate sameness or differentness with respect to a given quality or characteristic. Thus, even when a number is used to label a category (for example, 1 = white, 2 = black, 3 = other), a quantity is not implied.

1.4.2: The Ordinal Level

When the researcher goes beyond the nominal level of measurement and seeks to order his or her cases in terms of the degree to which they have any given characteristic, he or she is working at the **ordinal level of measurement**.

The nature of the relationship among ordinal categories depends on that characteristic the researcher seeks to measure. To take a familiar example, one might classify individuals with respect to socioeconomic status as lower class, middle class, or upper class. Or, rather than categorize the students in a given classroom as *either* prejudiced *or* tolerant, the researcher might rank them according to their degree of prejudice against Immigrants, as indicated in Table 1.3.

Table 1.3 Attitudes of 10 College Students toward Immigrants: Ordinal Data

Student	Rank
Nadine	1 = most prejudiced
Max	2 = second
Jacob	3 = third
Tatiana	4 = fourth
Ahn	5 = fifth
Christina	6 = sixth
Jaden	7 = seventh
Tanisha	8 = eighth
Ben	9 = ninth
Hung	10 = least prejudiced

The ordinal level of measurement yields information about the ordering of categories, but does not indicate the *magnitude of differences* between numbers. For instance, the social researcher who employs an ordinal-level measure to study prejudice toward Immigrants *does not know how much more prejudiced one respondent is than another*. In the example given in Table 1.3, it is not possible to determine how much more prejudiced Nadine is than Max or how much less prejudiced Hung is than Ben or Tanisha. This is because the intervals between the points or ranks on an ordinal scale are not known or meaningful. Therefore, it is not possible to assign *scores* to cases located at points along the scale.

1.4.3: The Interval/Ratio Level

By contrast to the ordinal level, the *interval and ratio levels of measurement* not only indicate the ordering of categories but also the exact distance between them. Interval and ratio measures employ constant units of measurement (for example, dollars or cents, degrees Fahrenheit or Celsius, yards or feet, minutes or seconds), which yield equal intervals between points on the scale. Table 1.4, for example, shows attitudes of college students toward Immigrants measured at the interval level. This allows us to see the magnitude or degree of differences in prejudice as opposed to just ranks.

Table 1.4 Attitudes of 10 College Students toward Immigrants: Interval Data

Student	Score[a]
Nadine	98
Max	96
Jacob	95
Tatiana	94
Ahn	22
Christina	21
Jaden	20
Tanisha	15
Ben	11
Hung	6

[a]Higher scores indicate greater prejudice against Immigrants.

Some variables in their natural form are **interval/ratio level**—for example, how many pounds you weigh, how many siblings you have, or how long it takes a student to complete an exam. In the social sciences, naturally formed interval/ratio measures might include the length of a prison sentence, the number of children in a family, or the amount of time—in minutes and hours—an individual spends on the job.

Other variables are interval/ratio because of how we scale them. Typically, an interval/ratio measure that we construct generates a set of scores that can be compared with one another. As currently used by social scientists, for example, a well-known measure of job satisfaction, employed by Tom W. Smith who directs the (GSS) at the National Opinion Research Center, is treated as an interval variable.

In this process, respondents are asked to indicate how satisfied they are with the work they do on a four-point rating scale:

- 1 for someone who is "very dissatisfied"
- 2 for someone who is "a little dissatisfied"
- 3 for someone who is "moderately satisfied"
- 4 for someone who is "very satisfied."

The occupations are then placed in a hierarchy from lowest to highest, depending on the overall evaluations—the mean (average) satisfaction score—they receive from a group of respondents who hold the jobs they are asked to judge. In one recent study, for example, the job title *clergy* received a mean rating of 3.79 (almost at the "very satisfied" level), whereas *waiters* received a mean of 2.85 (close to the "moderately satisfied" level); *physical therapists* received a mean score of 3.72, whereas *roofers* received a mean of 2.84.

As depicted in Table 1.5, we are able to order a group of eight occupations in terms of their degree of satisfaction

Table 1.5 Satisfaction Scores of Eight Jobs: Interval Data

Job	Satisfaction Score
Clergy	3.79
Teachers	3.61
Authors	3.61
Psychologists	3.59
Butchers	2.97
Cashiers	2.94
Bartenders	2.88
Roofers	2.84

and, in addition, determine the exact distances separating one from another. This requires making the assumption that our measure of job satisfaction uses a constant unit of measurement (one satisfaction point). Thus, we can say that the job of clergy is the most satisfying on the list because it received the highest score on the measure. We can also say that authors are only slightly more satisfied than psychologists, but much more satisfied than bartenders and roofers, both of which received extremely low scores. Depending on the purpose for which a study is designed, such information might be important to determine, but is not available at the ordinal level of measurement.

THE DIFFERENCE BETWEEN RATIO AND INTERVAL LEVEL The ratio level is the same as the interval level, but in addition presumes the existence of an absolute or true zero point. In contrast, an interval-level variable may have an artificial zero value or even none at all.

For example, age meets the condition for the ratio level, because a zero represents birth, or the complete absence of age. In contrast, the Fahrenheit scale of temperature possesses an artificial zero point, because "zero degrees" does not represent the total absence of heat, even though it does not feel particularly warm. Similarly, the IQ scale has no zero point at all—that is, there is no such thing as a zero IQ—and therefore qualifies only as an interval scale. Thus, we cannot say that a person with an IQ of 150 is 50% more intelligent than someone with an average 100 IQ.

Similarly, a score of zero on a scale of occupational satisfaction, if it existed, would indicate a total absence of any satisfaction at all ("complete dissatisfaction"), and therefore potentially represents a ratio scale. As constructed by the author, however, the scale of occupational prestige illustrated previously has not been given a score of zero (a score of "1" indicates "very" but not complete dissatisfaction) and is therefore at the interval, not the ratio, level.

When it comes right down to it, it makes little practical difference whether a variable is at the interval or the ratio level. There are many important statistical techniques that assume a standard distance between scale points (that is, an interval scale), but there are very few that require valid ratios between scale points (that is, a ratio scale). Thus, throughout the remainder of the text we shall indicate whether a technique requires the nominal level, the ordinal level, or the interval level.

1.4.4: Different Ways to Measure the Same Variable

As noted earlier, the level of measurement of certain naturally occurring variables like gender or hair color is clear-cut, while others are constructed by how the social researcher defines them. In fact, the same variable can be measured at different levels of precision depending on the research objectives.

Figure 1.1, for example, illustrates several ways in which the variable "pain" might be measured by a researcher interested in health issues. At the lowest level—nominal—respondents could be classified as being in pain or pain-free, or they could be asked to indicate what type of pain (sharp, dull or throbbing) they are experiencing. Of course, the extent of pain could be measured in an ordinal scale ranging from none to severe or respondents could indicate whether their pain was better, worse, or the same. More precisely, the degree of pain could be reported numerically from 0 to 10, reflecting an interval/ratio level scale. Alternative ways of measuring pain at the interval/ratio level include having respondents indicate their degree of pain by marking on a continuum, from no pain to worst pain. Finally, the Pain Faces Scale, with its associated scores, might be used for children with limited verbal skills or foreign-speaking adults.

1.4.5: Treating Some Ordinal Variables as Interval

At this point, the distinction between the nominal and ordinal levels should be quite clear. It would be difficult to confuse the level of measurement attained by the variable "color of hair" (blond, redhead, brunette, and black), which is nominal, with that of the variable "condition of hair" (dry, normal, oily), which is ordinal.

The distinction between ordinal and interval, however, is not always clear-cut. Often, variables that in the strictest sense are ordinal may be treated as if they were interval when the ordered categories are fairly evenly spaced. Actually, an earlier example—the measure of job satisfaction—can be used to make this point. To treat this measure as interval rather than ordinal, it is necessary to assume that the distance between "very dissatisfied" and

Figure 1.1 Different Ways to Measure Pain

Nominal Level

Question: Are you currently in pain? Yes or No

Question: How would you characterize the type of pain? Sharp, Dull, Throbbing

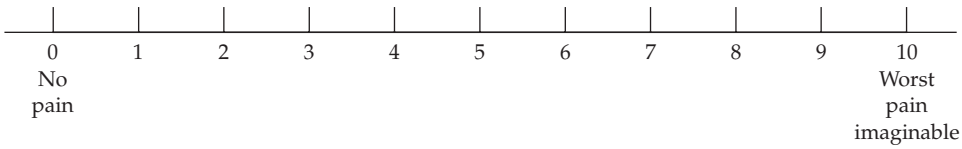
Ordinal Level

Question: How bad is the pain right now? None, Mild, Moderate, Severe

Question: Compared with yesterday, is the pain less severe, about the same, or more severe?

Interval/Ratio Level

0–10 Numerical Scale

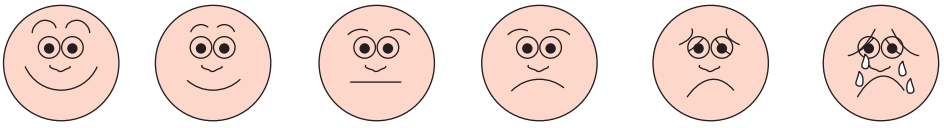


Visual Analog Scale

No pain — Worst pain

Ask patient to indicate on the line where the pain is in relation to the two extremes. Quantification is only approximate; for example, a midpoint mark would indicate that the pain is approximately half of the worst possible pain.

Pain Faces Scale



0 Very happy, no hurt

2 Hurts just a little bit

4 Hurts a little more

6 Hurts even more

8 Hurts a whole lot

10 Hurts as much as you can imagine

"a little dissatisfied" is roughly the same as the distance between "a little dissatisfied" and "moderately satisfied" and between "moderately satisfied" and "very satisfied." If we are unable to make the assumption of equal intervals between the points on the scale, then the satisfaction measure should be treated as an ordinal scale.

To take another example, the following two variables (*rank of professor* and *attitude toward professor*) shown in Table 1.6 are both ordinal:

Table 1.6 Ordinal Variables: Rank of Professor and Attitude toward Professor

Scale Value	Rank of Professor	Attitude toward Professor
1	Distinguished professor	Very favorable
2	Full professor	Favorable
3	Associate professor	Somewhat favorable
4	Assistant professor	Neutral
5	Instructor	Somewhat unfavorable
6	Lecturer	Unfavorable
7	Teaching assistant	Very unfavorable

Do you think either of the two variables—*rank of professor* and *attitude toward professor*—should be treated as if they were interval?

Show Answer

The *rank-of-professor* variable could hardly be mistaken for interval. The difference between *instructor* (5) and *lecturer* (6) is minimal in terms of prestige, salary, or qualifications, whereas the difference between *instructor* (5) and *assistant professor* (4) is substantial, with the latter generally requiring a doctorate and receiving a much higher salary. By contrast, the *attitude-toward-professor* variable has scale values that are roughly evenly spaced. The difference between *somewhat unfavorable* (5) and *unfavorable* (6) appears to be virtually the same as the difference between *somewhat unfavorable* (5) and *neutral* (4). This is also true of most attitude scales ranging from *strongly agree* to *strongly disagree*.

Rather than split hairs, many researchers make a practical decision. Whenever possible, they choose to treat ordinal variables as interval, but only when it is reasonable to assume that the scale has roughly equal intervals.

Thus, they would treat the *attitude-toward-professor* variable as if it were interval, but they would never treat the *rank-of-professor* variable as anything other than ordinal. As you will see later in the text, treating ordinal variables that have nearly evenly spaced values as if they were interval allows researchers to use more powerful statistical procedures.

1.4.6: Further Measurement Issues

Whether a variable is measured at the nominal, ordinal, or interval level is sometimes a natural feature of the characteristic itself, and not at all influenced by the decisions that the social researcher makes in defining and collecting data. Hair color (black, brown, blonde, gray, and so on), race (black, white, Asian, and so on), and region of residence (Northeast, Mid-Atlantic, South, Midwest, Mountain, and West) are, for example, unquestionably nominal-level variables. A researcher, however, can still expand the meaning of basic characteristics like these in an attempt to increase the precision and power of his or her data. Hair color, for example, can be redefined in terms of shades (for example, from dark brown to platinum blonde) to elevate the level of measurement to ordinal status. Similarly, for the purpose of measuring geographic proximity to Southern culture, an ordinal-level "Southerness scale" might be developed to distinguish Mississippi and Alabama at one extreme, Kentucky and Tennessee next, followed by Maryland and Delaware, and then Connecticut and Vermont at the other extreme. Although it may be somewhat stretching the point, a researcher could also develop an interval-level Southerness scale, using the number of miles a state's center lies above or below the Mason–Dixon line.

More commonly, there are situations in which variables must be downgraded in their level of measurement, even though this might reduce their precision. To increase the response rate, for example, a telephone interviewer might redefine age, an interval-level variable, into ordinal categories such as toddler, child, teenager, young adult, middle-aged, and senior.

Another important measurement distinction that social researchers confront is between discrete and continuous variables. Discrete data take on only certain specific values. For example, family size can be expressed only in whole numbers from 1 on up (there is no such thing as 3.47 people in a family; it's 1, 2, 3, 4, or more members). Family size therefore represents a discrete interval-level measure. Moreover, nominal variables (such as *New England states:* Massachusetts, Connecticut, Rhode Island, Vermont, Maine, and New Hampshire; *gender:* female and male; *religion:* Protestant, Catholic, Jewish, Muslim, Hindu, etc.), by virtue of their categorical nature, are always discrete.

Continuous variables, on the other hand, present an infinite range of possible values, although the manner in which we measure them may appear to be discrete. Body weight, for example, can take on any number of values, including 143.4154 pounds. Some bathroom scales may measure this weight to the nearest whole pound (143 pounds), and others may measure weight to the nearest half pound (143.5), and some even to the nearest tenth of a pound (143.4). Underlying whatever measuring device we use, however, is a natural continuum. Similarly, age is a continuous variable and theoretically could be measured in nanoseconds from birth on. Yet it is customary to use whole numbers (years for adults, weeks for infants) in recording this variable. As shown earlier, it is also a common practice arbitrarily to divide the continuum of age into categories such as toddler, child, teenager, young adult, middle-aged, and senior.

1.5: The Functions of Statistics

Objective: **Demonstrate how statistics is used as a tool for description and decision making in the data-analysis stage of social research**

When researchers use numbers—when they *quantify* their data at the nominal, ordinal, or interval level of measurement—they are likely to employ statistics as a tool of *description* or *decision making*. Let us now take a closer look at these important functions of statistics.

1.5.1: Description

To arrive at conclusions or obtain results, a social researcher often studies hundreds, thousands, or even larger numbers of persons or groups. As an extreme case, the U.S. Bureau of the Census conducts a complete enumeration of the U.S. population, in which millions of individuals are contacted. Despite the aid of numerous sophisticated procedures, it is always a formidable task to describe and summarize the mass of data generated from large-scale research projects.

To take a familiar example, the examination grades of 80 students have been listed in Table 1.7. Do you see any patterns in these grades? Can you describe these grades in a few words? In a few sentences? Can you tell if they are particularly high or low on the whole?

Your answer to these questions should be "no." However, using even the most basic principles of descriptive statistics, it is possible to characterize the distribution of the examination grades in Table 1.7 with a good deal of clarity and precision, so that overall tendencies or group characteristics can be quickly discovered and easily

Table 1.7 Examination Grades of 80 Students

72	49	81	52	31
38	81	58	68	73
43	56	45	54	40
81	60	52	52	38
79	83	63	58	59
71	89	73	77	60
65	60	69	88	75
59	52	75	70	93
90	62	91	61	53
83	32	49	39	57
39	28	67	74	61
42	39	76	68	65
58	49	72	29	70
56	48	60	36	79
72	65	40	49	37
63	72	58	62	46

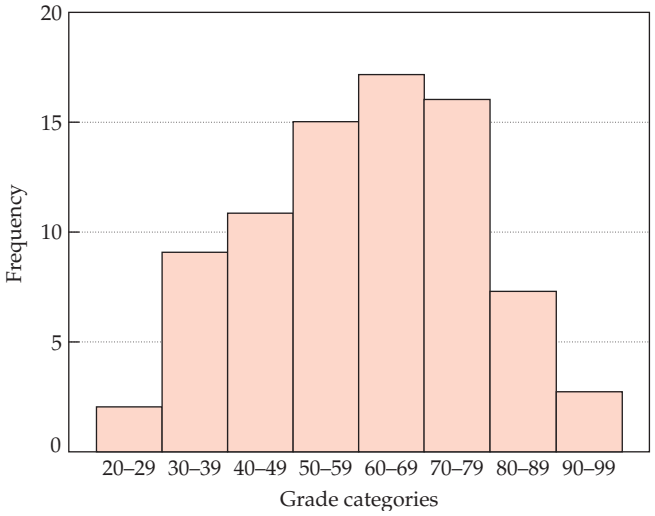
communicated to almost anyone. First, the grades can be rearranged in consecutive order (from highest to lowest) and grouped into a much smaller number of categories. As shown in Table 1.8, this *grouped frequency distribution* presents the grades within broader categories along with the number or *frequency* (*f*) of students whose grades fell into these categories. It can be readily seen, for example, that 17 students received grades between 60 and 69; only 2 students received grades between 20 and 29.

Table 1.8 Examination Grades of 80 Students: A Grouped Frequency Distribution

Grades	*f*
90–99	3
80–89	7
70–79	16
60–69	17
50–59	15
40–49	11
30–39	9
20–29	2
	$N = 80$

GRAPHS AND THE ARITHMETIC AVERAGE Another useful procedure rearranges the grades graphically. As shown in Figure 1.2, the categories of grades are placed (from 20–29 to 90–99) along one line of a graph (that is, the *horizontal baseline*) and their numbers or frequencies along another line (that is, the *vertical axis*). This arrangement results in a rather easily visualized graphic representation in which we can see that most grades fall between 50 and 80, whereas relatively few grades are much higher or lower.

Figure 1.2 Graph of Examination Grades of 80 Students



A particularly convenient and useful statistical method—one with which you are already more or less familiar—is to ask: What is the grade of the *average* person in this group of 80 students? The arithmetic average (or *mean*), which can be obtained by adding the entire list of grades and dividing this sum by the number of students, gives us a clearer picture of the overall group tendency or class performance. The arithmetic average in this example happens to be 60.5, a rather low grade compared against the class averages with which most students may be familiar. Apparently, this group of 80 students did relatively poorly as a whole on this particular exam.

Consider this analogy. Suppose a friend calls and wants to set you up on a blind date with someone who is "a perfect match." You would probably have a few questions before deciding whether or not to agree to meet this "perfect" stranger. Knowing things such as the person's age might be critical to your decision, whereas other attributes such as hair length and eye color would probably be less informative.

In certain respects, confronting a large array of data, such as that in Table 1.7, is like confronting the prospect of a blind date. Statisticians attempt to describe a set of blind data not only using frequency distributions (as in Table 1.8), but also with a variety of summary measures. Statistics like the minimum and maximum values in the data set are mildly informative, while quantities like the arithmetic mean or middlemost score are extremely telling about the distribution of data.

Returning to the possible fix-up, your friend might be able to e-mail you a photograph of the potential date. This would be helpful, of course, but only to the extent that the photo is of high quality—taken with good lighting and free of distortion. Similarly, a chart like Figure 1.2 depicting a distribution helps researchers to make sense of the data, but only if the graphic is accurately drawn and distortion-free.