

Common Biases

People make mistakes. More interestingly, people make a variety of systematic and predictable mistakes. The predictability of these mistakes means that once we identify them, we can learn to avoid them. As explained in Chapter 1, individuals develop rules of thumb, or heuristics, to reduce the information-processing demands of decision making. By providing managers with efficient ways of dealing with complex problems, heuristics produce good decisions a significant proportion of the time. However, heuristics also can lead managers to make systematically biased mistakes. Cognitive bias occurs in situations in which an individual inappropriately applies a heuristic when making a decision.

By highlighting a number of mistakes that even very smart people make on a regular basis, this chapter offers you the opportunity to audit your own decision-making process and identify the biases that affect you. Throughout the chapter, quiz items allow you to examine your problem-solving abilities and discover how your judgments compare to those of others. The quiz items illustrate thirteen predictable biases that frequently lead managers to judgments that systematically deviate from rationality.

To begin, answer the following two problems:

Problem 1. The following ten corporations were ranked by *Fortune* magazine to be among the largest 500 United States-based firms according to sales revenues for 2003:

Group A: Reebok International, Hilton Hotels, Starbucks, RadioShack, Hershey Foods

Group B: CoconoPhillips, American International Group, McKesson, AmerisourceBergen, The Altria Group

Which group of organizations (A or B) had the larger total sales revenues?

Problem 2 (adapted from Kahneman and Tversky, 1973). The best student in my introductory MBA class this past semester writes poetry and is rather shy and small in stature. What was the student's undergraduate major? *Business*

- a. Chinese studies
- b. Psychology

If you answered A for each of the two problems, you may gain comfort in knowing that the majority of respondents also choose A. If you answered B, you are in the minority. In this case, however, the minority represents the correct response. All corporations in group B were among the top twenty-five firms in terms of sales revenue, while none of the corporations in group A had sales large enough to be in the top 375 firms. In fact, the total revenue for group B was more than *sixteen times* the total revenue for group A. In the second problem, the student described was actually a psychology major, but more important, selecting psychology as the student's major represents a more rational response given the limited information.

Problem 1 illustrates the availability heuristic discussed in Chapter 1. In this problem, group A consists of consumer firms, while group B consists of conglomerates less well known to consumers. Because most of us are more familiar with consumer firms than conglomerates, we can more easily generate information in our minds about their size. If we were aware of our bias resulting from the availability heuristic, we would recognize our differential exposure to this information and adjust our judgments accordingly, or at least question them.

Problem 2 illustrates the representativeness heuristic. The reader who responds "Chinese studies" has probably overlooked relevant base-rate information—namely, the likely ratio of Chinese studies majors to psychology majors within the MBA student population. When asked to reconsider the problem in this context, most people acknowledge the relative scarcity of Chinese studies majors seeking MBAs, and change their response to "psychology." This example emphasizes that logical base-rate reasoning is often overwhelmed by qualitative judgments drawn from available descriptive information.

Problems 1 and 2 demonstrate how easy it is to draw faulty conclusions when we over-rely on cognitive heuristics. Throughout this chapter, additional quiz items are presented to further increase your awareness of the impact of heuristics on your decisions and to help you develop an appreciation for the systematic errors that emanate from overdependence on them. Some of the thirteen biases examined in this chapter are related to the availability heuristic. Another group emanates from the representativeness heuristic. A third group has causes beyond these two heuristics. The affect heuristic will appear in later chapters.

The goal of the chapter is to help you "unfreeze" your decision-making patterns by showing you how easily heuristics become biases when improperly applied. By working on numerous problems that demonstrate the failures of these heuristics, you will become more aware of the biases in your decision making. Once you are able to spot these biases, you will be able to improve the quality of your decisions.

Before reading further, please take a few minutes to respond to the problems presented in Table 2-1.

TABLE 2.1 Chapter Problems

Respond to the following problems before reading the rest of the chapter.

Problem 3. Please rank order the following causes of death in the United States between 1990 and 2000, placing a 1 next to the most common cause, 2 next to the second most common, etc.

- 3 Tobacco 300,000
1 Poor diet and physical inactivity 1 million
2 Motor vehicle accidents 500,000
4 Firearms (guns) 100,000
5 Illicit drug use 35,000

Now estimate the number of deaths caused by each of these five causes between 1990 and 2000.

Problem 4a. In four pages of a novel (about 2,000 words), how many words would you expect to find that have the form ing (seven-letter words that end with “ing”)? Indicate your best estimate by circling one of the following values:

- 0 1-2 3-4 5-7 8-10 11-15 16+

Problem 4b. In four pages of a novel (about 2,000 words), how many words would you expect to find that have the form n (seven-letter words that have the letter “n” in the sixth position)? Indicate your best estimate by circling one of the following values:

- 0 1-2 3-4 5-7 8-10 11-15 16+

Problem 5. Mark is finishing his MBA at a prestigious university. He is very interested in the arts and at one time considered a career as a musician. Where is he more likely to take a job?

- a. In arts management
b. With a consulting firm

Problem 6 (from Tversky and Kahneman, 1974). A certain town is served by two hospitals. In the larger hospital about forty-five babies are born each day and in the smaller hospital about fifteen babies are born each day. As you know, about 50 percent of all babies are boys. However, the exact percentage varies from day to day. Sometimes it may be higher than 50 percent, sometimes lower.

For a period of one year, each hospital recorded the days in which more than 60 percent of the babies born were boys. Which hospital do you think recorded more such days?

- a. The larger hospital
 b. The smaller hospital
c. About the same (that is, within 5 percent of each other)

(Continues)

TABLE 2.1 Chapter Problems (Continued)

Problem 7. You have started buying stocks on the Internet, beginning with five different stocks. Each stock goes down soon after your purchase. As you prepare to make a sixth purchase, you reason that it should be more successful, since the last five were "lemons." After all, the odds favor making at least one successful pick in six decisions. This thinking is:

- a. Correct
 (b) Incorrect

Problem 8. You are the sales forecaster for a department store chain with nine locations. The chain depends on you for quality projections of future sales in order to make decisions on staffing, advertising, information system developments, purchasing, renovation, and the like. All stores are similar in size and merchandise selection. The main difference in their sales occurs because of location and random fluctuations. Sales for 2004 were as follows:

Store	2004	2006
1	\$12,000,000	13,200,000
2	11,500,000	12,650,000
3	11,000,000	12,100,000
4	10,500,000	11,550,000
5	10,000,000	11,000,000
6	9,500,000	10,450,000
7	9,000,000	9,900,000
8	8,500,000	9,350,000
9	8,000,000	8,800,000
TOTAL	\$90,000,000	\$99,000,000

Your economic forecasting service has convinced you that the best estimate of total sales increases between 2004 and 2006 is 10 percent (to \$99,000,000). Your task is to predict 2006 sales for each store. Since your manager believes strongly in the economic forecasting service, it is imperative that your total sales equal \$99,000,000.

Problem 9. Linda is thirty-one years old, single, outspoken, and very smart. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and she participated in antinuclear demonstrations.

Rank the following eight descriptions in order of the probability (likelihood) that they describe Linda:

- 5 a. Linda is a teacher in an elementary school.
~~7~~ b. Linda works in a bookstore and takes yoga classes.
2 c. Linda is active in the feminist movement.
~~0~~ d. Linda is a psychiatric social worker.
1 e. Linda is a member of the League of Women Voters.

(Continues)

TABLE 2.1 Chapter Problems (Continued)

- 8 f. Linda is a bank teller.
4 g. Linda is an insurance salesperson.
3 h. Linda is a bank teller who is active in the feminist movement.

Problem 10. A new Internet company recently made its initial public offering, becoming publicly traded. At its opening, the stock sold for \$20 per share. The company's closest competitor went public one year ago, also at a price of \$20 per share. The competitor's stock is now priced at \$100 per share. What will the new firm be worth one year from now?

\$100 per share

Problem 11. Which of the following appears most likely? Which appears second most likely?

- a. Drawing a red marble from a bag containing 50 percent red marbles and 50 percent white marbles. 50%
 b. Drawing a red marble seven times in succession, with replacement (a selected marble is put back into the bag before the next marble is selected), from a bag containing 90 percent red marbles and 10 percent white marbles.
 c. Drawing at least one red marble in seven tries, with replacement, from a bag containing 10 percent red marbles and 90 percent white marbles.

Problem 12. Listed below are ten uncertain quantities. Do not look up any information on these items. For each, write down your best estimate of the quantity. Next, put a lower and upper bound around your estimate, so that you are confident that your 98 percent range surrounds the actual quantity.

Estimate	Lower	Upper	
<u>20 b</u>	<u>2 b</u>	<u>100 b</u>	a. Wal-Mart's 2003 revenue
<u>106</u>	<u>25</u>	<u>1000</u>	b. Microsoft's 2003 revenue
<u>30</u>	<u>10</u>	<u>50</u>	c. Median age of U.S. citizens according to the 2000 Census
<u>10</u>	<u>1</u>	<u>100</u>	d. Market value of Best Buy as of March 14, 2003
<u>5</u>	<u>1</u>	<u>100</u>	e. Market value of Heinz as of March 14, 2003
<u>32</u>	<u>10</u>	<u>100</u>	f. Rank of McDonald's in the 2003 <i>Fortune</i> 500
<u>496</u>	<u>100</u>	<u>500</u>	g. Rank of Nike in the 2003 <i>Fortune</i> 500
<u>1mil</u>	<u>20000</u>	<u>2mil</u>	h. The average amount of money that a family in the U.S. will spend on each child from the time he/she is born until the time he/she turns eighteen (as of 2003)
<u>100</u>	<u>10</u>	<u>150</u>	i. Number of endangered species listed in the United States as of February 25, 2004
<u>127%</u>	<u>5-8%</u>	<u>30%</u>	j. Percentage of the U.S. population under five years old according to the 2000 Census

BIASES EMANATING FROM THE AVAILABILITY HEURISTIC

Bias 1: Ease of Recall (based on vividness and recency)

Problem 3. Please rank order the following causes of death in the United States between 1990 and 2000, placing a 1 next to the most common cause, 2 next to the second most common, etc.

<u>3</u> Tobacco	50,000
<u>1</u> Poor diet and physical inactivity	200,000
<u>2</u> Motor vehicle accidents	100,000
<u>4</u> Firearms (guns)	25,000
<u>5</u> Illicit drug use	5,000

Now estimate the number of deaths caused by each of these five causes between 1990 and 2000.

It may surprise you to learn that, according to the *Journal of the American Medical Association* (Mokdad, Marks, Stroup, and Gerberding, March 10, 2004, p. 1240), the causes above are listed in the order of how many deaths that they cause, with tobacco consumption causing the most deaths and illicit drug use causing the fewest. Even if you got the order right or came close, my guess is that you underestimated the magnitude of difference between the first two causes and the last three causes. The first two causes, tobacco and poor diet/physical inactivity, resulted in 435,000 and 400,000 deaths respectively, while the latter three causes resulted in far fewer deaths—43,000, 29,000, and 17,000 deaths respectively. Vivid deaths caused by cars, guns, and drugs tend to get a lot of press coverage. The availability of vivid stories in the media biases our perception of the frequency of events toward the last three causes over the first two. As a result, we may underestimate the likelihood of death due to tobacco and poor diet, while overestimating the hazards of cars, guns, and drugs.

Many life decisions are affected by the vividness of information. Although most people recognize that AIDS is a devastating disease, many individuals ignore clear data about how to avoid contracting AIDS. In the fall of 1991, however, sexual behavior in Dallas was dramatically affected by one vivid piece of data that may or may not have been true. In a chilling interview, a Dallas woman calling herself C.J. claimed she had AIDS and was trying to spread the disease out of revenge against the man who had infected her. After this vivid interview made the local news, attendance at Dallas AIDS seminars increased dramatically, AIDS became the main topic of Dallas talk shows, and requests for HIV tests surged citywide. Although C.J.'s possible actions were a legitimate cause for concern, it is clear that most of the health risks related to AIDS are not a result of one woman's actions. There are many more important reasons to be concerned about AIDS. However, C.J.'s vivid report had a more substantial effect on many people's behavior than the mountains of data available.

Tversky and Kahneman (1974) argue that when an individual judges the frequency with which an event occurs by the availability of its instances, an event whose

instances are more easily recalled will appear to be more frequent than an event of equal frequency whose instances are less easily recalled. They cite evidence of this bias in a lab study in which individuals were read lists of names of well-known personalities of both genders. Different lists were presented to two groups. One group was read a list in which the women listed were relatively more famous than the listed men, but the list included more men's names overall. The other group was read a list in which the men listed were relatively more famous than the listed women, but the list included more women's names overall. After hearing their group's list, participants in both groups were asked if the list contained the names of more women or men. In both groups, participants incorrectly guessed that the gender that included the relatively more famous personalities was the more numerous. Participants apparently paid more attention to vivid household names than to less well-known figures, leading to inaccurate judgments.

While this example of vividness may seem fairly benign, it is not difficult to see how the availability bias could lead managers to make potentially destructive workplace decisions. The following came from the experience of one of my MBA students: As a purchasing agent, he had to select one of several possible suppliers. He chose the firm whose name was the most familiar to him. He later found out that the salience of the name resulted from recent adverse publicity concerning the firm's extortion of funds from client companies!

Managers conducting performance appraisals often fall victim to the availability heuristic. Working from memory, vivid instances of an employee's behavior (either positive or negative) will be most easily recalled from memory, will appear more numerous than commonplace incidents, and will therefore be weighted more heavily in the performance appraisal. The recency of events is also a factor: Managers give more weight to performance during the three months prior to the evaluation than to the previous nine months of the evaluation period.

Because of our susceptibility to vividness and recency, Kahneman and Tversky suggest that we are particularly prone to overestimating unlikely events. For instance, if we actually witness a burning house, our assessment of the probability of such accidents is likely to be greater than if we had merely read about the fire in the local newspaper; our direct observation of the event makes it more salient to us. Similarly, Slovic and Fischhoff (1977) discuss the implications of the misuse of the availability heuristic in debates about the perceived risks of nuclear power. They point out that any discussion of potential hazards, regardless of their likelihood, will increase the salience of these hazards and increase their perceived risks.

Bias 2: Retrievability (based on memory structures)

Problem 4a. In four pages of a novel (about 2,000 words), how many words would you expect to find that have the form _____ing (seven-letter words that end with "ing")? Indicate your best estimate by circling one of the following values:

0 1-2 3-4 (5-7) 8-10 11-15 16+

Problem 4b. In four pages of a novel (about 2,000 words), how many words would you expect to find that have the form _ _ _ _ n _ (seven-letter words that have the letter “n” in the sixth position)? Indicate your best estimate by circling one of the following values:

0 1-2 3-4 **5-7** 8-10 11-15 16+

Tversky and Kahneman (1983) found that most people respond with a higher number for Problem 4a than for Problem 4b. However, this response pattern must be incorrect. Since all words with seven letters that end in “ing” also have an “n” as their sixth letter, the frequency of words that end in “ing” cannot be larger than the number of words with “n” as the sixth letter. Tversky and Kahneman (1983) argue that “ing” words are more retrievable from memory because of the commonality of the “ing” suffix, whereas the search for words that have an “n” as the sixth letter does not easily generate this group of words.

Just as retrievability affects our vocabulary-search behavior, organizational modes affect information-search behavior within our work lives. We structure organizations to provide order, but this same structure can lead to confusion if the presumed order is not exactly as suggested. For example, many organizations have an information systems division that has generalized expertise in computer applications. Assume that you are a manager in a product division and need computer expertise. If that expertise exists within the information systems group, the organizational hierarchy will lead you to the correct resource. If, however, the information systems group lacks expertise in a specific application, but this expertise exists elsewhere in the organization, the hierarchy is likely to bias the effectiveness of your search. I am not arguing for the overthrow of organizational hierarchies; I am merely identifying the dysfunctional role of hierarchies in potentially biasing search behavior. If we are aware of the potential bias, we need not be affected by this limitation.

Retail store location is influenced by the way in which consumers search their minds when seeking a particular commodity. Why are multiple gas stations at the same intersection? Why do “upscale” retailers want to be in the same mall? Why are the biggest bookstores in a city often located within a couple blocks of each other? An important reason for this pattern is that consumers learn the “location” for a particular type of product or store and organize their minds accordingly. To maximize traffic, the retailer needs to be in the location that consumers associate with this type of product or store.

Bias 3: Presumed Associations

People frequently fall victim to the availability bias in their assessment of the likelihood of two events occurring together. For example, consider your response to the following two questions: Is marijuana use related to delinquency? Are couples who get married under the age of twenty-five more likely to have bigger families? In assessing the marijuana question, most people typically try to remember several delinquent marijuana users and either assume or do not assume a correlation based on the availability of this mental data. However, a proper analysis would require you to recall *four* groups of people: marijuana users who are delinquents, marijuana users who are not delinquents, delinquents who do not use marijuana, and nondelinquents who do not use marijuana.

The same analysis applies to the marriage question. Proper analysis would include four groups: couples who married young and have large families, couples who married young and have small families, couples who married older and have large families, and couples who married older and have small families.

Indeed, there are always at least four separate situations to consider when assessing the association between two dichotomous events. However, our everyday decision making commonly ignores this scientifically valid fact. Chapman and Chapman (1967) have noted that when the probability of two events co-occurring is judged by the availability of perceived co-occurring instances in our minds, we usually assign an inappropriately high probability that the two events will co-occur again. Thus, if we know a lot of marijuana users who are delinquents, we assume that marijuana use is related to delinquency. Similarly, if we know of a lot of couples who married young and have had large families, we assume that this trend is more prevalent than it may actually be. In testing for this bias, Chapman and Chapman provided participants with information about hypothetical psychiatric patients. The information included a written clinical diagnosis of a "patient" and a drawing of a person made by the "patient." The participants were asked to estimate the frequency with which each diagnosis (for example, suspiciousness or paranoia) was accompanied by various facial and body features in the drawings (for example, peculiar eyes). Throughout the study, participants markedly overestimated the frequency of pairs commonly associated together by social lore. For example, diagnoses of suspiciousness were overwhelmingly associated with peculiar eyes.

To summarize, a lifetime of experience has led us to believe that, in general, we recall frequent events more easily than infrequent events and recall likely events more easily than unlikely events. In response to this learning, we have adopted the availability heuristic to help us estimate the likelihood of events. This simplifying heuristic often leads us to accurate, efficient judgments. However, as these first three biases (ease of recall, retrievability, and presumed associations) indicate, the misuse of the availability heuristic can lead to systematic errors in managerial judgment. We too easily assume that our available recollections are truly representative of the larger pool of events that exists outside of our range of experience.

BIASES EMANATING FROM THE REPRESENTATIVENESS HEURISTIC

Bias 4: Insensitivity to Base Rates

Problem 5. Mark is finishing his MBA at a prestigious university. He is very interested in the arts and at one time considered a career as a musician. Where is he more likely to take a job?

- a. In arts management
- b. With a consulting firm

How did you decide on your answer? Odds are, you responded like most people. Using the representativeness heuristic discussed in Chapter 1, most people approach this problem by analyzing the degree to which Mark is representative of their image of

individuals who take jobs in each of the two areas. Consequently, they usually conclude that Mark took the arts management job. However, as we discussed in our analysis of Problem 2 earlier in this chapter, this response overlooks relevant base-rate information. Reconsider the problem in light of the fact that a much larger number of MBAs take jobs with consulting firms than in arts management—relevant information that should enter into any reasonable prediction of Mark's career path. With this base-rate data, it is only reasonable to predict that he will be more likely to work for a consulting firm.

Judgmental biases of this type frequently occur when individuals cognitively ask the wrong question. If you answered "arts management," you probably wondered, "How likely is it that a person working in the management of the arts would fit Mark's description?" In fact, the problem requires you to ask the question, "How likely is it that someone fitting Mark's description will choose arts management?" By itself, the representativeness heuristic incorrectly results in a similar answer to both questions, since this heuristic leads individuals to compare the resemblance of the personal description and the career path. However, when base-rate data are considered, they are irrelevant to the first question listed, but crucial to a reasonable prediction based on the second question. While a large percentage of individuals in arts management may fit Mark's description, there are undoubtedly a larger absolute number of management consultants fitting Mark's description because of the relative preponderance of MBAs in consulting.

Participants do use base-rate data correctly when no other information is provided (Kahneman and Tversky, 1972). In the absence of a personal description of Mark in Problem 5, people will choose "consulting firm" based on the past frequency of this career path for MBAs. Thus, people understand the relevance of base-rate information, but tend to disregard such data when descriptive data are also available. Ignoring base rates has many unfortunate implications. Prospective entrepreneurs typically spend far too much time imagining their success and far too little time considering the base rate for business failures. Entrepreneurs think that the base rate for failure is not relevant to their situation, and many individuals lose their life savings as a result. Similarly, unnecessary emotional distress is caused in the divorce process because of the failure of couples to create prenuptial agreements that facilitate the peaceful resolution of a marriage. The suggestion of a prenuptial agreement is often viewed as a sign of bad faith. However, in far too many cases, the failure to create prenuptial agreements occurs when individuals approach marriage with the false belief that the very high base rate for divorce does not apply to them.

Bias 5: Insensitivity to Sample Size

Problem 6 (from Tversky and Kahneman, 1974). A certain town is served by two hospitals. In the larger hospital about forty-five babies are born each day and in the smaller hospital about fifteen babies are born each day. As you know, about 50 percent of all babies are boys. However, the exact percentage varies from day to day. Sometimes it may be higher than 50 percent, sometimes lower.

For a period of one year, each hospital recorded the days in which more than 60 percent of the babies born were boys. Which hospital do you think recorded more such days?

- a. The larger hospital
- b. The smaller hospital
- c. About the same (that is, within 5 percent of each other)

Most individuals choose C, expecting the two hospitals to record a similar number of days in which 60 percent or more of the babies born are boys. People seem to have some basic idea of how unusual it is to have 60 percent of a random event occurring in a specific direction. By contrast, simple statistics tell us that it is much more likely to observe 60 percent of male babies in a smaller sample than in a larger sample. The interested reader can verify this fact with an introductory statistics book. However, anecdotally, this effect is easy to understand. Think about which is more likely: getting six heads in ten flips of a coin or getting 6,000 heads in 10,000 flips of a coin. Our intuition correctly tells us that six out of ten is not that unusual, but 6,000 in 10,000 is very unusual. Sampling theory tells us that the expected number of days in which more than 60 percent of the babies are boys is three times greater in the small hospital, since a large sample is less likely to deviate from the mean. However, most people judge the probability to be the same in each hospital, effectively ignoring sample size.

Although the importance of sample size is fundamental in statistics, Tversky and Kahneman (1974) argue that sample size is rarely a part of our intuition. Why not? When responding to problems dealing with sampling, people often use the representativeness heuristic. For instance, they think about how representative it would be for 60 percent of babies born to be boys in a random event. As a result, people ignore the issue of sample size—which is critical to an accurate assessment of the problem.

Consider the implications of this bias for advertising strategies. Market research experts understand that a sizable sample will be more accurate than a small one, but use consumers' bias to the advantage of their clients: "Four out of five dentists surveyed recommend sugarless gum for their patients who chew gum." Without mention of the exact number of dentists involved in the survey, the results of the survey are meaningless. If only five or ten dentists were surveyed, the size of the sample would not be generalizable to the overall population of dentists.

Bias 6: Misconceptions of Chance

Problem 7. You have started buying stocks on the Internet, beginning with five different stocks. Each stock goes down soon after your purchase. As you prepare to make a sixth purchase, you reason that it should be more successful, since the last five were "lemons." After all, the odds favor making at least one successful pick in six decisions. This thinking is:

- a. Correct
- b. Incorrect

Most people are comfortable with the preceding logic, or at least have used similar logic in the past. However, the logic in Problem 7 is incorrect. In fact, the performance of the first five stocks will not directly affect the performance of the sixth stock. Relying on their intuition and the representativeness heuristic, most individuals

incorrectly conclude that a sixth poor performance is unlikely because the probability of getting six “lemons” in a row is extremely low. Unfortunately, this logic ignores the fact that we have already witnessed five “lemons” (in itself an unlikely occurrence), and the performance of the sixth stock is independent of the performance of the first five. Before you make similar mistakes in the stock market, be sure to read Chapter 7.

This question parallels research by Kahneman and Tversky (1972) showing that people expect a sequence of random events to “look” random. Specifically, participants routinely judged the sequence of coin flips H-T-H-T-T-H to be more likely than H-H-H-T-T-T, which does not “appear” random, and more likely than the sequence H-H-H-H-T-H, which does not represent the equal likelihood of heads and tails. Simple statistics, of course, tell us that each of these sequences is equally likely because of the independence of multiple random events.

Problem 7 moves beyond dealing with random events in recognizing our inappropriate tendency to assume that random and nonrandom events will balance out. Will the sixth stock perform well? Maybe! But your earlier failures are completely irrelevant to its potential for success.

The logic concerning misconceptions of chance provides a process explanation of the gambler’s fallacy. After holding bad cards on ten hands of poker, the poker player believes he is “due” for a good hand. After winning \$1,000 in the Pennsylvania State Lottery, a woman changes her regular number—after all, how likely is it that the same number will come up twice? Tversky and Kahneman (1974) note: “Chance is commonly viewed as a self-correcting process in which a deviation in one direction induces a deviation in the opposite direction to restore the equilibrium. In fact, deviations are not corrected as a chance process unfolds, they are merely diluted.”

In the preceding examples, individuals expected probabilities to even out. In some situations, our minds misconstrue chance in exactly the opposite way. In sports such as basketball, we often think of a particular player as having a “hot hand” or “being on a good streak.” If your favorite player has made his last four shots, is the probability of his making his next shot higher, lower, or the same as the probability of his making a shot without the preceding four hits? Most sports fans, sports commentators, and players believe that the answer is “higher.” In fact, there are many biological, emotional, and physical reasons that this answer could be correct. However, it is wrong! In an extensive analysis of the shooting of the Philadelphia 76ers and the Boston Celtics, Gilovich, Vallone, and Tversky (1985) found that immediately prior shot performance did not change the likelihood of success on the upcoming shot. Out of all of the findings in this book, this is the effect that my managerial students have the hardest time accepting. We can all remember sequences of five hits in a row; streaks are part of our conception of chance in athletic competition. However, our minds do not think of a string of “four in a row” shots as a situation in which “he missed his fifth shot.” As a result, we have a misconception of connectedness when, in fact, chance (or the player’s normal probability of success) is really in effect.

The belief in the hot hand has interesting implications for how players compete. Passing the ball to the player who is “hot” is commonly endorsed as a good strategy. Similarly, the opposing team often will concentrate on guarding the “hot” player. Another player, who is less hot but is equally skilled, may have a better chance of scoring. Thus the belief in the “hot hand” is not just erroneous, but could also be costly if you make decisions under this illusion.

The mythical perception of a "hot hand" is not limited to basketball. Imagine that you receive a free copy of an investor newsletter that advises you to sell stock because the market will fall during the next six months. You ignore this newsletter, and then it happens to be correct. At the end of the six months, another free copy of this newsletter tells you the market will rise during the next six months. Again, you ignore the advice, and again the newsletter is correct. A third free copy of the newsletter advises you to buy stocks for the next six-month period. Once again, you ignore the newsletter, and once again it is correct. After these eighteen months, you receive a direct-mail solicitation for this newsletter, pointing out that they have been giving you great free advice for the past eighteen months. If you want this excellent advice in the future, you must pay a small subscription fee. Are you tempted to subscribe to this publication? Many people would be impressed by its consistent past performance and would sign up, expecting more sound advice.

Now consider what this advice may look like from the other side. Suppose a publisher creates eight financial newsletters, each managed by a different expert. In their first issues, each of the eight makes a six-month recommendation about the general direction of the market; four predict a rise in the market, and four predict a fall in the market. The four who predicted a fall in the market were correct, and the four who predicted a rise go out of business. Of the remaining four newsletters, two predict a rise for the second six-month period and two predict a fall. The market rises, and the two that predicted a fall in the second six-month period go out of business. Of the two remaining in business after twelve months, one predicts a rise in the market for the third six-month period, and the other predicts a fall. The market rises, and the newsletter that was correct all three times advertises this fact. It seems they have some important insight into financial markets. Yet, we can see that if there are many "experts" making predictions, some will be consistently correct simply by chance, though we will be biased to give credit to the one that got lucky.

Tversky and Kahneman's (1971) work also shows that misconceptions of chance are not limited to gamblers, sports fans, or laypersons. Research psychologists also fall victim to the "law of small numbers." They believe that sample events should be far more representative of the population from which they were drawn than simple statistics would dictate. Putting too much faith in the results of initial samples, scientists often grossly overestimate the replicability of empirical findings. The representativeness heuristic may be so well institutionalized in our decision processes that even scientific training and its emphasis on the proper use of statistics may not eliminate its biasing influence.

Bias 7: Regression to the Mean

Problem 8. You are the sales forecaster for a department store chain with nine locations. The chain depends on you for quality projections of future sales in order to make decisions on staffing, advertising, information system developments, purchasing, renovation, and the like. All stores are similar in size and merchandise selection. The main difference in their sales occurs because of location and random fluctuations. Sales for 2004 were as follows:

Store	2004	2006
1	\$12,000,000	
2	11,500,000	
3	11,000,000	
4	10,500,000	
5	10,000,000	
6	9,500,000	
7	9,000,000	
8	8,500,000	
9	8,000,000	
TOTAL	\$90,000,000	\$99,000,000

Your economic forecasting service has convinced you that the best estimate of total sales increases between 2004 and 2006 is 10 percent (to \$99,000,000). Your task is to predict 2006 sales for each store. Since your manager believes strongly in the economic forecasting service, it is imperative that your total sales equal \$99,000,000.

Think about the processes you might use to answer this problem. Consider the following logical pattern of thought: "The overall increase in sales is predicted to be 10 percent ($[\$99,000,000 - \$90,000,000]/\$90,000,000$). Lacking any other specific information on the stores, it makes sense simply to add 10 percent to each 2004 sales figure to predict 2006 sales. This means that I predict sales of \$13,200,000 for store 1, sales of \$12,650,000 for store 2, and so on." This logic, in fact, is the most common approach people use in response to this item.

Unfortunately, this logic is faulty. Why? Statistical analysis would dictate that we first assess the predicted relationship between 2004 and 2006 sales. This relationship, formally known as a correlation, can vary from total independence (that is, 2004 sales do not predict 2006 sales) to perfect correlation (2004 sales are a perfect predictor of 2006 sales). In the former case, the lack of a relationship between 2004 and 2006 sales would mean that 2004 sales would provide absolutely no information about 2006 sales, and your best estimates of 2006 sales would be equal to total sales divided by the number of stores (\$99,000,000 divided by 9 equals \$11,000,000). However, in the latter case of perfect predictability between 2004 and 2006 sales, our initial logic of simply extrapolating from 2004 performance by adding 10 percent to each store's performance would be completely accurate. Obviously, 2004 sales are likely to be partially predictive of 2006 sales—falling somewhere between independence and perfect correlation. Thus, the best prediction for store 1 should lie between \$11,000,000 and \$13,200,000, depending on how predictive you think 2004 sales will be of 2006 sales. The key point is that in virtually all such predictions, you should expect the naive \$13,200,000 estimate to regress toward the overall mean (\$11,000,000).

In a study of sales forecasting, Cox and Summers (1987) examined the judgments of professional retail buyers. They examined sales data, during a two-week period, from two department stores for six different apparel styles for a total of twelve different sales forecasts. The task was for professional buyers to forecast the sales in week 2 based on week 1 data. The sales from week 1, in fact, regressed to the mean in week 2. However, the forecasts of thirty-one professional buyers failed to reflect the tendency for regression to the mean.

Many effects regress to the mean. Brilliant students frequently have less successful siblings. Short parents tend to have taller children. Great rookies have mediocre

second years (the “sophomore jinx”). Firms that achieve outstanding profits one year tend to perform less well the next year. In each case, individuals are often surprised when made aware of these predictable patterns of regression to the mean.

Why is the regression-to-the-mean concept, while statistically valid, counterintuitive? Kahneman and Tversky (1973) suggest that the representativeness heuristic accounts for this systematic bias in judgment. They argue that individuals typically assume that future outcomes (for example, 2002 sales) will be directly predictable from past outcomes (2000 sales). Thus, we tend to naively develop predictions based on the assumption of perfect correlation with past data.

In some unusual situations, individuals do intuitively expect a regression-to-the-mean effect. In 2001, when Barry Bonds hit seventy-three home runs, few expected him to repeat this performance the following year. When Wilt Chamberlain scored 100 points in a single game, most people did not expect him to score 100 points in his next game. When a historically 3.0 student got a 4.0 one semester, her parents did not expect a repeat performance the following semester. When a real estate agent sold five houses in one month (an abnormally high performance), his coagents did not expect equally high sales from him the following month. Why is regression to the mean more intuitive in these cases? Because, when a performance is extreme, we know it cannot last. Thus, under very unusual circumstances, we expect performance to regress. However, we generally do not recognize the regression effect in less extreme cases.

Consider Kahneman and Tversky’s (1973) classic example in which misconceptions about regression led to overestimation of the effectiveness of punishment and the underestimation of the power of reward. In a discussion about flight training, experienced instructors noted that praise for an exceptionally smooth landing was typically followed by a poorer landing on the next try, while harsh criticism after a rough landing was usually followed by an improvement on the next try. The instructors concluded that verbal rewards were detrimental to learning, while verbal punishments were beneficial. Obviously, the tendency of performance to regress to the mean can account for the results; verbal feedback may have had absolutely no effect. However, to the extent that the instructors were prone to biased decision making, they were liable to reach the false conclusion that punishment is more effective than positive reinforcement in shaping behavior.

What happens when managers fail to acknowledge the regression principle? Consider an employee who performs extremely well during one evaluation period. He (and his boss) may inappropriately expect similar performance in the next period. What happens when the employee’s performance regresses toward the mean? He (and his boss) will begin to make excuses for not meeting expectations. Managers who fail to recognize the tendency of events to regress to the mean are likely to develop false assumptions about future results and, as a result, make inappropriate plans.

Bias 8: The Conjunction Fallacy

Problem 9. Linda is thirty-one years old, single, outspoken, and very smart. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and she participated in anti-nuclear demonstrations.

Rank the following eight descriptions in order of the probability (likelihood) that they describe Linda:

- a. Linda is a teacher in an elementary school.

- b. Linda works in a bookstore and takes yoga classes.
- c. Linda is active in the feminist movement.
- d. Linda is a psychiatric social worker.
- e. Linda is a member of the League of Women Voters.
- f. Linda is a bank teller.
- g. Linda is an insurance salesperson.
- h. Linda is a bank teller who is active in the feminist movement.

Examine your rank orderings of descriptions C, F, and H. Most people rank order C as more likely than H and H as more likely than F. Their rationale for this ordering is that C–H–F reflects the degree to which the descriptions are representative of the short profile of Linda. Linda's profile was constructed by Tversky and Kahneman to be representative of an active feminist and unrepresentative of a bank teller. Recall from the representativeness heuristic that people make judgments according to the degree to which a specific description corresponds to a broader category within their minds. Linda's profile is more representative of a feminist than of a feminist bank teller, and is more representative of a feminist bank teller than of a bank teller. Thus, the representativeness heuristic accurately predicts that most individuals will rank order the items C–H–F.

Although the representativeness heuristic accurately predicts how individuals will respond, it also leads to another common, systematic distortion of human judgment—the conjunction fallacy (Tversky and Kahneman, 1983). This is illustrated by a reexamination of the potential descriptions of Linda. One of the simplest and most fundamental qualitative laws of probability is that a subset (for example, being a bank teller and a feminist) cannot be more likely than a larger set that completely includes the subset (for example, being a bank teller). Statistically speaking, the broad set “Linda is a bank teller” must be rated at least as likely, if not more so, than the subset “Linda is a bank teller who is active in the feminist movement.” After all, there is some chance (although it may be small) that Linda is a bank teller but not a feminist. Based on this logic, a rational assessment of the eight descriptions will result in F being ranked more likely than H.

Simple statistics demonstrate that a conjunction (a combination of two or more descriptors) cannot be more probable than any one of its descriptors. By contrast, the conjunction fallacy predicts that a conjunction will be judged more probable than a single component descriptor when the conjunction appears more representative than the component descriptor. Intuitively, thinking of Linda as a feminist bank teller “feels” more correct than thinking of her as only a bank teller.

The conjunction fallacy can also be triggered by a greater availability of the conjunction than of one of its unique descriptors (Yates and Carlson, 1986). That is, if the conjunction creates more intuitive matches with vivid events, acts, or people than a component of the conjunction, the conjunction is likely to be perceived falsely as more probable than the component. Participants in a study by Tversky and Kahneman (1983) judged the chances of a massive flood somewhere in North America, in 1989, in which one thousand people drown, to be less likely than the chances of an earthquake in

California, sometime in 1989, causing a flood in which more than a thousand people drown. Yet, the latter possibility (California earthquake leading to flood) is a subset of the former; many other events could cause a flood in North America. Tversky and Kahneman (1983) have shown that the conjunction fallacy is likely to lead to deviations from rationality in judgments of sporting events, criminal behavior, international relations, and medical decisions. The obvious concern arising from the conjunction fallacy is that it leads us to poor predictions of future outcomes, causing us to be ill-prepared to cope with unanticipated events.

We have examined five biases that emanate from the use of the representativeness heuristic: insensitivity to base rates, insensitivity to sample size, misconceptions of chance, regression to the mean, and the conjunction fallacy. Experience has taught us that the likelihood of a specific occurrence is related to the likelihood of a group of occurrences which that specific occurrence represents. Unfortunately, we tend to overuse this information in making decisions. The five biases we have just explored illustrate the systematic irrationalities that can occur in our judgments when we are unaware of this tendency.

BIASES BEYOND AVAILABILITY AND REPRESENTATIVENESS

Bias 9: Anchoring

Problem 10. A new Internet company recently made its initial public offering, becoming publicly traded. At its opening, the stock sold for \$20 per share. The company's closest competitor went public one year ago, also at a price of \$20 per share. The competitor's stock is now priced at \$100 per share. What will the new firm be worth one year from now?

Was your answer affected by the other firm's appreciation? Most people are influenced by this fairly irrelevant information. Reconsider how you would have responded if the other firm was now worth only \$10/share. On average, individuals give higher estimates of the new firm's future value when the other firm is currently worth \$100 per share, rather than \$10 per share.

Why do we pay attention to such irrelevant anchors? There are at least two reasons that anchors affect decisions. First, people often develop estimates by starting from an initial anchor, based on whatever information is provided, and adjusting from the anchor to yield a final answer (Epley and Gilovich, 2001; Epley, 2004). Adjustments away from anchors are usually not sufficient (Tversky and Kahneman, 1974). Second, Mussweiler and Strack (1999) show that the existence of an anchor leads people to access information that is consistent with that anchor (the commonalities between the two competitors) and not access information that is inconsistent with the anchor (differences between the two firms).

Tversky and Kahneman (1974) have provided systematic, empirical evidence of the effect of anchors—even when an anchor is known to be irrelevant. In one study, participants were asked to estimate the percentage of African countries in the United Nations. For each participant, a random number (obtained by a spin of a roulette

wheel, observed by the participant) was given as a starting point. From there, participants were asked to state whether the actual quantity was higher or lower than this random value and then develop their best estimate. It was found that the arbitrary values from the roulette wheel had a substantial impact on estimates. For example, for those who received ten countries and sixty-five countries as starting points, median estimates were twenty-five and forty-five, respectively. Thus, even though the participants were aware that the anchor was random and unrelated to the judgment task, the anchor had a dramatic effect on their judgment. Interestingly, paying participants according to their accuracy did not reduce the magnitude of the anchoring effect.

Salary negotiations represent a very common context for observing the influence of an anchor in the managerial world. For example, pay increases often come in the form of a percentage increase. A firm may have an average increase of 8 percent, with increases for specific employees varying from 3 percent to 13 percent. While society has led us to accept such systems as equitable, I believe that such a system overweights the anchor (last year's salary) and leads to substantial inequities. What happens if an employee has been substantially underpaid? The raise system described does not rectify past inequities, since a pay increase of 11 percent may leave that employee still underpaid. Conversely, the system would work in the employee's favor had she been overpaid. Employers often ask job applicants to reveal their current salaries. Why? Employers are searching for a value from which they can anchor an adjustment. If the employee is worth far more than his current salary, the anchoring bias predicts that the firm will make an offer below the employee's true value. Does an employee's current salary provide fully accurate information about his or her true worth? I think not. Thus, the use of such compensation systems accepts past inequities as an anchor and makes inadequate adjustments from that point. Furthermore, these findings suggest that when an employer is deciding what offer to make to a potential employee, any anchor that creeps into the discussion is likely to have an inappropriate effect on the eventual offer, even if the anchor is "ignored" as being ridiculous.

There are numerous examples of the anchoring phenomenon in everyday life. For example:

- In education, children are tracked by a school system that may categorize them into a certain level of performance at an early age. For example, a child who is anchored in the C group may be expected to achieve a mediocre level of performance. Conversely, a child of similar abilities who is anchored in the A group may be perceived as being a better student than the student in group C merely because assignment to the A group confers high-performer status.
- We have all fallen victim to the first-impression syndrome when meeting someone for the first time. We often place so much emphasis on first impressions that we fail to adjust our opinion appropriately at a later date.

Joyce and Biddle (1981) have provided empirical support for the presence of the anchoring effect among practicing auditors of Big Four accounting firms. Auditors participating in one condition were asked the following (adapted from original to keep the problem current):

It is well known that many cases of management fraud go undetected even when competent annual audits are performed. The reason, of course, is that Generally

Accepted Auditing Standards are not designed specifically to detect executive-level management fraud. We are interested in obtaining an estimate from practicing auditors of the prevalence of executive-level management fraud as a first step in ascertaining the scope of the problem.

1. Based on your audit experience, is the incidence of significant executive-level management fraud more than 10 in each 1,000 firms (that is, 1 percent) audited by Big Four accounting firms?
 - a. Yes, more than 10 in each 1,000 Big Four clients have significant executive-level management fraud.
 - b. No, fewer than 10 in each 1,000 Big Four clients have significant executive-level management fraud.
2. What is your estimate of the number of Big Four clients per 1,000 that have significant executive-level management fraud? (Fill in the blank below with the appropriate number.)

_____ in each 1,000 Big Four clients have significant executive-level management fraud.

The second condition differed only in that participants were asked whether the fraud incidence was more or less than 200 in each 1,000 firms audited, rather than 10 in 1,000. Prior to the auditing scandals that started to emerge in 2001, participants in the first condition estimated a fraud incidence of 16.52 per 1,000 on average, compared with an estimated fraud incidence of 43.11 per 1,000 in the second condition! In my own use of these problems with executive classes, answers to both versions have roughly doubled since the fall of Enron, but the differences between the two versions of the problem remain large. Seasoned executives, including professional auditors, are affected by anchors.

Epley (2004) provides evidence that we can predict when each of two different processes will be used to create the anchoring bias. Specifically, he shows that when an anchor is externally set (not set by the decision maker), the anchor leads to a biased search for information compatible with the anchor (Mussweiler and Strack, 1999, 2000a, 2000b). In contrast, when someone develops her own anchor, she will start with that anchor and insufficiently adjust away from it (Epley and Gilovich, 2001).

Nisbett and Ross (1980) note that the anchoring bias itself dictates that it will be very difficult to get you to change your decision-making strategies as a result of reading this book. They argue that the heuristics we identify are currently serving as your cognitive anchors and are central to your judgment processes. Thus, any cognitive strategy that I suggest must be presented and understood in a manner that will force you to break your existing cognitive anchors. Based on the evidence in this section, this should be a difficult challenge—but one that is important enough to be worth the effort!

Bias 10: Conjunctive and Disjunctive Events Bias

Problem 11. Which of the following appears most likely? Which appears second most likely?

- a. Drawing a red marble from a bag containing 50 percent red marbles and 50 percent white marbles.

- b. Drawing a red marble seven times in succession, with replacement (a selected marble is put back into the bag before the next marble is selected), from a bag containing 90 percent red marbles and 10 percent white marbles.
- c. Drawing at least one red marble in seven tries, with replacement, from a bag containing 10 percent red marbles and 90 percent white marbles.

The most common ordering of preferences is B–A–C. Interestingly, the correct order of likelihood is C (52 percent), A (50 percent), B (48 percent)—the exact opposite of the most common intuitive pattern! This result illustrates a general bias to overestimate the probability of conjunctive events, or events that must occur in conjunction with one another (Bar-Hillel, 1973), and to underestimate the probability of disjunctive events, or events that occur independently (Tversky and Kahneman, 1974). Thus, when multiple events all need to occur (choice B), we overestimate the true likelihood, while if only one of many events needs to occur (choice C), we underestimate the true likelihood.

The overestimation of conjunctive events is a powerful explanation of the timing problems that typically occur with projects that require multistage planning. Individuals, businesses, and governments frequently fall victim to the conjunctive-events bias in terms of timing and budgets. Home remodeling, new product ventures, and public works projects seldom finish on time or on budget.

Consider the following real-life scenarios:

- After three years of study, doctoral students typically dramatically overestimate the likelihood of completing their dissertations within a year. This occurs even when they plan how long each component of the project will take. Why do they not finish in one year?
- A partner managed a consulting project in which five teams were each analyzing a different strategy for a client. The alternatives could not be compared until all teams completed their analysis. As the client's deadline approached, three of the five teams were behind schedule, but the partner assured the client that all five would be ready on time. In the end, the manager presented only three of the five alternatives to the client (two were still missing). Unimpressed, the client dropped the consulting firm. Whose fault was it that the project failed?
- The City of Boston undertook a massive construction project to move Interstate Highway 93 below ground as it passes through the city (The Big Dig). City officials developed a very clear budget based on each subcontractor's estimate. Nevertheless, as of late 2003, the Big Dig was \$12 billion over budget. What went wrong?

Why are we so optimistic in our assessments of a project's cost and time frame? Why are we so surprised when a seemingly unlikely setback occurs? Because of the human tendency to underestimate disjunctive events. "A complex system, such as a nuclear reactor or the human body, will malfunction if any of its essential components fails," argue Tversky and Kahneman (1974). "Even when the likelihood of failure in each component is slight, the probability of an overall failure can be high if many components are involved."

An awareness of our underestimation of disjunctive events also has its positive side. Consider the following:

It's Monday evening (10:00 P.M.). Your boss calls to tell you that you must be at the Chicago office by 9:30 A.M. the next morning. You call all five airlines that have flights that get into Chicago by 9:00 A.M. Each has one flight, and all the flights are booked. When you ask the probability of getting on each of the flights if you show up at the airport in the morning, you are disappointed to hear probabilities of 30 percent, 25 percent, 15 percent, 20 percent, and 25 percent. Consequently, you do not expect to get to Chicago in time.

In this case, the disjunctive bias leads you to expect the worst. In fact, if the probabilities given by the airlines are unbiased and independent, you have a 73 percent chance of getting on one of the flights (assuming that you can arrange to be at the right ticket counter at the right time)!

Bias 11: Overconfidence

Problem 12. Listed below are ten uncertain quantities. Do not look up any information on these items. For each, write down your best estimate of the quantity. Next, put a lower and upper bound around your estimate, so that you are confident that your 98 percent range surrounds the actual quantity.

Estimate	Lower	Upper	
_____	_____	_____	a. Wal-Mart's 2003 revenue
_____	_____	_____	b. Microsoft's 2003 revenue
_____	_____	_____	c. Median age of U.S. citizens according to the 2000 Census
_____	_____	_____	d. Market value of Best Buy as of March 14, 2003
_____	_____	_____	e. Market value of Heinz as of March 14, 2003
_____	_____	_____	f. Rank of McDonald's in the 2003 <i>Fortune</i> 500
_____	_____	_____	g. Rank of Nike in the 2003 <i>Fortune</i> 500
_____	_____	_____	h. The average amount of money that a family in the U.S. will spend on each child from the time he/she is born until the time he/she turns eighteen (as of 2003)
_____	_____	_____	i. Number of endangered species listed in the United States as of February 25, 2004
_____	_____	_____	j. Percentage of the U.S. population under five years old according to the 2000 Census

How many of your ten ranges will actually surround the true quantities? If you set your ranges so that you were 98 percent confident, you should expect to correctly bound approximately 9.8, or nine to ten, of the quantities. Let's look at the correct answers: (a) \$246,525,000,000, (b) \$28,365,000,000, (c) 35.5, (d) \$9,124,100,000, (e) \$10,628,900,000, (f) 124, (g) 188, (h) \$250,000, (i) 514, (j) 6.8%.

How many of your ranges actually surrounded the true quantities? If you surround nine or ten, we can conclude that you were appropriately confident in your estimation ability. Most people surround only between three (30 percent) and seven (70 percent), despite claiming a 98 percent confidence that each range will surround the true value. Why? Most of us are overconfident in our estimation abilities and do not acknowledge our true uncertainty.

In Alpert and Raiffa's (1969) initial demonstration of overconfidence based on 1,000 observations (100 participants on 10 items), 42.6 percent of quantities fell outside 90 percent confidence ranges. Since then, overconfidence has been identified as a common judgmental pattern and demonstrated in a wide variety of settings. For example, Fischhoff, Slovic, and Lichtenstein (1977) found that participants who assigned odds of 1,000:1 of being correct were correct only 81 to 88 percent of the time. For odds of 1,000,000:1, their answers were correct only 90 to 96 percent of the time! This effect is in part due to the fact that people are imperfect at gauging their own level of accuracy. Given this lack of self-awareness about one's knowledge, overconfidence will increase as people become more sure of themselves (Erev, Wallsten, and Budescu, 1994).

People also fail to account for the difficulty of questions; we tend to be more overconfident when asked to respond to questions of moderate to extreme difficulty than to easy questions (Fischhoff, Slovic, and Lichtenstein, 1977). As participants' knowledge of a question decreases, they do not correspondingly decrease their level of confidence. This may be another result of the fact that people imperfectly estimate their own performance. Specifically, we are most likely to overestimate our performance when it is at its lowest (Erev et al., 1994). So, participants typically demonstrate no overconfidence, and often some underconfidence, when asked questions with which they are familiar. Thus, we should be most alert to the potential for overconfidence when considering areas outside of our expertise.

Are groups as overconfident as individuals? Sniezek and Henry (1989) investigated the accuracy and confidence of groups decisions about unknown situations. They found that, in general, groups make more accurate judgments than individuals about uncertain events. This is particularly true in groups in which there is a broad variance in individual judgments and a relatively high level of disagreement. However, groups are just as susceptible as individuals to unreasonably high levels of confidence in their judgments. Some 98 percent of participants believed that their group's judgments were in the top half of all group judgments with respect to accuracy. This finding suggests that overconfidence is a significant pitfall for groups as well as for individuals.

Lichtenstein, Fischhoff, and colleagues suggest two viable strategies for eliminating overconfidence. First, Lichtenstein, Fischhoff, and Phillips (1982) found that giving people feedback about their overconfident judgments has been moderately successful at reducing this bias. Second, Koriat, Lichtenstein, and Fischhoff (1980) found that asking people to explain why their answers might be wrong (or far off the mark) can decrease overconfidence by enabling them to recognize contradictions in their judgment.

Why should you be concerned about overconfidence? After all, it has probably given you the courage to attempt endeavors that have stretched your abilities. Unwarranted confidence can indeed be beneficial in some situations. However, consider the potential adverse effects of excess confidence in the following situations:

- You are a surgeon and are trying to persuade a patient's family to agree to a difficult operation. When the family asks you to estimate the likelihood that the patient will survive the operation, you respond, "95 percent." If the patient dies on the operating table, was he one of the unlucky 5 percent, or are you guilty of malpractice for an overconfident projection?
- You are the chief legal counsel for a firm that has been threatened with a multi-million dollar lawsuit. You are 98 percent confident that the firm will not lose in court. Is this degree of certainty sufficient for you to recommend rejecting an out-of-court settlement? Suppose you learn that, if you lose the case, your firm will go bankrupt. Based on what you know now, are you still comfortable with your 98 percent estimate?
- You have developed a marketing plan for a new product. You are so confident in your plan that you have not developed any contingencies for early market failure. When the first stage of your plan falters, will you expedite changes in the marketing strategy, or will your overconfidence blind you to its flaws?

These examples demonstrate the serious problems that can result from the tendency to be overconfident. While confidence in your abilities is necessary for achievement in life, and can inspire respect and confidence in others, overconfidence can be a barrier to effective professional decision making.

Bias 12: The Confirmation Trap

Imagine that the sequence of three numbers below follows a rule, and your task is to diagnose that rule (Wason, 1960). When you write down other sequences of three numbers, an instructor will tell you whether or not your sequence follows the rule.

2-4-6

What sequences would you write down? How would you know when you had enough evidence to guess the rule? Wason's study participants tended to offer fairly few sequences, and the sequences tended to be consistent with the rule that they eventually guessed. Commonly proposed rules included "numbers that go up by two" and "the difference between the first two numbers equals the difference between the last two numbers." In fact, Wason's rule was much broader: "any three ascending numbers." This solution requires participants to accumulate disconfirming, rather than confirming, evidence. For example, if you think the rule is "numbers that go up by two," you must try sequences that do not conform to this rule to find the actual rule. Trying the sequences 1-3-5, 10-12-14, 122-124-126, and so on, will only lead you into the confirmation trap. Similarly, if you think the rule is "the difference between the first two

numbers equals the difference between the last two numbers," you must try sequences that do not conform to this rule to find the actual rule. Trying the sequences 1-2-3, 10-15-20, 122-126-130, again, would only bring you feedback that strengthens your hypothesis. Only six out of Wason's twenty-nine participants found the correct rule on their first guess. Wason concluded that obtaining the correct solution necessitates "a willingness to attempt to falsify hypotheses, and thus to test those intuitive ideas that so often carry the feeling of certitude" (p. 139).

I have used this task hundreds of times in classes. My first volunteer typically guesses "numbers going up by two" and is quickly eliminated. My second volunteer is often just as quick with a wrong answer. Interestingly, at this stage, it is rare that I will have answered "no" to a sequence proposed by either volunteer. Why? Because people tend to seek confirmatory information, even when disconfirming information is more powerful and important.

Once you become aware of the confirmation trap, you are likely to find that it pervades your decision-making processes. When you make a tentative decision (to buy a new car, to hire a particular employee, to start research and development on a new product line), do you search for data that supports your decision before making the final commitment? Most of us do. However, the existence of the confirmation trap implies that the search for challenging, or disconfirming, evidence will provide the most useful insights. For example, when you are seeking to confirm your decision to hire a particular employee, you will probably have no trouble finding positive information on the individual, such as recommendations from past employers. In fact, it may be more important for you to determine whether negative information on this individual, such as a criminal record, as well as positive information on another potential applicant, also exists. Now consider the last car you purchased. Imagine that the day after you drove your new car home, your local newspaper printed two lists ranking cars by performance—one by fuel efficiency and one by crash test results. Which list would you pay more attention to? Most of us would pay more attention to whichever list confirms that we made a good purchase.

I recently watched my friend Dick Thaler engage a group of financial executives in the 2-4-6 task. After the basic demonstration, Thaler told the audience that he was forming two new consulting firms. One of them, called "Yes Person," would respond to all requests for advice by telling the clients that all their ideas are great. In fact, to speed service and ensure satisfaction, Yes Person would allow the clients to write the consulting report themselves if they liked. The other consulting firm, called "Devil's Advocate," would disapprove of any plans currently being considered by a client. Reports by Devil's Advocate would consist of a list of the top ten reasons a plan should not be undertaken.

Which consulting style would be more useful to the client? Thaler insisted to his audience that Devil's Advocate would provide a much more important service than Yes Person, and I agree. However, real-world consulting engagements often bear a closer resemblance to the Yes Person format than to that of Devil's Advocate, in part because consulting firms know that clients like to hear how good their ideas are. Our desire to confirm our initial ideas is so strong that we will pay people to back us up! When pressed, Thaler conceded that his two firms don't really exist, and could never succeed. After all, he pointed out, no firm would ever hire Devil's Advocate, and Yes Person already had too much competition from established consulting firms.

Bias 13: Hindsight and the Curse of Knowledge

Imagine yourself in the following scenarios:

- You are an avid football fan, and you are watching a critical game in which your team is behind 35–31. With three seconds left and the ball on the opponent's three-yard line, the quarterback calls a pass play into the corner of the end zone. When the play fails, you shout, "I *knew* that was a bad play."
- You are riding in an unfamiliar area, and your spouse is driving. When you approach an unmarked fork in the road, your spouse decides to go to the right. Four miles and fifteen minutes later, it is clear that you are lost. You blurt out, "I knew you should have turned left at the fork."
- A manager who works for you hired a new supervisor last year. You were well aware of the choices she had at the time and allowed her to choose the new employee on her own. You have just received production data on every supervisor. The data on the new supervisor are terrible. You call in the manager and claim, "There was plenty of evidence that he was the wrong man for the job."
- As director of marketing in a consumer-goods organization, you have just presented the results of an extensive six-month study on current consumer preferences for the products manufactured by your company. At the conclusion of your presentation, a senior vice president responds, "I don't know why we spent so much time and money collecting these data. I could have told you what the results were going to be."

Do you recognize any of your own behaviors in these scenarios? Do you recognize someone else's remarks? Each scenario exemplifies "the hindsight bias" (Fischhoff, 1975). People typically are not very good at recalling or reconstructing the way an uncertain situation appeared to them before finding out the results of the decision. What play would *you* have called? Did you really know that your spouse should have turned left? Was there really evidence that the selected supervisor was a bad choice? Could the senior vice president really have predicted your study's results? While our intuition is occasionally accurate, we tend to overestimate what we knew beforehand based upon what we later learned. The hindsight bias occurs when people look back on their own judgments, as well as those of others.

Fischhoff (1975) examined the differences between hindsight and foresight in the context of judging the outcome of historical events. In one study, participants were divided into five groups and asked to read a passage about the war between the British and Gurka forces in 1814. One group was not told the result of the war. The remaining four groups of participants were told either that: (1) the British won, (2) the Gurkas won, (3) a military stalemate was reached with no peace settlement, or (4) a military stalemate was reached with a peace settlement. Obviously, only one group was told the truthful outcome—in this case, (1). Each participant was then asked what his or her subjective assessments of the probability of each of the outcomes would have been without the benefit of knowing the reported outcome. Participants tended to believe that even if they had not been told the outcome, they would have judged the outcome that they were told happened as being most likely. Based on this and other varied examples, it becomes clear that knowledge of an outcome increases an individual's belief

about the degree to which he or she would have predicted that outcome without the benefit of that knowledge.

Anchoring is often used to explain the hindsight bias. According to this view, knowledge of an event's outcome becomes an anchor by which individuals interpret their prior judgments of the event's likelihood. Since adjustments to anchors are known to be inadequate, hindsight knowledge can be expected to bias perceptions of what one thinks one knew in foresight. Furthermore, to the extent that various pieces of data about the event vary in support of the actual outcome, evidence that is consistent with the known outcome may become cognitively more salient and thus more available in memory (Slovic and Fischhoff, 1977). This tendency will lead an individual to justify a claimed foresight in view of "the facts provided." Finally, the relevance of a particular piece of data may later be judged important to the extent to which it is representative of the final observed outcome.

In the short run, hindsight has a number of advantages. For instance, it is flattering to believe that your judgment is far better than it actually is! In addition, hindsight allows us to criticize other people's apparent lack of foresight. However, the hindsight bias reduces our ability to learn from the past and to evaluate decisions objectively. In general, individuals should be judged by the process and logic of their decisions, not on their results. A decision maker who makes a high-quality decision that does not work out should be rewarded, not punished. Why? Because results are affected by a variety of factors outside the direct control of the decision maker. When we rely on hindsight offered by results, we will inappropriately evaluate the decision makers' logic, judging their outcomes rather than their methods.

Closely related to the hindsight bias is the "curse of knowledge," which argues that when assessing others' knowledge, people are unable to ignore knowledge that they have that others do not have (Camerer, Loewenstein, and Weber, 1989). Knowledge that is psychologically available is hard to forget when a person is imagining how much others know; sophistication stands in the way of a fair assessment. This "curse" explains the difficulty teachers often have adjusting their lessons according to what students already know, and the tendency of product designers to overestimate the average person's ability to master high-tech devices. Similarly, Hoch (1988) found that marketing experts (who are also consumers) are generally worse at predicting the beliefs, values, and tastes of other consumers than nonexpert consumers are. This results from the marketing experts acting as if the non-expert consumer understood as much about the products as they did.

Have you ever given someone what you believed were very clear directions to your home, only to find that they got lost? Keysar (1994) argues that an individual often assumes that when she sends an ambiguous message (which is clear to her) to another individual, based on information that the receiver does not possess, her intent will be magically understood by the other party. Keysar (1994) had people read scenarios that provided them with privileged information about "David." They read that David had dinner at a particular restaurant based on a friend's recommendation. Half the participants in the experiment learned that he really enjoyed his meal, and the other half learned that he disliked it very much. All the participants read that David wrote his friend the following note: "About the restaurant, it was marvelous, just marvelous." The participants who knew that David enjoyed the restaurant had a strong tendency to believe that the friend would take the comment as sincere. In contrast,

participants who knew that David disliked the restaurant had a strong tendency to believe that the friend would take the comment as sarcastic. This result occurred despite the fact that both groups of participants knew that the friend had access to the same note and no additional information about David's dining experience. A great deal of disappointment occurs as a result of the failure to communicate clearly in organizations. Part of this disappointment results from our false belief that people understand our ambiguous messages.

INTEGRATION AND COMMENTARY

Heuristics, or rules of thumb, are the cognitive tools we use to simplify decision making. The preceding pages have described thirteen of the most common biases that result when we over-rely on these judgmental heuristics. These biases, along with their associated heuristics, are summarized in Table 2.2. Again, I must emphasize that more than one heuristic can operate on our decision-making processes at any given time. Overall, the use of heuristic "shortcuts" results far more often in adequate decisions than inadequate ones. The logic of heuristics is that, on average, any loss in decision quality will be outweighed by time saved. However, as I have demonstrated in this chapter, a blanket acceptance of heuristics is unwise. First, as illustrated by the quiz items, there are many instances in which the loss in decision quality far outweighs the time saved by heuristics. Second, the foregoing logic suggests that we have voluntarily accepted the quality tradeoffs associated with heuristics. In reality, we have not: Most of us are unaware of their existence and their ongoing impact upon our decision making. Consequently, we fail to distinguish between situations in which they are beneficial and situations in which they are potentially harmful.

To emphasize the distinction between legitimate and illegitimate uses of heuristics, let's reconsider Problem 5. Participants tended to predict that Mark would be more likely to take a job in arts management, despite the fact that the contextual data overwhelmingly favored his choice of a position with a consulting firm. In this case, the representativeness heuristic prevents us from appropriately incorporating relevant base-rate data. However, if the choice of "consulting firm" were replaced with a less common career path for an MBA from a prestigious university (such as steel-industry management), then the representativeness heuristic is likely to lead to an accurate prediction. That is, when base-rate data are unavailable or irrelevant (that is, when the choices have the same base rate), the representativeness heuristic provides a reasonably good cognitive tool for matching Mark to his most likely career path. The key to improved judgment, therefore, lies in learning to distinguish between appropriate and inappropriate uses of heuristics. This chapter gives you the foundation you need to learn to make this distinction.

TABLE 2.2 Summary of the Thirteen Biases Presented in Chapter 2

Bias	Description
<i>Biases Emanating from the Availability Heuristic</i>	
1. Ease of recall	Individuals judge events that are more easily recalled from memory, based on vividness or recency, to be more numerous than events of equal frequency whose instances are less easily recalled.

(Continues)

TABLE 2.2 Summary of the Thirteen Biases Presented in Chapter 2 (Continued)

Bias	Description
2. Retrievability	Individuals are biased in their assessments of the frequency of events based on how their memory structures affect the search process.
3. Presumed associations	Individuals tend to overestimate the probability of two events co-occurring based on the number of similar associations they can easily recall, whether from experience or social influence.
<i>Biases Emanating from the Representativeness Heuristic</i>	
4. Insensitivity to base rates	When assessing the likelihood of events, individuals tend to ignore base rates if any other descriptive information is provided—even if it is irrelevant.
5. Insensitivity to sample size	When assessing the reliability of sample information, individuals frequently fail to appreciate the role of sample size.
6. Misconceptions of chance	Individuals expect that a sequence of data generated by a random process will look “random,” even when the sequence is too short for those expectations to be statistically valid.
7. Regression to the mean	Individuals tend to ignore the fact that extreme events tend to regress to the mean on subsequent trials.
8. The conjunction fallacy	Individuals falsely judge that conjunctions (two events co-occurring) are more probable than a more global set of occurrences of which the conjunction is a subset.
<i>Biases Beyond Availability and Representativeness</i>	
9. Anchoring	Individuals make estimates for values based upon an initial value (derived from past events, random assignment, or whatever information is available) and typically make insufficient adjustments from that anchor when establishing a final value.
10. Conjunctive and disjunctive events bias	Individuals exhibit a bias toward overestimating the probability of conjunctive events and underestimating the probability of disjunctive events.
11. Overconfidence	Individuals tend to be overconfident of the infallibility of their judgments when answering moderately to extremely difficult questions.
12. The confirmation trap	Individuals tend to seek confirmatory information for what they think is true and fail to search for disconfirmatory evidence.
13. Hindsight and the curse of knowledge	After finding out whether or not an event occurred, individuals tend to overestimate the degree to which they would have predicted the correct outcome. Furthermore, individuals fail to ignore information they possess that others do not when predicting others' behavior.