CHAPTER OBJECTIVES

ENUMERATIVE INDUCTION
- Know what enumerative induction is and how it's used.
- Learn the definitions of target population, sample, and relevant property.
- Understand the two ways in which an enumerative induction can fail to be strong.
- Understand the error known as hasty generalization and know how to avoid it.
- Understand the basics of opinion polls and know the definitions of random sampling, self-selecting sample, margin of error, and confidence level.

ANALOGICAL INDUCTION
- Know how to formulate and evaluate an argument by analogy.
- Know how to use the following criteria to evaluate arguments by analogy: relevant similarities, relevant dissimilarities, the number of instances compared, and diversity among cases.

CAUSAL ARGUMENTS
- Know what causal claims and arguments are.
- Be able to apply Mill's methods to the evaluation of causal arguments.
- Be aware of the ways in which people can make errors in causal reasoning.
- Recognize and know how to avoid the post hoc fallacy.
- Learn the definitions of necessary and sufficient conditions.
- Be able to distinguish between necessary and sufficient conditions in everyday contexts.
We now pass from an exploration of deductive arguments to a close examination of inductive ones—a very small step since both these argument types are common features of our everyday lives. Recall that a deductive argument is intended to provide logically conclusive support for its conclusion, being valid or invalid, sound or unsound. An inductive argument, on the other hand, is intended to supply only probable support for its conclusion, earning the label of “strong” if it succeeds in providing such support and “weak” if it fails. The conclusion of an inductively strong argument is simply more likely to be true than not. If the argument’s premises are true, it is said to be cogent. Unlike valid deductive arguments, an inductively strong argument cannot guarantee that the conclusion is true—but it can render the conclusion probably true, even highly likely to be true. Inductive arguments, then, cannot give us certainty, but they can give us high levels of probability—high enough at least to help us acquire knowledge in everything from physics to bird watching.

Deductive logic is the invisible framework on which much of our reasoning hangs and the solid bond that holds together the logical lattices of mathematics, computer science, and other theoretical or abstract disciplines. Inductive reasoning, though, gives us most of what we know about the empirical workings of the world, allowing us in science and in ordinary experience to soar reliably from what we know to what we don’t. It allows us to reason “beyond the evidence”—from bits of what is already known to conclusions about what those bits suggest is probably true.

Inductive arguments come in several forms. In this chapter we will examine three of them and focus, as in previous chapters, on how to evaluate their merits in real-life contexts.

**Enumerative Induction**

As you may have noticed in Chapter 3, sometimes an inductive argument reason from premises about a group, or class, of things to a conclusion about a single member of the group—that is, from the general to the particular, or the whole to the part. For example:

*Almost all of the students attending this college are pacifists.*

*Wei-en attends this college.*

*Therefore, Wei-en is probably a pacifist.*

*Eighty-two percent of residents in this neighborhood have been victims of crimes.*

*Samuel is a resident of this neighborhood.*

*Therefore, Samuel will probably be a victim of a crime.*

Such an inductive argument has been known traditionally as a *statistical syllogism*. The word *syllogism*—which is usually reserved for deductive arguments—refers to the fact that this argument consists of three statements: two premises and a conclusion. *Syllogism* is used to indicate that the generalization expressed in one of the premises is less than universal. But the
The defining feature of this argument is that its line of reasoning goes from a statement about a group of things to a conclusion about a single member of that group.

Our main concern in this section, however, is a more common inductive argument that reasons from premises about individual members of a group to conclusions about the group as a whole (from particular to general, or the part to the whole). In such cases we begin with observations about some members of the group and end with a generalization about all of them. This argument pattern is called **enumerative induction**, and it’s a way of reasoning that we all find both natural and useful:

*Most peace activists I know are kind-hearted. So probably all peace activists are kind-hearted.*

Every Gizmo computer I’ve bought in the last two years has had a faulty monitor. Therefore all Gizmo computers probably have faulty monitors.

Forty percent of the pickles that you’ve pulled out of the barrel are exceptionally good. So 40 percent of all the pickles in the barrel are probably exceptionally good.

More formally, enumerative induction has this form:

\[ X \text{ percent of the observed members of group } A \text{ have property } P. \]
\[ \text{Therefore, } X \text{ percent of all members of group } A \text{ probably have property } P. \]

In this formal guise, our pickle argument looks like this:

*Forty percent of the observed pickles from the barrel are exceptionally good. Therefore, 40 percent of all the pickles in the barrel are probably exceptionally good.*

Enumerative induction comes with some useful terminology. The group as a whole—the whole collection of individuals in question—is called the **target population** or **target group**. The observed members of the target group are called the **sample members** or **sample**. And the property we’re interested in is called the **relevant property** or **property in question**. In the foregoing example, the target group is the pickles in the barrel. The sample is the observed pickles. And the property is the quality of being exceptionally good.

Now, using this terminology we can study arguments by enumeration a little closer. Remember that an inductive argument can not only be strong or weak, but it can also vary in its strength—in the degree of support that the premises give to the conclusion. So argument strength depends on the premises as well as on how much is claimed in the conclusion. Let’s look at some examples.
Argument 1

All the corporate executives Jacques has worked for have been crooks.
Therefore, all corporate executives are probably crooks.

The target group is corporate executives, the sample is the corporate executives Jacques has worked for, and the relevant property is being a crook. We don’t know how many corporate executives Jacques has worked for, but we must assume from what we know about career paths in corporate America that the number is small, probably no more than a dozen. Neither do we know exactly how many corporate executives there are, but we can safely guess that there are thousands or hundreds of thousands. It should be obvious then that this enumerative inductive falls short on at least one score: The sample is too small. We simply cannot draw reliable conclusions about all corporate executives based on a mere handful of them. The argument is weak.

We can fault this argument on another count: The sample is not representative of the target group. With thousands of corporate executives working for thousands of corporations, we must assume that corporate executives—in temperament, morality, demographics, and many other factors—are a diverse lot. It is therefore highly unlikely that Jacques’s former bosses are representative of all corporate executives in their crookedness (the relevant property). And if the sample is not representative of the whole, we cannot use it to draw accurate conclusions about the whole. Argument 1 is weak for this additional reason.

Consider this one:

Argument 2

All of the blue herons that we’ve examined at many different sites in the nature preserve (about two hundred birds) have had birth defects.
Therefore, most of the blue herons in the nature preserve probably have birth defects.

In this argument the target group is the blue herons in the nature preserve, the sample is the two hundred blue herons examined, and the relevant property is having birth defects. We would normally consider this a very strong enumerative induction. Assuming that the premise is true, we would probably be surprised to discover that only a tiny minority of the target group had birth defects. Since the sample was drawn from many parts of the preserve, we would deem it representative of the target group. And due to the general uniformity of characteristics among birds in the wild, we would assume that a sample of two hundred birds would be large enough to strongly support the conclusion. As it stands, argument 2 is strong.

On the other hand, a conclusion asserting that all of the target group had birth defects would normally go beyond what the evidence in the premise would support. There could easily be at least some blue herons in the preserve (assuming it to be sufficiently large) that don’t have birth defects, even if most do.

So you can see that an enumerative inductive argument can fail to be strong in two major ways: Its sample can be (1) too small or (2) not representative. Of course,
it's possible for an enumerative induction to be perfectly strong—but have false premises, in which case the argument isn't cogent. That is, the data (or evidence) stated in the premises could have been misinterpreted, fabricated, or misstated.

Sample Size

Let's say that you decide to conduct a survey of college students to determine their attitude toward federal deficits. So you stand around in the student center and query the first five students that pass by. Four out of the five say that deficits don't matter. You conclude: Eighty percent of the student body believe that deficits don't matter. Should you send your findings to the school newspaper—or to CNN?

No way. This survey is a joke—the sample is much too small to yield any reliable information about the attitudes of the students as a whole. This verdict may seem obvious, but just about everyone at one time or another probably makes this kind of mistake, an error known as hasty generalization. We're guilty of hasty generalization whenever we draw a conclusion about a target group based on an inadequate sample size. People regularly make this mistake when dealing with all sorts of enumerative inductive evidence—political polls, consumer opinion surveys, scientific studies (especially medical research), quality-control checks, anecdotal reports, and many others.

In our everyday experience, we may casually make, hear, or read hasty generalizations like this:

You should buy a Dell computer. They're great. I bought one last year, and it has given me nothing but flawless performance.

The only male professor I've had this year was a chauvinist pig. All the male professors at this school must be chauvinist pigs.

Psychology majors are incredibly ignorant about human psychology. Believe me, I know what I'm talking about: My best friend is a psych major. What an ignoramus!

The French are snobby and rude. Remember those two high-and-mighty guys with really bad manners? They're French. I rest my case.

The food at Pappie's Restaurant is awful. I had a sandwich there once, and the bread was stale.

In general, the larger the sample, the more likely it is to reliably reflect the nature of the larger group. In many cases our common sense tells us when a sample is or is not large enough to draw reliable conclusions about a particular target group. A good rule of thumb is this: The more homogeneous a target group is in traits relevant to the property in question, the smaller the sample can be; the less homogeneous, the larger the sample should be.

For example, if we want to determine whether cottontail rabbits have teeth, we need to survey only a tiny handful of cottontail rabbits (maybe even just one)
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because cottontail rabbits are fairly uniform in their physical characteristics. In this sense, if you’ve seen one cottontail rabbit, you’ve seen them all. On the other hand, if we want to know the sexual preferences of Hispanics who live in North American suburbs, surveying just a few won’t do. Questioning a sample of two or twenty or even two hundred North American suburban Hispanics will not give us a reliable read on the sexual preferences of the target group. In social, psychological, and cultural properties, people are too diverse to judge a large target group by just a few of its members. In biological properties, however, *Homo sapiens* is relatively uniform. We need to survey only one normal member of the species to find out if humans have ears.

**Representativeness**

In addition to being the proper size, a sample must be a **representative sample**—it must resemble the target group in all the ways that matter. If it does not properly represent the target group, it’s a **biased sample**. An enumerative inductive argument is strong only if the sample is representative of the whole.

Many arguments using unrepresentative samples are ludicrous; others are more subtle.

*College students are glad that Congress is controlled by Republicans. Surveys of the members of Young Republican clubs on dozens of college campuses prove this.*

*Most nurses in this hospital are burned out, stressed out, and overworked. Just ask the ones who work in the emergency department. They’ll tell you they’re absolutely miserable.*
No one is happy. Almost everyone is complaining about something. Just look at the letters to the editor in any big-city newspaper. Complaints, complaints, complaints.

To be truly representative, the sample must be like the target group by (1) having all the same relevant characteristics and (2) having them in the same proportions that the target group does. The “relevant characteristics” are features that could influence the property in question. For example, let’s say that you want to survey adult residents of Big City to determine whether they favor distributing condoms in high schools. Features of the residents that could influence whether they favor condom distribution include political party affiliation, ethnic background, and being Catholic. So the sample of residents should have all of these features and have them in the same proportions as the target group (residents of Big City). If half the adult residents of Big City are Catholic, for example, then half the sample should consist of residents who are Catholic.

Say that we want to determine how the ten thousand eligible voters in a small town intend to vote in an upcoming presidential election. We survey one thousand of them, which should be more than enough for our purposes. But the voters we poll are almost all over seventy years old and live in nursing homes. Our sample is biased because it does not reflect the makeup of the target group, most of whom are people under forty-five who live in their own homes, work in factories or offices, and have school-age children. Any enumerative argument based on this survey would be weak.

We are often guilty of biased sampling in everyday situations. One way this happens is through a phenomenon called selective attention (see Chapters 2 and 4), the tendency to observe and remember things that reinforce our beliefs and to gloss over and dismiss things that undercut those beliefs. We may tell our friends that The Sopranos is a lousy TV series because we remember that three episodes were boring—but we conveniently forget the four other episodes that we thought were superb. Or we may be convinced that Dr. Jones is one of the legendary “absent-minded professors.” But this generalization seems plausible to us only because we’re on the lookout for instances in which the professor’s behavior seems to fit the stereotype, and we don’t notice instances that contradict the stereotype.

Opinion Polls

Enumerative inductions reach a high level of sophistication in the form of opinion polls conducted by professional polling organizations. Opinion polls are used to arrive at generalizations about everything from the outcome of presidential elections to public sentiments about cloning babies to the consumer’s appetite for tacos. But as complex as they are, opinion polls are still essentially inductive arguments (or the basis of inductive arguments) and must be judged accordingly.

So as inductive arguments, opinion polls should (1) be strong and (2) have true premises. More precisely, any opinion poll worth believing must (1) use a large
FURTHER THOUGHT

How Survey Questions Go Wrong

Many opinion polls are untrustworthy because of flaws in the way the questions are asked. The sample may be large enough and representative in all the right ways, but the poll is still dubious. Here are a few of the more common problems.

QUESTION PHRASING

Poll results can be dramatically skewed simply by the way the questions are worded. A poll might ask, for example, “Are you in favor of a woman’s right to kill her unborn child?” The question is ostensibly about a woman’s right to terminate a pregnancy through abortion and is supposed to be a fair measure of attitudes on the question. But the wording of the question practically guarantees that a very large percentage of respondents will answer “no.” The controversial and emotionally charged characterization of abortion as the killing of an unborn child would likely persuade many respondents to avoid answering “yes.” More neutral wording of the question would probably elicit a very different set of responses.

Another example: A 1995 poll of African Americans discovered that 95 percent of the sample group approved of a local school voucher program. To get this huge approval rating, the survey question was worded like this: “Do you think that parents in your area should or should not have the right to choose which local schools their children will attend?” Who would want to give up such a right? No wonder the question elicited an overwhelming number of “shoulds.”

Such biased wording is often the result of pollster sloppiness. Many other times it’s a deliberate attempt to manipulate the poll results. The crucial test of polling questions is whether they’re likely to bias responses in one direction or another. Fair questions aren’t skewed this way—or are skewed as little as possible.

QUESTION ORDERING

The order in which questions are asked in a poll can also affect the poll results. Pollsters know that if the economy is in bad shape and they ask people about the economic mess first and then ask them how they like the president, the respondents are likely to give the president lower marks than if the order of the questions was reversed. Likewise, if you’re asked specific questions about crimes that have been committed in your home town and then you’re asked if you feel safe from crime, you’re more likely to say no than if you’re asked the questions in reverse order.

“Facts do not cease to exist because they are ignored.”
—Aldous Huxley
RESTRICTED CHOICES

Opinion polls frequently condense broad spectrums of opinions on issues into a few convenient choices. Some of this condensation is necessary to make the polling process manageable. But some of it is both unnecessary and manipulative, seriously distorting the opinions of those polled. Daniel Goleman of the New York Times offers this example: "In one survey . . . people were asked if they felt ‘the courts deal too harshly or not harshly enough with criminals.’ When offered just the two options, 6 percent said ‘too harshly’ and 78 percent answered ‘not harshly enough.’ But when a third alternative was added—‘don’t have enough information about the courts to say’—29 percent took that option, and 60 percent answered ‘not harshly enough.’"

enough sample that accurately represents the target population in all the relevant population features and (2) generate accurate data (the results must correctly reflect what they purport to be about). A poll can fail to meet this latter requirement through data-processing errors, botched polling interviews, poorly phrased questions, and the like. (See the box “How Survey Questions Go Wrong.”)

In national polling, samples need not be enormous to be accurate reflections of the larger target population. Modern sampling procedures used in national polls can produce representative samples that are surprisingly small. Polling organizations such as Gallup and Harris regularly conduct polls in which the target group is American adults (more than 187 million), and the representative sample consists of only one thousand to fifteen hundred individuals.

How can a sample of one thousand be representative of almost two hundred million people? By using random sampling. To ensure that a sample is truly representative of the target group, the sample must be selected randomly from the target group. In a simple random selection, every member of the target group has an equal chance of being selected for the sample. Imagine that you want to select a representative sample from, say, one thousand people at a football game, and you know very little about the characteristics of this target population. Your best bet for getting a representative sample of this group is to choose the sample members at random. Any nonrandom selection based on preconceived notions about what characteristics are representative will likely result in a biased sample.

Selecting a sample in truly random fashion is easier said than done (humans have a difficult
FURTHER THOUGHT

Mean, Median, and Mode

If you read enough opinion polls, you will surely encounter one of these terms: mean, median, or mode. These concepts are invaluable in expressing statistical facts, but they can be confusing. Mean is simply an average. The mean of these four numbers—6, 7, 4, and 3—is 5 (6 + 7 + 4 + 3 = 20 divided by 4 = 5). The median is the middle point of a series of values, meaning that half the values are above the point and half the values are below the point. The median of these eleven values—3, 5, 7, 13, 14, 17, 21, 23, 24, 27, 30—is 17 (the number in the middle). The mode is the most common value. The mode in this series of values—7, 13, 13, 14, 17, 21, 21, 27, 30, 30—is 13 (the most frequently appearing value).

The notions of mean, median, and mode are often manipulated to mislead people. For example, let’s say that the dictator of Little Island Nation (population one thousand) proposes a big tax cut for everyone, declaring that the mean tax savings will be $5000 (the total tax cut divided by one thousand taxpayers). The Islanders begin to gleefully envision how they will spend their $5000. But then they learn that the mean figure has been skewed higher because of a few millionaires whose tax savings will be $100,000 or more. The tax savings for the vast majority of taxpayers is actually less than $500. The $5000 figure that the dictator tossed out is the true mean—but painfully misleading. To the Islanders, the median tax savings is much more revealing: The median is $400. The mode, the most common figure, is $300. When they get all the facts, the Islanders stage a revolt—the first one in history caused by a better understanding of statistics.

“The so-called science of poll-taking is not a science at all but a mere necromancy. People are unpredictable by nature, and although you can take a nation’s pulse, you can’t be sure that the nation hasn’t just run up a flight of stairs.”

—E. B. White
survey and are eager to spout off; or who may simply like to fill out questionnaires. Magazines, newspapers, talk shows, and news programs sometimes acknowledge the use of self-selecting samples by labeling the survey in question as "unscientific." But whether or not that term is used, the media frequently tout the results of such distorted surveys as though the numbers actually proved something.

So a well-conducted poll using a random sample of one thousand to fifteen hundred people can reliably reflect the opinions of the whole adult population. Even so, if a second well-conducted poll is done in exactly the same way, the results will not be identical to that of the first poll. The reason is that every instance of sampling is only an approximation of the results that you would get if you polled every single individual in a target group. And, by chance, each attempt at sampling will yield slightly different results. If you dipped a bucket into a pond to get a one gallon sample of water, each bucketful would be slightly different in its biological and chemical content—even if the pond's content was very uniform.

**NEWSMAKERS**

Is Barack Obama the Antichrist?

A 2010 Harris poll says that 14 percent of Americans believe President Obama may be the antichrist. Really? Some sharp observers at *Newsweek* aren't buying it. Their reason, they say, is that the survey has built-in biases. According to *Newsweek*,

The poll started by telling people "Here are some things people have said about President Obama" and then asked them to agree or disagree with a series of pejorative statements—from "Obama wants the terrorists to win," to "Obama may be the antichrist." Respondents were not given a set of alternative statements to consider. As ABC’s award-winning pollster Gary Langer explains, presenting the questions like that practically guarantees a skewed result. "Some people have said ‘is a biasing introductory phrase,” he writes. “It imbeds the subsequent statements with an air of credibility—particularly when you don’t note that others say something else.”

Sample selection was also a problem: It was self-selecting. Participants agreed to take an online survey concerning adverse characterizations of the president and to accept cash and prizes for doing so. The result was a nonrandom sample and an unreliable poll.
Such differences are referred to as the **margin of error** for a particular sampling or poll. Competently executed opinion polls will state their results along with a margin of error. A presidential poll, for example, might say that Candidate X will receive 62 percent of the popular vote, plus or minus 3 points (a common margin of error for presidential polls). The usual way of expressing this number is 62 percent ±3. This means that the percentage of people in the target population who will likely vote for Candidate X is between 59 and 65 percent.

Connected to the concept of margin of error is the notion of **confidence level**. In statistical theory, the confidence level is the probability that the sample will accurately represent the target group within the margin of error. A confidence level of 95 percent (the usual value) means that there is a 95 percent chance that the results from polling the sample (taking into account the margin of error) will accurately reflect the results that we would get if we polled the entire target population. So if our aforementioned presidential poll has a 95 percent confidence level, we know that there’s a 95 percent chance that the sampling results of 62 percent ±3 points will accurately reflect the situation in the whole target group. Of course, this confidence level also means that there’s a 5 percent chance that the poll’s results will not be accurate.

Note that “confidence level” refers only to sampling error, the probability of the sample not accurately reflecting the true values in the target population. It doesn’t tell you anything about any other kinds of polling errors such as bias that can occur because of poorly worded questions or researchers who may consciously or unconsciously influence the kinds of answers received.

Sample size, margin of error, and confidence level are all related in interesting ways.

- Up to a point, the larger the sample, the smaller the margin of error because the larger the sample, the more representative it is likely to be. Generally, for national polls, a sample size of six hundred yields a margin of error of 65 points; a sample of one thousand, 64 points; and a sample of fifteen hundred, 63 points. But increasing the sample size substantially to well beyond one thousand does not substantially decrease the margin of error. Boosting the sample from fifteen hundred to ten thousand, for example, pushes the margin of error down to only 1 percent.

- The lower the confidence level, the smaller the sample size can be. If you’re willing to have less confidence in your polling results, then a smaller sample will do. If you can accept a confidence level of only 90 percent (a 10 percent chance of getting inaccurate
Polling the Clueless

Sometimes polls end up surveying not the views of people with genuine opinions but what has been called "non-attitudes." This happens when respondents answer polling questions even though they have no real opinion on the subject or no idea what the questions are really about. Presumably, people—being people—would rather give a bogus answer than admit that they are clueless.

In one landmark poll conducted many years ago, respondents were asked, "Some people say that the 1975 Public Affairs Act should be repealed. Do you agree or disagree with this idea?" One-third of those polled offered their opinion on the issue. Trouble was, the Public Affairs Act did not exist. The pollsters made it up.

results), then you don't need a sample size of fifteen hundred to poll the adult population.

- The larger the margin of error, the higher the confidence level can be. With a large margin of error (68, for example), you will naturally have more confidence that your survey results will fall within this wide range. This idea is the statistical equivalent of a point made earlier: You can have more confidence in your enumerative inductive argument if you qualify, or decrease the precision of, the conclusion.

**Enumerative Induction**

- Target group: The class of individuals about which an inductive generalization is made
- Sample: The observed members of a target group
- Relevant property: The property under study in a target group
- Hasty generalization: The drawing of a conclusion about a target group based on an inadequate sample size
- Biased sample: A sample that is not representative of its target group
- Simple random sampling: The selecting of a sample to ensure that each member of the target group has an equal chance of being chosen
- Margin of error: The variation between the values derived from a sample and the true values of the whole target group
- Confidence level: The probability that the sample will accurately represent the target group within the margin of error
To sum up: An enumerative induction, like any other inductive argument, must be strong and have true premises for us to be justified in accepting the conclusion. A strong enumerative induction must be based on a sample that is both large enough and representative. An opinion poll, as a sophisticated enumerative induction, must use a sufficiently large and representative sample and ensure that the gathered data accurately reflect what’s being measured.

Exercise 8.1

For each of the following enumerative inductions, (1) identify the target group, sample, and relevant property; (2) indicate whether the argument is strong or weak; and (3) if it’s weak, say whether the problem is a sample that’s too small, not representative, or both. Assume that the information provided in the premises of each argument is true.

1. Two-thirds of the adults in New York City identify themselves as “pro-choice” in the abortion debate. And almost 70 percent of adults in San Francisco do. This makes the situation perfectly clear: A large majority of the people in this country are pro-choice.

2. Most people are fed up with celebrities who get on their soapbox and air their political opinions. When people on the street have been asked by TV reporters how they feel about this issue, they almost always say that they wish celebrities would keep their opinions to themselves.

3. Doctors used to think that anti-arrhythmic drugs were the cure for irregular heartbeats. They overprescribed these drugs and fifty thousand patients died. Doctors used to believe that the cure for ulcers was a bland diet, but that turned out to be wrong too. Every new treatment we see these days sounds great. But history tells us that they will all turn out to be worthless.

4. I’ve asked at least a dozen first-year students at this university whether the United States should go to war with “terrorist” countries, and they all have said no. So most of the students at this university are against such a militant policy.

5. A randomized Gallup poll of Berkeley students shows that 90 percent of them are in favor of immigration reform. Thus, we can safely say that Americans definitely want immigration reform.

6. In every winter for the past twenty years Buffalo has received several feet of snow. Therefore, assuming that the effects of global warming are minimal, Buffalo is likely to get several feet of snow in the next fifty winters.

7. Most newspaper reports of crimes in Chicago involve alleged perpetrators who belong to racial minorities. Therefore, most crimes in Chicago are committed by racial minorities.

8. Eighty-five percent of dentists who suggest that their patients chew gum recommend Brand X gum. Therefore, 85 percent of dentists recommend Brand X gum.
2. Anita supplements her research by conducting phone interviews of a random sample of eight hundred adult residents of her city (population one million), asking a slightly modified question: “Are you willing to support the arts by giving money to local theater groups?” She conducts a similar poll in another large city. In both polls, at least 60 percent of respondents say yes.

3. The sociologist interviews three hundred of her friends (instead of two hundred) who belong to the target group, and she asks four hundred (instead of two hundred) of her female colleagues at her college to complete and return a survey asking the key question. Again, 75 percent of respondents say that they are not satisfied with their partners’ performance.

4. The national polling organization surveys fifteen hundred physicians of various specialties chosen randomly from a national registry. Ninety-five percent of the respondents say that obstetrician-gynecologists provide quality care for pregnant women.

5. The magazine receives over thirty thousand completed questionnaires in the mail (instead of twenty thousand). Fifty-five percent of the respondents say that they’ve been sexually harassed at work.

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**Analogical Induction**

An analogy is a comparison of two or more things alike in specific respects. In literature, science, and everyday life, analogies are used to explain or describe something. Analogies (often in the form of similes) can be powerful literary devices, both unforgettable and moving:

\[
\ldots \text{the evening is spread out against the sky} \\
\text{Like a patient etherized upon a table} \ldots \\
[T. S. Eliot]
\]

\[
\ldots \text{As cold waters to a thirsty soul,} \\
\text{so is good news from a far country.} \\
[Proverbs 25:25]
\]

\[
\ldots \text{Out, out brief candle!} \\
\text{Life’s but a walking shadow, a poor player} \\
\text{That struts and frets his hour upon the stage} \\
\text{And then is heard no more. It is a tale} \\
\text{Told by an idiot, full of sound and fury,} \\
\text{Signifying nothing.} \\
[Macbeth, Act V]
\]

But an analogy can also be used to argue *inductively for a conclusion*. Such an argument is known as an *analogical induction*, or simply an *argument by analogy*.
An analogical induction reasons this way: Because two or more things are similar in several respects, they must be similar in some further respect. For example:

Humans can move about, solve mathematical equations, win chess games, and feel pain.
Robots are like humans in that they can move about, solve mathematical equations, and win chess games.
Therefore, it’s probable that robots can also feel pain.

This argument says that because robots are like humans in several ways (ways that are already known or agreed on), they must be like humans in yet another way (a way that the argument is meant to establish).
So analogical induction has this pattern:

Thing A has properties $P_1$, $P_2$, $P_3$ plus the property $P_4$.
Thing B has properties $P_1$, $P_2$, and $P_3$.
Therefore, thing B probably has property $P_4$.

Argument by analogy, like all inductive reasoning, can establish conclusions only with a degree of probability. The greater the degree of similarity between the two things being compared, the more probable the conclusion is.
Arguments by analogy are probably used (and misused) in every area of human endeavor—but especially in law, science, medicine, ethics, archaeology, and forensics. Here are a few examples.

Argument 3: Medical Science
Mice are mammals, have a mammalian circulatory system, have typical mammalian biochemical reactions, respond readily to high blood pressure drugs, and experience a reduction in blood cholesterol when given the new Drug Z.
Humans are mammals, have a mammalian circulatory system, have typical mammalian biochemical reactions, and respond readily to high blood pressure drugs. Therefore, humans will also experience a reduction in blood cholesterol when given the new Drug Z.

Argument 4: Religion
A watch is a mechanism of exquisite complexity with numerous parts precisely arranged and accurately adjusted to achieve a purpose—a purpose imposed by the watch’s designer. Likewise the universe has exquisite complexity with countless parts—from atoms to asteroids—that fit together precisely and accurately to produce certain effects as though arranged by plan. Therefore, the universe must also have a designer.

Argument 5: Law
The case before the court involves a school-sponsored charity drive at which school officials led a public prayer. At issue is whether the school officials were in violation of the constitutional ban on government support of religion. A similar case—a relevant precedent—involved school-sponsored prayer at a school soccer game, and again at issue was whether the school
was in violation of the constitutional ban on government support of religion. In that case, the high court ruled that the school-sponsored prayer was unconstitutional. Therefore, the high court should also rule in the charity-drive case that the officially led prayer is unconstitutional.

**Argument 6: Forensics**

Whenever we have observed this pattern in the spatter of blood, we have subsequently learned that the gunshot victim was about 4 feet from the gun when it was fired and that the victim was facing away from the assailant. In this crime scene, we have exactly the same pattern of blood spatter. Therefore, the victim was about 4 feet from the gun when it was fired and was facing away from the assailant.

Arguments by analogy are easy to formulate—perhaps too easy. To use an analogy to support a particular conclusion, all you have to do is find two things with some similarities and then reason that the two things are similar in yet another way. You could easily reach some very loopy conclusions. You could argue this, for instance: Birds have two legs, two eyes, breathe air, and fly; and humans have two legs, two eyes, and breathe air; therefore, humans can also fly. So the question is, how do we sort out the worthy analogical inductions from the

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**Further Thought**

**Analogical Induction in Moral Reasoning**

In Chapter 11 we’ll study in detail the uses of argument and critical thinking in moral reasoning. For now, it’s sufficient to know this: When we try to show that a particular action is right or wrong, we often rely on argument by analogy. We argue that since an action is relevantly similar to another action, and the former action is clearly right (or wrong), then we should regard the latter action in the same way. For example, we might propose an argument like this:

Premise 1: Caring more for the members of one’s own family than outsiders is morally permissible.

Premise 2: America’s policy of giving more aid to its own citizens than those of other countries is relevantly similar to caring more for the members of one’s own family than outsiders.

Conclusion: Therefore, America’s policy of giving more aid to its own citizens than those of other countries is probably morally permissible.

Here, as in any argument by analogy, the conclusion can be established only with a degree of probability. And we would evaluate its strength the same way we would any other analogical argument.
unworthy (or really wacky)? How do we judge which ones have conclusions worth accepting and which ones don't?

Fortunately, there are some criteria we can use to judge the strength of arguments by analogy:

1. Relevant similarities
2. Relevant dissimilarities
3. The number of instances compared
4. Diversity among cases

If you find yourself thinking that they make perfect sense, that's probably because you already use these criteria in your own arguments by analogy.

**Relevant Similarities**

The more relevant similarities there are between the things being compared, the more probable the conclusion. Consider this argument:

*In the Vietnam War, the United States had not articulated a clear rationale for fighting there, and the United States lost. Likewise, in the present war the United States has not articulated a clear rationale for fighting. Therefore, the United States will lose this war too.*

There is just one relevant similarity noted here (the lack of rationale). As it stands, this argument is weak; the two wars are only dimly analogous. A single similarity between two wars in different eras is not enough to strongly support the conclusion. But watch what happens if we add more similarities:

*In the Vietnam War, the United States had not articulated a clear rationale for fighting, there was no plan for ending the involvement of U.S. forces (no exit strategy), U.S. military tactics were inconsistent, and the military's view of enemy strength was unrealistic. The United States lost the Vietnam War. Likewise, in the present war, the United States has not articulated a clear rationale for fighting, there is no exit strategy, U.S. tactics are inconsistent, and the military's view of enemy strength is naive. Therefore, the United States will also lose this war.*

With these additional similarities between the Vietnam War and the current conflict, the argument is considerably stronger. (The premises, of course, may be false, rendering the argument not cogent, even if the inference were strong.) Arguments 3–6 (medical science, religion, law, and forensics) can also be strengthened by citing additional relevant similarities between the things compared.

Notice that this first criterion involves relevant similarities. The similarities cited in an analogical induction can't strengthen the argument at all if they have nothing to do with the conclusion. A similarity (or dissimilarity) is relevant to an argument by analogy if it has an effect on whether the conclusion is probably true. The argument on war that was just given mentions five different similarities between the Vietnam War and the present war, and each similarity is
relevant because it has some bearing on the probability of the conclusion. But what if we added these similarities?

1. In both wars, some combatants have green eyes.
2. In both wars, some soldiers are taller than others.
3. In both wars, ticket sales to movies in the United States increase.

These factors would make no difference to the probability of the conclusion. They're irrelevant and can neither strengthen nor weaken the argument.

**Relevant Dissimilarities**

Generally, the more relevant dissimilarities, or disanalogies, there are between the things being compared, the less probable the conclusion. Dissimilarities weaken arguments by analogy. Consider argument 3 (regarding Drug Z). What if we discover that cholesterol-lowering drugs that work in mice almost never work in humans? This one dissimilarity would severely weaken the argument and make the conclusion much less probable.

Pointing out dissimilarities in an analogical induction is a common way to undermine the argument. Sometimes finding one relevant dissimilarity is enough to show that the argument should be rejected. A familiar response to argument 4 (the watch argument) is to point out a crucial dissimilarity between a watch and the universe: The universe may resemble a watch (or mechanism) in some ways, but it also resembles a living thing, which a watch does not.

**The Number of Instances Compared**

The greater the number of instances, or cases, that show the relevant similarities, the stronger the argument. In the war argument, for example, there is only one instance that has all the relevant similarities: the Vietnam War. But what if there were five additional instances—five different wars that have the relevant similarities to the present war? The argument would be strengthened. The Vietnam War, though it is relevantly similar to the present war, may be an anomaly, a war with a unique set of properties. But citing other cases that are relevantly similar to the present war shows that the relevant set of similarities is no fluke.

Argument 6 (the forensics induction) is an especially strong argument in part because it cites numerous cases. It implies the existence of such instances when it says “Whenever we have observed this pattern . . .”

**Diversity Among Cases**

As we've seen, dissimilarities between the things being compared weaken an argument by analogy. Such dissimilarities suggest that the things being compared are not strongly analogous. And we've noted that several cases (instead of just one) that exhibit the similarities can strengthen the argument. In this criterion, however, we focus on a very different point: The greater the diversity among the cases that exhibit the relevant similarities, the stronger the argument.
Take a look at this argument:

(1) In the 1990s a U.S. senator, a Republican from Virginia, was chairman of the commerce committee, had very close ties to Corporation X, had previously worked for Corporation X before coming to office, and was found to have been taking bribes from Corporation X.

(2) In the 1980s another U.S. senator, a Democrat from Texas, was chairman of the commerce committee, had very close ties to Corporation X, had previously worked for Corporation X before coming to office, and was found to have been taking bribes from Corporation X.

(3) In the 1970s another U.S. senator, an Independent from Arkansas with strong religious values, was chairman of the commerce committee, had very close ties to Corporation X, had previously worked for Corporation X before coming to office, and was found to have been taking bribes from Corporation X.

(4) Now the newly elected Senator Jones, a Democrat from New York with strong support from labor unions, is chairman of the commerce committee, has very close ties to Corporation X, and has previously worked for Corporation X before coming to office.

(5) Therefore, Senator Jones will take bribes from Corporation X.

Here we have several similarities in question, and they exist between the Senator Jones situation (described in premise 4) and three other cases (detailed in premises 1–3). But what makes this argument especially strong is that the cases are diverse despite the handful of similarities—one case involves a Republican senator from Virginia; another, a Democratic senator from Texas; and finally a religious Independent senator from Arkansas. This state of affairs suggests that the similarities are not accidental or contrived but are strongly linked even in a variety of situations.

**REVIEW NOTES**

**ANALOGICAL INDUCTION**

**ANALOGICAL ARGUMENT PATTERN**

Thing A has properties $P_1$, $P_2$, $P_3$, plus the property $P_4$.

Thing B has properties $P_1$, $P_2$, and $P_3$.

Therefore, thing B probably has property $P_4$.

**CRITERIA FOR JUDGING ARGUMENTS BY ANALOGY**

1. The number of relevant similarities
2. The number of relevant dissimilarities
3. The number of instances compared
4. The diversity among cases
As you know, an inductive argument cannot guarantee the truth of the conclusion, and analogical inductions are no exception. But by carefully applying the foregoing criteria, we can increase our chances of arriving at well-supported conclusions (or of identifying those conclusions that are not). This is happily the case—even though there is no magic formula for using the criteria in real-life situations.

Exercise 8.6

Evaluate each of the following passages and indicate whether it contains (a) an argument by analogy, (b) a literary analogy, or (c) an enumerative induction. If the passage contains an argument by analogy, indicate the total number of things (instances) being compared, the relevant similarities mentioned or implied, the conclusion, and whether the argument is strong or weak.

1. “The moon was a ghostly galleon tossed upon cloudy seas.” [Alfred Noyes]

2. “Duct tape is like the force. It has a light side, a dark side, and it holds the universe together.” [Carl Zwanzig]

3. Girls are smarter than boys. Girls in the debate club always argue better than boys. And the mean grade-point average of the girls in the glee club is higher than that of the boys in the club.

4. “Howard Hughes was able to afford the luxury of madness, like a man who not only thinks he is Napoleon but hires an army to prove it.” [Ted Morgan]

5. “Look around the world; contemplate the whole and every part of it: you will find it to be nothing but one great machine, subdivided into an infinite number of lesser machines, which again admit of subdivisions, to a degree beyond what human senses and faculties can trace and explain. All these various machines, and even their most minute parts, are adjusted to each other with an accuracy, which ravishes into admiration all men who have ever contemplated them. The curious adapting of means to ends, throughout all nature, resembles exactly, though it much exceeds, the production of human contrivance; of human design, thought, wisdom, and intelligence. Since therefore the effects resemble each other, we are led to infer, by all the rules of analogy, that the causes also resemble; and that the Author of Nature is somewhat similar to the mind of men; though possessed of much larger faculties, proportioned to the grandeur of the work, which he has executed. By this argument a posteriori, and by this argument alone, do we prove at once the existence of a Deity, and his similarity to human mind and intelligence.” [David Hume]

*6. My brother was always good at arithmetic, so he'll be a whiz at algebra.

7. Tolerating a vicious dictator is like tolerating a bully on the block. If you let the bully push you around, sooner or later he will beat you up and take everything you have. If you let a dictator have his way, he will abuse
how, under appropriate conditions, a cell may, in the course of untold millions of years, give origin to the human race.” [Herbert Spencer]

4. The casinos in Atlantic City have brought a tremendous amount of revenue into both area businesses and local government, without inviting the evils of organized crime and causing the degradation of law and order or quality of life. The same can be said for the Turning Stone casino in upstate New York, as well as for Casino Niagara in Niagara Falls, Canada. A casino built in Buffalo, New York, will provide all the same benefits without the disadvantages.

5. A well-established moral principle is that one is morally justified in using deadly force in self-defense when one is threatened with death or great pain from an assailant. A disease such as terminal cancer can also threaten one with death or great pain. So suicide—a use of deadly force—must sometimes be morally justified when it is an act of self-defense against an assailant (terminal disease) that threatens death or great pain.

6. “If we survey the universe, so far as it falls under our knowledge, it bears a great resemblance to an animal or organized body, and seems actuated with a like principle of life and motion. A continual circulation of matter in it produces no disorder; a continual waste in every part is incessantly repaired: The closest sympathy is perceived throughout the whole system. And each part or member, in performing its proper offices, operates both to itself preservation and to that of the whole. The world, therefore, I infer, is an animal, and the Deity is the soul of the world, activating it and activated by it.” [Philo, in Hume’s Dialogues Concerning Natural Religion]

7. “The mass of men serve the State thus, not as men mainly, but as machines, with their bodies. They are the standing army, and the militia, jailers, constables, posse comitatus, &c. In most cases there is no free exercise whatever of the judgment or of the moral sense; but they put themselves on a level with wood and earth and stones, and wooden men can perhaps be manufactured that will serve the purpose as well. Such command no more respect than men of straw, or a lump of dirt.” [Henry David Thoreau]

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### Causal Arguments

Our world is a shifting, multifarious, complicated web of causes and effects—and that’s an oversimplification. Incredibly, the normal human response to the apparent causal chaos is to jump in and ask what causes what. What causes breast cancer? What made Malcolm steal the car? What produced that rash on Norah’s arm? What brought the universe into existence? When we answer such questions (or try to), we make a **causal claim**—a statement about the causes of things. And when we try to prove or support a causal claim, we make a **causal argument**—an inductive argument whose conclusion contains a causal claim.

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"I would rather discover a single causal connection than win the throne of Persia."
—Democritus
Causal arguments, being inductive, can give us only probable conclusions. If the premises of a strong causal argument are true, then the conclusion is only probably true, with the probability varying from merely likely to highly probable. The probabilistic nature of causal arguments, however, is not a failing or weakness. Causal reasoning is simply different from deductive reasoning, and it is our primary method of acquiring knowledge about the workings of the world. The great human enterprise known as science is concerned mainly with causal processes and causal arguments, and few people would consider this work inferior or unreliable because it was not deductively unshakeable.

Causal arguments can come in several inductive forms, some of which you already know about. For example, we sometimes reason about cause and effect using enumerative induction:

One time, when I made the aluminum rod come in contact with the rotating circular-saw blade, sparks flew.

Another time, when I made the aluminum rod come in contact with the rotating circular-saw blade, sparks flew.

Many other times, when I made the aluminum rod come in contact with the rotating circular-saw blade, sparks flew.

Therefore, making the aluminum rod come in contact with the rotating circular-saw blade always causes sparks to fly.

Occasionally, we may argue to a causal conclusion using analogical induction:

Ten years ago a massive surge in worldwide oil prices caused a recession.

Five years ago a massive surge in worldwide oil prices caused a recession.

Therefore, the current massive surge in worldwide oil prices will cause a recession.

Most often, though, we use another type of induction in which we reason to a causal conclusion by pinpointing the best explanation for a particular effect. Let’s say that after a hailstorm you discover that the roof of your car, which you had left parked outside in the driveway, has a hundred tiny dents in it. You might reason like this: The dents could have been caused by the mischievous kids next door, or by a flock of lunatic woodpeckers, or by the hailstorm. After considering these options (and a few others), you decide that the best explanation (or hypothesis) for the dents is the hailstorm. So you conclude that the hailstorm caused the dents in your car’s roof.

This is a very powerful and versatile form of inductive reasoning called inference to the best explanation. It’s the essence of scientific thinking and a
mainstay of our everyday problem-solving and knowledge acquisition (whether causal or noncausal). Because of the importance and usefulness of such reasoning, this text devotes three chapters to it in Part 4. So we won’t try to cover the same ground here. Instead, we’ll concentrate on some other inductive patterns of reasoning that have traditionally been used to assess causal connections.

Testing for Causes

English philosopher John Stuart Mill (1806–1873) noted several ways of evaluating causal arguments and formulated them into what are now known as “Mill’s methods” of inductive inference. Despite their fancy name, however, the methods are basically common sense and are used by just about everyone. They also happen to be the basis of a great deal of scientific testing. Let’s look at a few of the more important ones.

Agreement or Difference

A modified version of Mill’s Method of Agreement says that if two or more occurrences of a phenomenon have only one relevant factor in common, that factor must be the cause.

Imagine that dozens of people stop into Elmo’s corner bar after work as they usually do and that ten of them come down with an intestinal illness one hour after leaving the premises. What caused them to become ill? There are a lot of possibilities. Maybe a waiter who had a flu-like illness sneezed into their drinks, or the free tacos had gone bad, or another patron had a viral infection and passed it along via a handshake. But let’s say that there is only one relevant factor that’s common to all ten people who got sick: They all had a drink from the same bottle of wine. We could then plausibly conclude that something in the wine probably caused the illness.

Public health officials often use the Method of Agreement, especially when they’re trying to determine the cause of an unusual illness in a population of several thousand people. They might be puzzled, say, by an unusually large number of cases of rare liver disease in a city. If they discover that all the affected people have the same poison in their bloodstreams—and this is the only common relevant factor—they have reason to believe that the poison is the cause of the liver disease. In such situations, the poison may turn out to have an industrial or agricultural source.

Here’s a schematic of an argument based on the Method of Agreement:

Instance 1: Factors $a$, $b$, and $c$ are followed by $E$.
Instance 2: Factors $a$, $c$, and $d$ are followed by $E$.
Instance 3: Factors $b$ and $c$ are followed by $E$.
Instance 4: Factors $c$ and $d$ are followed by $E$.
Therefore, factor $c$ is probably the cause of $E$. 
There’s only one factor—factor c—that consistently accompanies effect E. The other factors are sometimes present and sometimes not. We conclude then that factor c brings about E.

Mill’s (modified) Method of Difference says that the relevant factor present when a phenomenon occurs, and absent when the phenomenon does not occur, likely is the cause. Here we look not for factors that the instances of the phenomenon have in common, but for factors that are points of difference among the instances.

Suppose that the performance of football players on a major league team has been consistently excellent except for six players who’ve recently been playing the worst games of their careers. The only relevant difference between the high- and low-performing players is that the latter have been taking daily doses of Brand X herbal supplements. If the supplement dosing is really the only relevant difference, we could plausibly conclude that the supplements are causing the lousy performance. (Finding out if the supplements are indeed the only relevant difference, of course, is easier said than done.)

So arguments based on the Method of Difference have this form:

Instance 1: Factors a, b, and c are followed by E.
Instance 2: Factors a and b are not followed by E.
Therefore, factor c is probably the cause of E.

Both Agreement and Difference

If we combine these two reasoning patterns, we get a modified version of what Mill called the Joint Method of Agreement and Difference. Using this joint method is, obviously, just a matter of applying both methods simultaneously—a procedure that generally increases the probability that the conclusion is true. This combined method, then, says that the likely cause is the one isolated when you (1) identify the relevant factors common to occurrences of the phenomenon (the Method of Agreement) and (2) discard any of these that are present even when there are no occurrences (the Method of Difference).

Let’s apply this combined method to the mystery illness at Elmo’s bar. Say that among the ten patrons who become ill, the common factors are that they all drank from the same bottle of wine, and they all had the free tacos. So we reason that the likely cause is either the wine or the tacos. After further investigation, though, we find that other patrons who ate the tacos did not become ill. We conclude that the wine is the culprit.

The schematic for arguments based on the Joint Method of Agreement and Difference is:

Instance 1: Factors a, b, and c are followed by E.
Instance 2: Factors a, b, and d are followed by E.
Instance 3: Factors b and c are not followed by E.
Instance 4: Factors b and d are not followed by E.
Therefore, factor a is probably the cause of E.
Factors \(a\) and \(b\) are the only relevant factors that are accompanied by \(E\). But we can eliminate \(b\) as a possibility because when it's present, \(E\) doesn't occur. So \(b\) can't be the cause of \(E\); \(a\) is most likely the cause.

You can see the Joint Method of Agreement and Difference at work in modern "controlled trials" used to test the effectiveness of medical treatments. In these experiments, there are two groups of subjects—one known as the experimental group; the other, the control group. The experimental group receives the treatment being tested, usually a new drug. The control group receives a bogus, or inactive, treatment (referred to as a placebo). This setup helps ensure that the two groups are as similar as possible and that they differ in only one respect—the use of the genuine treatment. A controlled trial, then, reveals the relevant factor common to the occurrence of the effect, which is the subjects' response to the treatment (Method of Agreement). And it shows the only important difference between the occurrence and nonoccurrence of the effect: the use of the treatment being tested.

**Correlation**

In many cases, relevant factors aren't merely present or absent during occurrences of the phenomenon—they are closely correlated with the occurrences. The cause of an occurrence varies as the occurrence (effect) does. For such situations Mill formulated the Method of Concomitant Variation. This method says that when two events are correlated—when one varies in close connection with the other—they are probably causally related.

If you observe that the longer you boil eggs, the harder they get (and no other relevant factors complicate this relationship), you can safely conclude that this correlation between boiling and hardening is a causal connection. You have good evidence that the boiling causes the hardening.

In medical science, such correlations are highly prized because direct evidence of cause and effect is so hard to come by. Correlations are often indirect evidence of one thing causing another. In exploring the link between cigarette smoking and lung cancer, for example, researchers discovered first that people who smoke cigarettes are more likely to get lung cancer than those who don't smoke. But later research also showed that the more cigarettes people smoke, the higher their risk of lung cancer. Medical scientists call such a correlation a dose-response relationship. The higher the dose of the element in question (smoking), the higher the response (the more cases of lung cancer). This dose-response relationship between cigarette smoking and lung cancer is, when combined with other data, strong evidence that smoking causes lung cancer.

We can represent arguments based on the Method of Concomitant Variation like this:

Instance 1: Factors \(a\), \(b\), and \(c\) are correlated with \(E\).
Instance 2: Factors \(a\), \(b\), and increased-\(c\) are correlated with increased \(E\).
Instance 3: Factors \(a\), \(b\), and decreased-\(c\) are correlated with decreased \(E\). Therefore, factor \(c\) is causally connected with \(E\).
A very important cautionary note must accompany this discussion of correlation: Correlation, of course, does not always mean that a causal relationship is present. A correlation could just be a coincidence (see later). An increase in home PC sales is correlated with a rise in the incidence of AIDS in Africa, but this doesn’t mean that one is in any way causally linked with the other.

**FURTHER THOUGHT**

**Is It Causal Confusion or ESP?**

For over two decades, scientist-writer Susan Blackmore (with degrees in psychology, physiology, and parapsychology) has been investigating the psychology of “psychic,” or paranormal, experience. Her central hypothesis has been that people’s supposed experience of extrasensory perception, or ESP (telepathy, clairvoyance, and precognition), is the result of errors in causal thinking. Specifically, people tend to mistake coincidence for causal connection. She writes:

My hypothesis is that psychic experiences are comparable to visual illusions. The experience is real enough, but its origin lies in internal processes, not peculiarities in the observable world. Like visual illusions they arise from cognitive processes that are usually appropriate but under certain circumstances give rise to the wrong answer. In other words, they are a price we pay for using efficient heuristics.

In the case of visual illusion, illusions arise when, for example, depth is seen in two-dimensional figures and constancy mechanisms give the answer that would be correct for real depth. The equivalent in the case of psychic experiences may be the illusion that a cause is operating and an explanation is required when in fact none is. In other words, psychic experiences are illusions of causality.

Experiences of telepathy, clairvoyance, and precognition imply a coincidence that is “too good to be just chance.” This is so whether the experience involves dreaming about a person’s death and that person dies within a few hours, feeling the urge to pick up one’s partner from the station and in fact he was stranded and needed help, or betting on a horse that later wins a race.
Some people's response to such events is to say, "That was just a chance coincidence"; while others' is to say, "That cannot be chance." In the latter case the person will then look for a causal explanation for the coincidence. If none can be found, a "cause," such as ESP, may be invoked. Alternatively, some kind of noncausal but meaningful connection may be sought, such as Jung's "acausal connecting principle."

There are two possible types of error that may be made here. First, people may treat connected events as chance coincidences, thereby missing real connections between events and failing to look for explanations. Second, they may treat chance events as connected and seek for explanations where none is required. In the real world of inadequate information and complex interactions one would expect errors of both types to occur. It is the latter type that, I suggest, gives rise to experiences of ESP.

One prediction of this approach is that those people who more frequently look for explanations of chance coincidences are more likely to have psychic experiences. Therefore, sheep [believers in ESP] should be those who underestimate the probability of chance coincidences.

It has long been known that probability judgments can be extremely inaccurate. Kahneman and Tversky (1973) have explored some of the heuristics, such as "representativeness" and "availability," that people find coincidences surprising (Fall 1982; Falk and McGregor 1983). Adding specific but superfluous detail can make coincidences seem more surprising, and things that happen to subjects themselves seem more surprising to them than the same things happening to other people.

There is, however, little research relating these misjudgments to belief in the paranormal or to having psychic experiences. Blackmore and Trosclair (1985) found that sheep performed worse than goats [skeptics about ESP] on a variety of probability tasks. For example, in questions testing for responsiveness to sample size, sheep did significantly worse than goats. The well-known birthday question was asked: How many people would you need to have at a party to have a 50:50 chance that two have the same birthday? As predicted, goats got the answer right significantly more often than sheep.

Subjects also played a coin-tossing computer game and were asked to guess how many hits they would be likely to get by chance. The correct answer, 10 hits in 20 trials, seems to be rather obvious. However, the sheep gave a significantly lower mean estimate of only 7.9, while goats gave a more accurate estimate of 9.6.
Causal Confusions

Mill’s methods and other forms of causal reasoning may be common sense, but they’re not foolproof. No inductive procedure can guarantee the truth of the conclusion. More to the point, it’s easy to commit errors in cause-and-effect reasoning—regardless of the method used—by failing to take into account pertinent aspects of the situation. This section describes some of the more common causal blunders to which we’re all prey.

Misidentifying Relevant Factors

A key issue in any type of causal reasoning is whether the factors preceding an effect are truly relevant to that effect. In the Method of Agreement, for example, it’s easy to find a preceding factor common to all occurrences of a phenomenon. But that factor may be irrelevant. In the case of Elmo’s bar, what if all those who became ill had black hair? So what? We know that hair color is very unlikely to be related to intestinal illness. Relevant factors include only those things that could possibly be causally connected to the occurrence of the phenomenon being studied. We could reasonably judge that factors relevant to the intestinal illness would include all the conditions that might help transmit bacteria or viruses.

Your ability to identify relevant factors depends mostly on your background knowledge—what you know about the kinds of conditions that could produce the occurrences in which you’re interested. Lack of background knowledge might lead you to dismiss or ignore relevant factors or to assume that irrelevant factors must play a role. The only cure for this inadequacy is deeper study of the causal possibilities in question.

Mishandling Multiple Factors

Most of the time, the biggest difficulty in evaluating causal connections is not that there are so few relevant factors to consider—but that there are so many. Too often the Method of Agreement and the Method of Difference are rendered useless because they cannot, by themselves, narrow the possibilities to just one. At the same time, ordinary causal reasoning is frequently flawed because of the failure to consider all the relevant antecedent factors. (Later chapters will refer to this problem as the failure to consider alternative explanations.)

Sometimes this kind of oversight happens because we simply don’t look hard enough for possible causes. At other times, we miss relevant factors because we don’t know enough about the causal processes involved. This again is a function of skimpy background knowledge. Either way, there is no countermeasure better than your own determination to dig out the whole truth.

Being Misled by Coincidence

Sometimes ordinary events are paired in unusual or interesting ways: You think of Hawaii, then suddenly a TV ad announces low-cost fares to Maui; you receive some email just as your doorbell sounds and the phone rings; or you stand in the
Coincidence, Birth Dates, and U.S. Presidents

When we’re tempted to say that the conjunction of two events “couldn’t be just coincidence,” we should think twice. People are often lousy at determining the true likelihood of events. Recall the birth-date problem mentioned in Chapter 4. It’s the classic example of misjudged probabilities: In a random selection of twenty-three people, what is the probability that at least two of them will have the same birth date? The answer: 50 percent, or 50-50. People are usually shocked when they hear the answer. Part of the reason is that they typically underestimate how often oddball coincidences occur and fail to see that such strange conjunctions must occur from time to time. Here’s a succinct explanation of the problem from social psychologist David G. Myers:

We’ve all marveled at such coincidences in our own lives. Checking out a photocopy counter from the Hope College library desk, I confused the clerk when giving my six-digit department charge number—which just happened at that moment to be identical to the counter’s six-digit number on which the last user had finished. Shortly after my daughter, Laura Myers, bought two pairs of shoes, we were astounded to discover that the two brand names on the boxes were “Laura” and “Myers.”

And then there are those remarkable coincidences that, with added digging, have been embellished into really fun stories, such as the familiar Lincoln–Kennedy coincidences (both with seven letters in their last names, elected 100 years apart, assassinated on a Friday while beside their wives, one in Ford’s theater, the other in a Ford Motor Co. car, and so forth). We also have enjoyed newspaper accounts of
astonishing happenings, such as when twins Lorraine and Levinia Christmas, driving to deliver Christmas presents to each other near Flitcham, England, collided.

My favorite is this little known fact: In Psalm 46 of the King James Bible, published in the year that Shakespeare turned 46, the 46th word is “shake” and the 46th word from the end is “spear.” (More remarkable than this coincidence is that someone should have noted this) . . .

“In reality,” says mathematician John Allen Paulos, “the most astonishingly incredible coincidence imaginable would be the complete absence of all coincidences.” When Evelyn Marie Adams won the New Jersey lottery twice, newspapers reported the odds of her feat as 1 in 17 trillion—the odds that a given person buying a single ticket for two New Jersey lotteries would win both. But statisticians Stephen Samuels and George McCabe report that, given the millions of people who buy U.S. state lottery tickets, it was “practically a sure thing” that someday, somewhere, someone would hit a state jackpot twice. Consider: An event that happens to but one in a billion people in a day happens 2000 times a year. A day when nothing weird happened would actually be the weirdest day of all.3

lobby of a hotel thinking of an old friend—then see her walk by. Plenty of interesting pairings can also show up in scientific research. Scientists might find, for example, that men with the highest rates of heart disease may also have a higher daily intake of water. Or women with the lowest risk of breast cancer may own Toyotas. Such pairings are very probably just coincidence, merely interesting correlations of events. A problem arises, though, when we think that there nevertheless must be a causal connection involved.

For several reasons, we may very much want a coincidence to be a cause-and-effect relationship, so we come to believe that the pairing is causal. Just as often we may mistake causes for coincidences because we’re impressed or excited about the conjunction of events. The pairing of events may seem “too much of a coincidence” to be coincidence, so we conclude that one event must have caused the other. You may be thinking about how nice it would be for your sister to call you from her home in Alaska—then the phone rings, and it’s her! You’re tempted to conclude that your wishing caused her to call. But such an event, though intriguing and seemingly improbable, is not really so extraordinary. Given the ordinary laws of statistics, incredible coincidences are common and must occur. Any event, even one that seems shockingly improbable, is actually very probable over the long haul. Given enough opportunities to occur, events like this surprising phone call are virtually certain to happen to someone.

People are especially prone to “it can’t be just coincidence” thinking because, for several psychological reasons, they misjudge the probabilities involved. They may think, for example, that a phone call from someone at the moment they’re
thinking of that person is incredible—but only because they’ve forgotten about all the times they’ve thought of that person and the phone didn’t ring. Such probability misjudgments are a major source of beliefs about the paranormal or supernatural, topics that we address in Chapter 10. (See also the box “Is It Causal Confusion or ESP?” in this chapter.)

Unfortunately, there is no foolproof way to distinguish coincidence from cause and effect. But this rule of thumb can help:

Don’t assume that a causal connection exists unless you have good reason for doing so.

Generally, a good reason consists of the passing of one or more standard causal tests (such as the ones we’ve been discussing)—and being able to rule out any relevant factors that might undermine the verdict of those tests. Usually, when a cause-effect connection is uncertain, only further evaluation or research can clear things up.

Confusing Cause with Temporal Order

A particularly prevalent type of misjudgment about coincidences is the logical fallacy known as post hoc, ergo propter hoc (“after that, therefore because of that”). We believe that a cause must precede its effect. But just because one event precedes another that doesn’t mean that the earlier one caused the later. To think so is to be taken in by this fallacy. Outrageous examples of post hoc arguments include: “The rooster crowed, then the sun came up, so the rooster’s crowing caused sunrise!” and “Jasmine left her umbrella at home Monday, and this caused it to rain.” You can clearly see the error in such cases, but consider these arguments:

Argument 7
After the training for police officers was enhanced, violent crime in the city decreased by 10 percent. So enhanced training caused the decline in violent crime.

Argument 8
An hour after Julio drank the cola, his headache went away. The cola cured his headache.

Argument 9
As soon as Smith took office and implemented policies that reflected his conservative theory of economics, the economy went into a downward slide characterized by slow growth and high unemployment. Therefore, the Smith policies caused the current economic doldrums.

Argument 10
I wore my black shirt on Tuesday and got an F on a math quiz. I wore the same shirt the next day and flunked my psych exam. That shirt’s bad luck.

The conclusion of argument 7 is based on nothing more than the fact that the enhanced training preceded the reduction in violent crime. But crime rates can decrease for many reasons, and the enhanced training may have had nothing to do
with the decline in crime. For the argument to be strong, other considerations besides temporal order would have to apply—for example, that other possible causes or antecedent factors had been ruled out; that there was a close correlation between amount of training and decline in crime rates; or that in previous years (or in comparable cities) enhanced training was always followed by decreased violent crime (or no change in training was always followed by steady crime rates).

Argument 8 is also purely post hoc. Such reasoning is extremely common and underlies almost all folk remedies and a great deal of quackery and bogus self-cures. You take a vitamin E capsule, and eight hours later your headache is gone. But was it really the vitamin E that did the trick? Or was it some other overlooked factor such as something you ate, the medication you took (or didn’t take), the nap you had, the change in environment (from, say, indoors to outdoors), or the stress reduction you felt when you had pleasant thoughts? Would your headache have gone away on its own anyway? Was it the placebo effect—the tendency for people to feel better when treated even when the treatment is fake or inactive? A chief function of controlled medical testing is to evaluate cause-and-effect relationships by systematically ruling out post hoc thinking and irrelevant factors.

Argument 9 is typical post hoc reasoning from the political sphere. Unless there are other good reasons for thinking that the economic policy is causally connected to specific economic events, the argument is weak and the conclusion unreliable.

Argument 10 is 100 percent post hoc and undiluted superstition. There is no difference in kind between this argument and much of the notorious post hoc reasoning of centuries ago: “That girl gave me the evil eye. The next day I broke my leg. That proves she’s a witch, and the Elders of Salem should have her put to death!”

Confusing Cause and Effect

Sometimes we may realize that there’s a causal relationship between two factors—but we may not know which factor is the cause and which is the effect. We may be confused, in other words, about the answers to questions like these:

Does your coffee drinking cause you to feel stressed out—or do your feelings of being stressed out cause you to drink coffee?

Does participation in high school sports produce desirable virtues such as courage and self-reliance—or do the virtues of courage and self-reliance lead students to participate in high school sports?

Does regular exercise make people healthy—or are healthy people naturally prone to regular exercise?

As you can see, it’s not always a simple matter to discern what the nature of a causal link is. Again, we must rely on our rule of thumb: Don’t assume that a causal connection exists unless you have good reason for doing so. This tenet applies not only to our ordinary experience but to all states of affairs involving cause and effect, including scientific investigations.

In everyday life, sorting cause from effect is often easy because the situations we confront are frequently simple and familiar—as when we’re trying to
The Deadly Post Hoc Fallacy

Despite a growing body of scientific research showing no connection between a measles vaccine and autism in young children, many people have insisted that the vaccine causes the disorder. Some parents of autistic children reasoned that since autism symptoms arose after the children were vaccinated, the vaccine was to blame. As evidence builds against a causal link, the reasoning looks more and more post hoc—and dangerous. A recent study confirms previous findings:

Scientists who tried to replicate a study that once tied a measles vaccine with autism said on Wednesday they could not find any link and hope their study will encourage parents to vaccinate their children to combat a rash of measles outbreaks.

Parents’ refusals to have their children vaccinated against measles have contributed to the highest numbers of cases seen in the United States and parts of Europe in many years.

Measles kills about 250,000 people a year globally, mostly children in poor nations.

Public health officials have been stressing the safety of the combined measles-mumps-rubella, or MMR, shot and other childhood vaccines in the face of vocal groups who claim the immunizations may cause autism and other problems.

The U.S. Institute of Medicine has issued several definitive reports showing no connection between autism and any vaccinations.

What are the dangers for children of their parents’ post hoc reasoning? Why do you think some parents would hold to their belief in the vaccine-autism link in the face of contrary scientific evidence? Is the availability error at work here?

discover what caused the kettle to boil over. Here, we naturally rely on Mill’s methods or other types of causal reasoning. But as we’ve seen, in many other common circumstances, things aren’t so simple. We often cannot be sure that we’ve identified all the relevant factors, or ruled out the influence of coincidence,
or correctly distinguished cause and effect. Our rule of thumb, then, should be our guide in all the doubtful cases.

Science faces all the same kinds of challenges in its pursuit of causal explanations. And despite its sophisticated methodology and investigative tools, it must expend a great deal of effort to pin down causal connections. Identifying the cause of a disease, for example, usually requires not one study or experiment, but many. The main reason is that uncovering relevant factors and excluding irrelevant or misleading factors is always tough. This is why we should apply our rule of thumb even to scientific research that purports to identify a causal link. In Chapters 9 and 10, we’ll explore procedures for evaluating scientific research and for applying our rule of thumb with more precision.

Necessary and Sufficient Conditions

To fully appreciate the dynamics of cause and effect and to be able to skillfully assess causal arguments, you must understand two other important concepts: necessary conditions and sufficient conditions. Causal processes always occur under specific conditions. So we often speak of cause and effect in terms of the conditions for the occurrence of an event. Scientists, philosophers, and others go a step further and emphasize a distinction between necessary and sufficient conditions for the occurrence of an event:

A necessary condition for the occurrence of an event is one without which the event cannot occur.

A sufficient condition for the occurrence of an event is one that guarantees that the event occurs.

Suppose you drop a water-filled balloon from atop a building (aiming it at your least favorite professor, of course), and it breaks on the pavement. What are the necessary conditions for the breaking of the balloon (the effect)? There are several, including (1) your releasing the balloon, (2) the force of gravity acting on the water, (3) the weakness of the material that the balloon is made of (its breakability), and (4) the hardness of the pavement. If any one of these conditions is not present, the water balloon will not break. To state the obvious: If you don’t release

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**REVIEW NOTES**

**Causal Confusions**

- Misidentifying relevant factors
- Overlooking relevant factors
- Confusing coincidence with cause
- Confusing cause with temporal order (*post hoc* fallacy)
- Confusing cause and effect
the balloon, it won't drop. If gravity is not in force, the balloon won't fall. If the balloon material isn't breakable, it won't, well, break. If the pavement isn't hard enough, even a breakable balloon won't rupture. (For the sake of illustration, this list of necessary conditions is incomplete. Many, if not most, events in nature have large numbers of necessary conditions.)

What are the sufficient conditions for the balloon's breaking? Not one of the four conditions by itself is sufficient to cause the balloon to break. None guarantees the occurrence of the effect; none suffices to produce the event. But all the necessary conditions combined (these four and others) are sufficient to guarantee the balloon's breaking.

Failing to feed a healthy goldfish for a few weeks is a sure way to kill it. So this deprivation is a sufficient condition for its death, as is removing the water from its fishbowl. But neither taking away the fish's food nor draining its bowl is a necessary condition for a goldfish's death because its death can be caused without resorting to either of these methods. On the other hand, necessary conditions for sustaining the fish's life include feeding it, providing it with water to live in, ensuring that the water is properly oxygenated, and so on. Again, in this instance, the whole set of the necessary conditions would constitute a sufficient condition for sustaining the fish's life.

In cases in which a complete set of necessary conditions constitutes a sufficient condition for an event, we say that the conditions are individually necessary and jointly sufficient for an event to occur. As the previous examples suggest, however, it's possible to have a set of conditions that are individually necessary but not jointly sufficient. Say some of the conditions necessary for sustaining the goldfish's life are present, but not all of them are. Because some necessary conditions are missing, the sufficient condition for keeping the fish alive would not exist. On the other hand, it's also possible to have a set of conditions that are jointly sufficient but not individually necessary. By not feeding a goldfish for weeks we would create a set of conditions sufficient for the death of the fish. But these conditions aren't necessary for the death of a goldfish because we could ensure its death in other ways.

So there are conditions that are necessary but not sufficient for the occurrence of an event, and conditions that are sufficient but not necessary. There are also conditions that are both necessary and sufficient for an event. The Earth's being more massive than the moon is both a necessary and sufficient condition for the moon's being less massive than the Earth. A piece of paper's being heated to a sufficiently high temperature in the presence of oxygen is both a necessary and sufficient condition for the combustion of the paper.

In some situations, depending on our interests or practical concerns, we may focus on necessary causal conditions; in other situations, sufficient causal conditions. When we're interested in preventing or eliminating a state of affairs, we often zero in on necessary causal conditions. If you were a scientist trying to discover how to prevent mosquito infestations, you would try to determine the necessary conditions for the occurrence of mosquito infestations. Uncovering and understanding just one necessary condition could give you everything you need to control the problem. If you found out, for example, that
a necessary condition for mosquito breeding is standing water, you would need to look no further for an answer. Eliminating the standing water would prevent infestations.

When we’re interested in bringing about a state of affairs, we’re likely to focus on sufficient causal conditions. If you were a doctor devoted to treating clogged arteries in your patients, you would seek out treatments scientifically proven to be sufficient for alleviating the condition. The treatments might include surgery to remove the blockage or a procedure called balloon angioplasty to widen artery passageways.

Your success in appraising causal arguments often depends heavily on your ability to distinguish between statements expressing causes as necessary conditions and statements expressing causes as sufficient conditions. Consider:

*In the current situation, the president will send in U.S. troops if the United Nations refuses to act.*

This statement says that the condition required for the deployment of U.S. troops is the United Nations’ refusing to act. But is this a necessary or sufficient condition? The use of the word “if” by itself signals a sufficient condition. If sufficient condition is what’s meant, then the statement says that the UN’s refusing to act will automatically trigger the troop deployment. This outcome is assured if the UN refuses.

But if the statement is meant to express the idea that the UN refusal is a necessary condition, then we’re talking about a very different situation. If the UN refusal is a necessary condition, then it will not unavoidably trigger the troop deployment because the refusal may not be the only necessary condition. The idea of necessary condition is expressed by the phrase “only if” before the stipulated condition. To express necessary condition, the statement should read:

*In the current situation, the president will send in U.S. troops only if the United Nations refuses to act.*

So depending on the kind of causal condition meant, the statement could describe a war that’s sure to happen if the condition obtains—or a war that may not occur even if the condition does obtain.

As you might expect, conditions that are both necessary and sufficient are indicated by the phrase “if and only if.” For example:

*The paper will combust if and only if it’s heated to a sufficiently high temperature in the presence of oxygen.*

None of this discussion, however, should lead you to think that a causal condition must be either necessary or sufficient. It could be neither:

*Late delivery of the package caused John to miss his deadline.*

*Ricardo’s stubbornness caused the negotiations to break down.*
KEY WORDS

analogy  
argument by analogy (analogoical induction)  
biased sample  
causal argument  
causal claim  
confidence level  
enumerative induction  
hasty generalization  
inference to the best explanation  
marginal of error  
necessary condition  
post hoc, ergo propter hoc  
random sample  
relevant property  
representative sample  
sample (members)  
sufficent condition  
target group

Summary

Enumerative Induction

- An inductive argument is intended to provide only probable support for its conclusion, being considered strong if it succeeds in providing such support and weak if it does not.
- Inductive arguments come in several forms, including enumerative, analogical, and causal. In enumerative induction, we argue from premises about some members of a group to a generalization about the entire group. The entire group is called the target group; the observed members of the group, the sample; and the group characteristics we're interested in, the relevant property.
- An enumerative induction can fail to be strong by having a sample that's too small or not representative. When we draw a conclusion about a target group based on an inadequate sample size, we're said to commit the error of hasty generalization.
- Opinion polls are enumerative inductive arguments, or the basis of enumerative inductive arguments, and must be judged by the same general criteria used to judge any other enumerative induction.

Analogical Induction

- In analogical induction, or argument by analogy, we reason that since two or more things are similar in several respects, they must be similar in some further respect. We evaluate arguments by analogy according to several criteria: (1) the number of relevant similarities between things being compared, (2) the number of relevant dissimilarities, (3) the number of instances (or cases) of similarities or dissimilarities, and (4) the diversity among the cases.
Causal Arguments

- A causal argument is an inductive argument whose conclusion contains a causal claim. There are several inductive patterns of reasoning used to assess causal connections. These include the Method of Agreement, the Method of Difference, the Method of Agreement and Difference, and the Method of Concomitant Variation.

- Errors in cause-and-effect reasoning are common. They include misidentifying relevant factors in a causal process, overlooking relevant factors, confusing cause with coincidence, confusing cause with temporal order, and mixing up cause and effect.

- Crucial to an understanding of cause-and-effect relationships are the notions of necessary and sufficient conditions. A necessary condition for the occurrence of an event is one without which the event cannot occur. A sufficient condition for the occurrence of an event is one that guarantees that the event occurs.

Field Problems

1. Design an opinion poll to determine the percentage of people on campus who believe that individuals under age seventeen who commit crimes that carry the death penalty for adults should likewise get the death penalty. Specify all the following parameters: (1) the target group, (2) the makeup and size of the sample, (3) the methods for ensuring a random sample, (4) the methods for ensuring a representative sample, (5) the exact phrasing of the polling question(s), (6) the method for gathering the responses (telephone survey, "man on the street" poll, email questionnaire, etc.), and (7) the acceptable margin of error. Explain the reasons for your choices.

2. Devise an extended argument by analogy (two hundred to three hundred words) to support the proposition that Earth is not a mere planet of rock and soil but is a living organism, a notion that has come to be known as the gaia theory. You'll need to research this term on the Internet. (The original idea that inspired this view was not that the planet was an organism, but that it could be usefully viewed as an organism that is self-regulating.) People who take the idea literally might say, for example, that just as billions of cells in the human body perform the functions that sustain the body, so billions of organisms on Earth perform the functions that sustain the life of Earth. Use several relevant similarities in your argument. Then write a critique of your argument, focusing especially on relevant dissimilarities and the number of relevant similarities.

3. Select a causal argument on a political issue from recent op-ed pages (in newspapers or on websites). Then critique it, explaining why it's strong or weak, specifically noting whether it misidentifies or overlooks relevant factors, confuses cause with coincidence, commits the post hoc fallacy, confuses cause and effect, or mishandles or misunderstands necessary and sufficient conditions.
Self-Assessment Quiz

Answers appear in “Answers to Self-Assessment Quizzes” (Appendix C).

1. What is the logical form of enumerative induction, indicated schematically?

2. In enumerative induction, what are the target group, the sample, and the relevant property?

3. What are the two major ways in which an enumerative induction can fail to be strong?

4. What is the logical form of analogical induction, indicated schematically?

For each of the following enumerative inductions, indicate whether the argument is strong or weak. If it’s weak, say whether the problem is a sample that’s too small, not representative, or both.

5. All the women in my yoga class are against the war. Ninety percent of the members of a national women’s group (twelve thousand members) are against the war. And all my women friends are against the war. The fact is, almost all American women oppose this war.

6. Recently there was a racially motivated murder in Texas. Two white men killed a black man. Then another murder of a black man by some racist whites occurred in Louisiana. And in Mississippi an admitted racist finally was convicted of the murder of a black man that occurred years ago. The South has more racist killers than any other part of the country.

7. Most professors at this college are not grading as strictly as they used to. They now give Bs for work to which they used to assign Cs. The grading standards in American colleges are dropping.

8. The first time Ariana encountered trigonometry, she couldn’t understand it. And the first time she read Shakespeare, she didn’t get it. She will never understand anything.

9. Americans are quite satisfied with the administration’s recent foreign policy decisions. An “instant poll” conducted yesterday on the CNN website got fifteen thousand responses from site visitors—and 95 percent of them said that American foreign policy was on the right track.

10. Judging from what I’ve seen, anti-war demonstrators are just a bunch of peaceniks left over from the Vietnam War era.

Evaluate each of the following arguments by analogy, indicating (1) the two things being compared, (2) the conclusion, and (3) whether the argument is strong or weak.

11. “Suppose that someone tells me that he has had a tooth extracted without an anaesthetic, and I express my sympathy, and suppose that I am then asked, ‘How do you know that it hurt him?’ I might reasonably reply, ‘Well, I know that it would hurt me. I have been to the dentist and know how painful it is to have a tooth stopped without an anaesthetic, let alone...
taken out. And he has the same sort of nervous system as I have. I infer, therefore, that in these conditions he felt considerable pain, just as I should myself.” [Alfred J. Ayer]

12. “As for one who is choosy about what he learns . . . we shall not call him a lover of learning or a philosopher, just as we shall not say that a man who is difficult about his food is hungry or has an appetite for food. We shall not call him a lover of food but a poor eater. . . . But we shall call a philosopher the man who is easily willing to learn every kind of knowledge, gladly turns to learning things, and is insatiable in this respect.” [Socrates]

13. “Let us begin with a parable [showing that statements about God have no meaning]. . . . Once upon a time two explorers came upon a clearing in the jungle. In the clearing were growing many flowers and many weeds. One explorer says, ‘Some gardener must tend this plot.’ The other disagrees, ‘There is no gardener.’ So they pitch their tents and set a watch. No gardener is ever seen. ‘But perhaps he is an invisible gardener.’ So they set up a barbed-wire fence. They electrify it. . . . But no shrieks ever suggest that some intruder has received a shock. No movements of the wire ever betray an invisible climber. . . . Yet still the Believer is not convinced. ‘But there is a gardener, invisible, intangible, insensible.’ . . . At last the Sceptic despairs, ‘But what remains of your original assertion? Just how does what you call an invisible, intangible, eternally elusive gardener differ from an imaginary gardener or even from no gardener at all?’” [Antony Flew]

Analyze each of the following causal arguments. Identify the conclusion and whether the argument is weak or strong. If it’s weak, explain why with reference to the material in this chapter.

14. School violence is caused mainly by teens playing violent video games. Incidents of violence in schools have increased as more and more teens are playing violent video games, as the video games themselves have become more graphically and realistically violent, and as the number and variety of video games have expanded dramatically.

15. Smoking and exposure to secondhand smoke among pregnant women pose a significant risk to both infants and the unborn. According to numerous studies, each year the use of tobacco causes thousands of spontaneous births, infant deaths, and deaths from SIDS. Death rates for fetuses are 35 percent higher among pregnant women who smoke than among pregnant women who don’t smoke.

16. Why are crime rates so high, the economy so bad, and our children so prone to violence, promiscuity, and vulgarity? These social ills have arisen—as they always have—from the “moral vacuum” created when Americans turn away from religion. Our current slide into chaos started when prayer was banned from public schools and secular humanism swooped in to replace it. And as God has slowly faded from public life, we have got deeper in the hole.
17. The twelve of us went on a hike through the mountains. We all drank bottled water except Lisa, who drank from a stream. Later she got really sick. Some intestinal thing. But the rest of us were fine. We've repeated this adventure many times on other hikes, with all but one of us drinking bottled water and one drinking from a stream. Everything else was the same. Each time, the person who drank from the stream got really ill. Drinking from streams on these hikes causes intestinal illness. Don't do it.

18. Ever since I started drinking herbal tea in the morning, my energy level has improved and I'm a lot calmer during the day. That stuff works.

19. Yesterday my astrological chart—prepared by a top astrologer—said that I would meet an attractive person today, and I did. Last week, it said I'd come into some money, and I did. (Jack paid me that hundred dollars he owed me.) Now I'm a believer. The stars really do rule.

20. Most of the terminal cancer patients in this ward who had positive attitudes about their disease lived longer than expected. Most of the negative-disposition patients didn't live as long as expected. A positive attitude can increase the life expectancy of people with terminal cancer.

**Integrative Exercises**

These exercises pertain to material in Chapters 3 and 6-8.

For each of the following arguments, specify the conclusion and premises and indicate whether it is deductive or inductive. If it's deductive, use Venn diagrams or truth tables to determine its validity. If it's inductive, indicate whether it's an enumerative, analogical, or causal induction and whether it's strong or weak. If necessary, add implicit premises and conclusions.

1. It's clear that if the allies accidentally damage any holy sites when they attack enemy forces, the local people will never give the allies any respect or cooperation. The allies, though, will not damage any holy sites. Therefore, the locals will respect the allies and cooperate with them.

2. "By removing the exact-change-only lane at the Black Rock toll barrier, the New York State Thruway Authority has created artificial traffic jams. For 20 years, I have rarely encountered traffic problems at this toll barrier. Now it is a daily occurrence." [Letter to the editor, Buffalo News]

3. If people have free will, then they can be held morally responsible for what they do. But—as our judicial system demonstrates—people cannot really be held morally responsible for their actions. Thus, people do not have free will.

4. "If we take in hand any volume of divinity or school metaphysics, for instance; let us ask, Does it contain any abstract reasoning concerning quantity
or number? No. Does it contain any experimental reasoning concerning matter of fact and existence? No. Commit it then to the flames; for it can contain nothing but sophistry and illusion.” [David Hume]

5. No philosophy majors are persons without a brain. All students without a brain are persons who spend most of their time partying. So no philosophy majors are persons who spend most of their time partying.

6. “The decision to have or not to have a child is mine and mine alone. I am not cattle for the government to order about, demanding that I bring an unwanted child to term. Stripping me of the right to control my own destiny dehumanizes me, period. Anything less than my choice, on my terms, reduces me to property.” [Guest opinion, The Onion.com]

7. All politicians are corrupt manipulators, so some corrupt manipulators are effective leaders, since some effective leaders are politicians.

8. If we increase security in the country because of terrorist attacks, then our personal freedoms will be curtailed. If we do not increase security in the country, then terrorist attacks will increase. So either our personal freedoms will be curtailed or terrorist attacks will increase.

9. “A well regulated militia being necessary to the security of a free State, the right of the people to keep and bear arms shall not be infringed.” [U.S. Constitution]

10. “World War II would still be going on had we adhered to the rules we now find our troops having to operate under. War is brutal, and innocent folks are going to die in the process. The time has come to realize that we, as a nation, cannot afford another Vietnam. Let's use what means are necessary to win now and deal with the public outcry afterward.” [Letter to the editor, Buffalo News]

11. [Be careful: This one has an unstated conclusion.] “The U.S. is the only nation-state to have been condemned by the World Court for international terrorism. The U.S. vetoed a UN Security Council resolution calling on governments to observe international law. After deliberately targeting the civilian public health infrastructure, the U.S. military imposes a continuing economic blockade on Iraq which has directly resulted in the deaths of hundreds of thousands of children. The U.S. government is the primary financier and arms supplier for the decades-old Israeli war against the entire Palestinian people.” [Editorial, Alternative Press Review]

12. Almost all of the owners of restaurants, bars, and clubs in New York City are opposed to the city’s total ban on smoking in indoor public places. The vast majority of New Yorkers simply do not like this law.

13. Every student Maria knows who wears glasses also has a high grade-point average. So most students who wear glasses probably have high grade-point averages.

14. “The evils of the world are due to moral defects quite as much as to lack of intelligence. But the human race has not hitherto discovered any
method of eradicating moral defects. . . . Intelligence, on the contrary, is easily improved by methods known to every competent educator. Therefore, until some method of teaching virtue has been discovered, progress will have to be sought by improvement of intelligence rather than of morals.” [Bertrand Russell]

15. Television is destroying morality in this country. As TV violence, sex, and vulgarity have increased, so have violent crimes, sexual assaults, and violations of obscenity laws.

16. Several Navy planes and a number of ships have disappeared in the Bermuda Triangle. These odd vanishings cannot be mere coincidence. The Bermuda Triangle is the epicenter of mysterious forces unknown to science.

17. “The idea that mainstream corporate media—the broadcast networks and newspaper chains, both those under consolidated ownership and those few that still cling to independence—is consistently liberal is laughable on its face. . . . [The] raft of Bush endorsements from the ‘undeniably liberal’ papers . . . seems to provide some deniability. Add in the past and current presence of avowed conservatives like Jack Welch at the top of these organizations, look over to the regular political forums of the Sunday talk shows, scan the editorial pages of the supposedly liberal Washington Post (where conservative pundits overshadow their left colleagues in both numbers and vehemence) and the argument is clearly bogus.” [Letter to the editor, Salon.com]

18. Eighty-three percent of the letters to the editor received by this newspaper are adamantly pro-life. And since the Daily Planet is the only major newspaper in the city, and it provides the primary forum for discussion of local issues, we must conclude that this town is also overwhelmingly pro-life.

19. The big grandfather clock in the hallway struck midnight—and then the old man died. This doesn’t prove that the striking of the clock killed him, but it does show that the two events—the clock’s striking and the death of the old man—were somehow causally linked.

20. If the recession continues, people will lose billions of dollars in failed investments. People will indeed lose billions of dollars in failed investments, so the recession will continue.

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**Writing Assignments**


3. In a two-page essay argue for or against one of these claims:

- Men are better at science than women are.
- Everyone does what is in his or her own best interests.
- It's wrong for the government to tax citizens to support people who are poor and needy.
- Deadbeat dads (fathers who don't or won't pay child support that they are legally obligated to pay) should be put in jail.
- Sexual harassment is not a problem on this campus.
- Competition is always a good thing.
- Pornography should never be banned on a college campus.