

2. Reportedly, obesity among American children is increasing. Do any of these explanations seem better or worse?
 - a. Children are eating more.
 - b. Children are eating more fast food.
 - c. Text messaging takes up so much time, kids have no time left for exercise.
 - d. It's getting too hot to exercise, thanks to global warming.
3. In a recent study of more than 40,000 Japanese adults, it was found that those who drank lots of green tea were less likely to die from cardiovascular disease than were those who drank only a little. Do any of these explanations of that result seem better or worse?
 - a. Green tea may be more popular than black tea.
 - b. Green tea is better for your health than black tea is.
 - c. Green tea is known to contain more antioxidants than black tea.
 - d. Green-tea drinkers may be more likely to eat fruits and vegetables.
- ▲ 4. Japanese are less likely than Americans to die of stroke. Do any of these explanations seem better or worse?
 - a. Japanese people drink more green tea.
 - b. Japanese people eat more sushi.
 - c. NASCAR racing is more popular in America than in Japan.
 - d. Americans spend more time mowing lawns.
5. There is a strong association between lack of sleep and depression. Do any of these explanations seem better or worse?
 - a. Sleeplessness causes depression.
 - b. Depression causes sleeplessness.
 - c. Sleeplessness and depression may both result from some underlying cause.
6. When Horace thinks of doing a dusty job like vacuuming his car or sweeping out the garage, he almost always sneezes. Do any of these explanations seem better or worse?
 - a. Thinking of dust causes Horace to sneeze.
 - b. A sneeze coming on makes Horace think of dust.
 - c. It is probably just coincidence.
- ▲ 7. Every spring and summer, increased snow-cone consumption is correlated with each of the following. Which correlations may involve cause and effect?
 - a. Increased number of drownings
 - b. Increased sales of swimsuits
 - c. Increased sales of beer
 - d. Increased number of lightning strikes
 - e. Increased numbers of mosquitoes
8. The early 2000s saw a downturn in armed robbery, which coincided with increased cell phone ownership. Do any of these explanations seem better or worse?
 - a. Robbers backed off because they knew more people could call for help.
 - b. It's probably just coincidence.

- c. Criminals were becoming too busy talking on cell phones to rob anyone.
 - d. Robbers know most cell phones can take photos; they worried about having their pictures taken.
9. In 2007, the homicide rate was higher than in 2006. To which of the following is that fact possibly related by cause or effect?
 - a. In 2007, fewer hurricanes hit Florida.
 - b. During the preceding two years, the war in Iraq went badly.
 - c. Several years earlier, Bill Clinton had sex with an intern and lied about it.
 - d. In 2007, the price of houses declined sharply.
 - ▲ 10. The junior high basketball team played exceptionally well against a tough opponent. The coach rewarded the players with lavish praise and ice cream. In the next game, the team didn't play as well. Select the best responses:
 - a. "Obviously, rewarding the team backfired."
 - b. "The coach should have given them a better reward."
 - c. "The coach should have rewarded only the best players."
 - d. "The team probably still wouldn't have played as well, even if the coach hadn't rewarded the players."
 11. Can mere reading of articles about dieting cause teenage girls to resort to extreme weight-loss measures? According to a study published in the journal *Pediatrics* (reported by Carla K. Johnson of the Associated Press in January 2007), the answer might well be yes. In the study, female middle school students were interviewed in 1999 and again in 2004 and their heights and weights were measured. Those in the first interview who said they frequently read magazine articles about dieting were more likely than those who said they never read such articles to report in the second survey that they indulged in extreme weight-loss measures like vomiting and taking laxatives. The effect was present whether or not the girls were overweight or considered their weight important when they started reading the articles, the researchers said.
Propose two explanations for the findings that seem likely or possible.

Go to Church and Live Longer

According to Bill Scanlon, a reporter for the Scripps Howard News Service, researchers from the University of Colorado, the University of Texas, and Florida State University determined that twenty-year-olds who attend church at least once a week for a lifetime live on the average seven years longer than twenty-year-olds who never attend. The data came from a 1987 National Health Interview Survey that asked 28,000 people their income, age, church-attendance patterns, and other questions. The research focused on 2,000 of those surveyed who subsequently died between 1987 and 1995.

- a. Propose two different causal hypotheses to explain these findings.
- b. What data would you need to have greater confidence in these hypotheses?

Exercise 11-12

GENERAL CAUSAL CLAIMS

Recently, one of us experienced a scratchy throat of the sort that is the indisputable harbinger of an oncoming cold. On the recommendation of a friend, this author tried Zicam. He never did get a cold. Was this due to the Zicam? Well, maybe. But from the mere fact that a cold didn't develop after he took Zicam, we cannot conclude that the Zicam *caused* this result. That would be *post hoc, ergo propter hoc*. We can say, "I took Zicam, and the cold didn't develop." We can't say, "I took Zicam, and that *prevented* the cold from developing."

It is an interesting fact about human psychology that, if we were to read about a "clinical trial" that consisted of a single cold sufferer taking Zicam, we would laugh out loud. However, if a friend tells us that Zicam worked for him, we might very well take it ourselves. Logically, though, there is no difference between a "clinical trial" consisting of a single subject and a report from a friend.

The trouble with a report from a friend or a clinical trial with only one subject is that, generally, you can't control for all the variables, and as a result, you can't calculate the probability that the outcome was not just chance or due to some unrelated cause that was present coincidentally.

Scientists resolve this problem by concerning themselves with general causal claims, such as "Zicam reduces the frequency of colds." A statement like "Zicam kept me from getting a cold" is a claim about a specific cause-and-effect event; as such, it can be difficult to establish. "My uncle got lung cancer from smoking" is a statement about a specific cause-effect event, whereas "Smoking causes lung cancer" is a general causal claim. Science is mainly concerned with general causal hypotheses.

A general causal claim can be understood somewhat differently than a claim about a specific cause-effect event.* At least some general causal claims can be given a statistical interpretation that lends itself to scientific confirmation. For example, "Zicam prevents colds" can be interpreted as meaning not that Zicam will prevent every single cold but that, for humans, there is an association between taking Zicam and a reduced frequency of colds that cannot be attributed to chance. Given this interpretation, it could be true that Zicam prevents colds and also true that taking Zicam didn't prevent you from getting a cold.

CONFIRMING CAUSAL HYPOTHESES

This brings us at long last to the question of confirming a causal hypothesis.

When we apply heat to a pot of water, the water boils. We repeat the experiment, and we see that the water again boils. The Method of Agreement suggests a hypothesis: The heat caused the water to boil. Now we have to eliminate other possibilities: It could just be *coincidence* that the water boiled when we applied heat. But if we repeat the experiment many times, it would be a miraculous coincidence, since the water boils every time we apply heat. Could the aluminum pan we heated the water in have caused the water to boil? Unlikely; we can boil water in other pans as well. Unlike the heat, the

*For the following analysis, we follow Ronald N. Giere, *Understanding Scientific Reasoning*, 3rd ed. (Fort Worth: Holt, Rinehart, and Winston, 1991).

aluminum doesn't always accompany the boiling water, so we can eliminate it as the cause. Using the Method of Difference, we see that the only difference between the water boiling and not is the presence or absence of heat.

Let's apply the same ideas to a more complicated hypothesis, that Zicam prevents colds. How might you confirm this hypothesis?

Controlled Cause-to-Effect Experiments

One obvious way would be a controlled experiment: Infect willing subjects with a cold virus; randomly divide them into two groups, giving only the subjects in one group Zicam. To attach real numbers to this, let's say there are 100 subjects in the Zicam group ("experimental group") and 100 in the other ("control group"). Let's then suppose that 46 percent of the Zicam group came down with colds versus 60 percent of the control group. This is a **difference (*d*) in the frequency** of colds of 14 percentage points. Could such a difference be because the subjects in the Zicam group had mysterious cold-blocking properties? Probably not; subjects were randomly assigned to one of the two groups, so subjects with mysterious cold-blocking properties probably would have been evenly distributed between the two groups.

Could the difference in cold frequency (*d*) be due to chance? Well, you can't eliminate chance completely, but the probability that it wasn't due to chance can be quantified. As it turns out, with 100 subjects each in the Zicam group and the control group, there is a 95 percent probability that a *d* greater than 13 percentage points isn't due to chance. Another way of phrasing this is to say that, at the 95 percent level of confidence, *d* must exceed 13 percentage points to be **statistically significant**. If there were 250 subjects in each of the two groups (rather than 100), then any *d* greater than 8 percentage points would be statistically significant at the 95 percent level. Obviously, the larger the two groups of subjects, the smaller *d* needs to be to be statistically significant, that is, due to something other than chance (see Table 11-1).

Clearly, it isn't always feasible to conduct a controlled cause-to-effect experiment. Nevertheless, such experiments involve the same principles as testing the hypothesis that heat causes water to boil. In some situations, the

Table 11-1

Approximate Statistically Significant *d*'s at .05 Level

Number in Experimental Group (with Similarly Sized Control Group)	Approximate Figure That <i>d</i> Must Exceed to Be Statistically Significant (in Percentage Points)
40	27
10	19
25	13
50	8
100	6
250	4
500	3
1,000	
1,500	

In the Media

Here's to Wine and Cheese

Substance in Red Grapes Extends Mice Lives

WASHINGTON—A substance found in red wine protected mice from the ill effects of obesity, raising the tantalizing prospect the compound could do the same for humans and might also help people live longer, healthier lives, researchers reported Wednesday.

The substance, called resveratrol, enabled mice that were fed a high-calorie, high-fat diet to live normal, active lives despite becoming obese—the first time any compound has been shown to do that. Tests found the agent activated a host of genes that protect against the effects of aging, essentially neutralizing the adverse effects of a bad diet on the animals' health and life span.

Although much more work is needed to explore the benefits and safety of the substance, which is sold over the counter as a nutritional supplement, the findings could lead to the long-sought goal of extending the healthy human life span, experts said.

The researchers cautioned that the findings should not encourage people to eat badly, think-

ing resveratrol could make gluttony completely safe. They also noted that a person would have to drink at least 100 bottles of red wine a day or take mega doses of the commercially available supplements to get the levels given to the mice, which may not be safe in humans.

Preliminary tests in people are already under way.

"We've been looking for something like this . . . and maybe it's right around the corner—a molecule that could be taken in a single pill to delay the diseases of aging and keep you healthier as you grow old," said David A. Sinclair, a Harvard University molecular biologist who led the study. "The potential impact would be huge."

► RED WINE, Page A14

Mice photo, Associated Press/National Institutes of Health, Doug Hansen

—Rob Stein, *Washington Post*

effect we are interested in (boiling water, reduced frequency of colds) is present; in others, it isn't. Unless the effect is a random event, the cause also is present if and only if the effect is present. Something that has nothing to do with the effect may be present coincidentally when and only when the effect is present. But by repeating the experiment (using multiple subjects randomly divided into two groups, or heating water on multiple occasions), we reduce the possibility of coincidence.

At bottom, hypothesis confirmation is really just careful application of the Method of Difference combined with the Method of Agreement. The water boils when it is heated (and, up to a point, boils more vigorously as the heat increases)—that's the Method of Agreement. And the only difference between its boiling and not boiling is the application of heat—that's the Method of Difference. Similarly, every subject in the experimental group has Zicam—that's the Method of Agreement. And the only difference, apart from the fact that the Zicam group shows the effect (reduced frequency of colds), is the Zicam they took—that's the Method of Difference.



For various reasons, researchers prefer to experiment on laboratory animals rather than on humans. Here, for example, the resveratrol that was given to the mice was equivalent to that found in more than 100 bottles of red wine.

BENEFITS FROM RED GRAPES

High concentrations of the antioxidant resveratrol are found in red wine and the skin of red grapes.

RESVERATROL'S EFFECTS

- Decreases stickiness of blood's platelet cells, reduces risk of heart disease
- Anti-cancer agent
- Anti-inflammatory

Sources: Functional Food for Health, *Science* magazine U.S. National Library of Medicine, MCT graphics.



Alternative Methods of Testing Causal Hypotheses in Human Populations

Experimenting on humans isn't always practical or ethically desirable. However, researchers have alternatives.

One alternative is to match a group of people who have subjected themselves to a suspected causal agent with a control group—supposedly similar people who haven't done so—in order to see if the frequency of a possible effect is greater in the first group. For example, to find out if obesity contributes to heart disease, you wouldn't want deliberately to try to make people obese. Instead, you'd match a group of people who have become obese for other reasons with a similar group of non-obese people, to see if there is more heart disease in the first group. Such cause-to-effect studies aren't nearly as conclusive in their findings as controlled experiments, because one cannot be sure that factors other than the hypothesized cause that contribute to heart disease are equally distributed in the two groups.

Nonexperimental
Cause-to-Effect
Studies

Nonexperimental Effect-to-Cause Studies

Another method of testing a causal hypothesis that avoids direct experimentation on subjects is to compare a group of subjects who have the *effect* (rather than the suspected cause) with a group of subjects who don't, in order to see whether the hypothesized cause is more prevalent in the former group. For example, a researcher might compare a group of people who have heart problems with a matched group of people who do not, to see if there is more obesity in the first group. The problem here is that other factors besides obesity that are linked to heart disease cannot be known to have been equally distributed among both groups.

Experiments on Animals

Another method of testing causal hypotheses that avoids experimenting on humans is to conduct the experiments on animals. Apart from ethical considerations, findings from such experiments apply to humans by analogical reasoning, which we discussed in Chapter 10.

The following exercise sets will help you tell the difference between general and specific causal claims and will give you practice analyzing experiments and studies aimed at testing causal hypotheses.

Exercise 11-13

Identify each of the following as (a) a claim about a specific case of cause and effect, (b) a general causal claim, or (c) neither of these.

- ▲ 1. The hibiscus died while we were away. There must have been a frost.
2. Carlos isn't as fast as he used to be; that's what old age will do.
3. Kent's college education helped him get a high-paying job.
- ▲ 4. The most frequently stolen utility vehicle is a 2007 Honda Civic.
5. Vitamin C prevents colds.
6. The woman he returned to be with is Deborah.
- ▲ 7. The high reading on the thermometer resulted from two causes: This thermometer was located lower to the ground than at other stations, and its shelter was too small, so the ventilation was inadequate.
8. Oily smoke in the exhaust is caused by worn rings.
9. The initial tests indicate that caffeine has toxic effects in humans.
- ▲ 10. Neonatal sepsis is usually fatal among newborns.
11. WIN 51,711 halts development of paralysis in mice that have been infected with polio-2.
12. A stuck hatch cover on *Spacelab* blocked a French ultraviolet camera from conducting a sky survey of celestial objects.
13. An experimental drug has shown broad antiviral effects on a large number of the picornaviruses against which it has been tested.
- ▲ 14. Investigation revealed the problem was a short-circuited power supply.
15. Arteriovenous malformations—distortions of the capillaries connecting an arteriole and a small vein in the brain—can bleed, causing severe headaches, seizures, and even death.
16. Because of all the guns that its citizens own, the United States has never been invaded.

- ▲ 17. According to two reports in the *New England Journal of Medicine*, oil from fish can prevent heart disease.
18. The most important cause in the growing problem of illiteracy is television.
19. "Raymond the Wolf passed away in his sleep one night from natural causes; his heart stopped beating when the three men who slipped into his bedroom stuck knives in it."
—Jimmy Breslin, *The Gang That Couldn't Shoot Straight*
- ▲ 20. The dramatic increases in atmospheric CO₂, produced by the burning of fossil fuels, are warming the planet and will eventually alter the climate.

There is no single event, activity, decision, law, judgment, in this period of time that I call the "three strikes" era—other than "three strikes"—that could explain the tremendous acceleration in the drop in crime.

—Dan Lungren, former California attorney general, who helped draft California's Three Strikes law

Exercise 11-14

Under this law, conviction for a third felony carried with it a mandatory sentence of twenty-five years to life. Although the crime rate in California had been falling before the law took effect in 1994, it reportedly fell even faster after the law was enacted, and California's crime rate dropped to levels not seen since the 1960s.

Provide two reasonable alternative hypotheses to explain the acceleration of the drop in the crime rate in California. What data would you need to be convinced that Lungren's hypothesis is the best?

Suppose a university teacher wants to know whether or not requiring attendance improves student learning. How could she find out? In groups (or individually if the instructor prefers), describe an experiment that an instructor might actually use. Groups may then compare proposals to see who has the best idea.

Exercise 11-15

Exercise 11-16

For each of the following investigations:

- a. Identify the causal hypothesis at issue.
 - b. Identify what kind of investigation it is.
 - c. Describe the control and experimental groups.
 - d. State the difference in effect (or cause) between control and experimental groups.
 - e. Identify any problems in either the investigation or the report of it, including but not necessarily limited to uncontrolled variables.
 - f. State the conclusion you think is warranted by the report.
- ▲ 1. Scientists have learned that people who drink wine weekly or monthly are less likely to develop dementia, including Alzheimer's disease. (Daily wine drinking, however, seems to produce no protective effect.) The lead wine researcher was Dr. Thomas Truelsen, of the Institute of Preventive Medicine at Kommunehospitalet in Copenhagen. The researchers identified

the drinking patterns of 1,709 people in Copenhagen in the 1970s and then assessed them for dementia in the 1990s, when they were aged 65 or older. When they were assessed two decades later, 83 of the participants had developed dementia. People who drank beer regularly were at an increased risk of developing dementia.

—adapted from BBC News (online)

2. Learning music can help children do better at math. Gordon Shaw of the University of California, Irvine, and Frances Rauscher at the University of Wisconsin compared three groups of second graders: 26 received piano instruction plus practice with a math videogame, 29 received extra English lessons plus the game, and 28 got no special lessons. After four months, the piano kids scored 15 to 41 percent higher on a test of ratios and fractions than the other participants.

—adapted from Sharon Begley, Newsweek

3. The Carolina Abecedarian Project [A-B-C-D, get it?] selected participants from families thought to be at risk for producing mildly retarded children. These families were all on welfare, and most were headed by a single mother who had scored well below average on a standardized IQ test (obtaining IQs of 70 to 85). The project began when the participating children were 6 to 12 weeks old and continued for the next 5 years. Half of the participants were randomly assigned to take part in a special day-care program designed to promote intellectual development. The program ran from 7:15 to 5:15 for 5 days a week for 50 weeks each year until the child entered school. The other children received the same dietary supplements, social services, and pediatric care but did not attend day care. Over the next 21 years, the two groups were given IQ tests and tests of academic achievement. The day-care program participants began to outperform their counterparts on IQ tests starting at 18 months and maintained this IQ advantage through age 21. They also outperformed the others in all areas of academic achievement from the third year of school onward.

—adapted from Developmental Psychology, 6th ed., David R. Schaffer

- ▲ 4. Research at the University of Pennsylvania and the Children's Hospital of Philadelphia indicates that children who sleep in a dimly lighted room until age two may be up to five times more likely to develop myopia (nearsightedness) when they grow up.

The researchers asked the parents of children who had been patients at the researchers' eye clinic to recall the lighting conditions in the children's bedroom from birth to age two.

Of a total of 172 children who slept in darkness, 10 percent were nearsighted. Of a total of 232 who slept with a night light, 34 percent were nearsighted. Of a total of 75 who slept with a lamp on, 55 percent were nearsighted.

The lead ophthalmologist, Dr. Graham E. Quinn, said that "just as the body needs to rest, this suggests that the eyes need a period of darkness."

—adapted from an AP report by Joseph B. Verrangia

5. You want to find out if the coffee grounds that remain suspended as sediment in French press, espresso, and Turkish and Greek coffee can cause headaches.

You divide fifty volunteers into two groups and feed both groups a pudding at the same time every day. However, one group mixes eight grams of finely pulverized used coffee grounds into the pudding before eating it (that's equivalent to the sediment in about one and a half liters of Turkish coffee). Within three weeks, you find that 50 percent of the group that has eaten grounds have had headaches; only 27 percent of the other group have experienced a headache. You conclude that coffee grounds may indeed cause headaches and try to get a grant for further studies. (This is a fictitious experiment.)

6. Do you enjoy spicy Indian and Asian curries? That bright yellow-orange color is due to curcumin, an ingredient in the spice turmeric. An experiment conducted by Bandaru S. Reddy of the American Health Foundation in Valhalla, New York, and reported in *Cancer Research* suggests that curcumin might suppress the development of colon cancer.

Places where turmeric is widely used have a low incidence of colon cancer, so the research team decided to investigate. They administered a powerful colon carcinogen to sixty-six rats and then added curcumin at the rate of 2,000 parts per million to the diet of thirty of them. At the end of a year, 81 percent of the rats eating regular rat food had developed cancerous tumors, compared with only 47 percent of those that dined on the curcumin-enhanced diet. In addition, 38 percent of the tumors in rats eating regular food were invasive, and that was almost twice the rate in rodents eating curcumin-treated chow.

—adapted from Science News

- ▲ 7. Does jogging keep you healthy? Two independent researchers interested in whether exercise prevents colds interviewed twenty volunteers about the frequency with which they caught colds. The volunteers, none of whom exercised regularly, were then divided into two groups of ten, and one group participated in a six-month regimen of jogging three miles every other day. At the end of the six months, the frequency of colds among the joggers was compared both with that of the nonjoggers and with that of the joggers prior to the experiment. It was found that, compared with the nonjoggers, the joggers had 25 percent fewer colds. The record of colds among the joggers also declined in comparison with their own record prior to the exercise program.
8. "In the fifty-seven-month study, whose participants were all male physicians, 104 of those who took aspirin had heart attacks, as compared with 189 heart attacks in those who took only a sugar pill. This means ordinary aspirin reduced the heart attack risk for healthy men by 47 percent. At least seven long-term studies of more than 11,000 heart attack victims have shown that one-half or one aspirin per day can reduce the risk of a second attack by up to 20 percent."

—adapted from the Los Angeles Times

9. "Although cigarette ads sometimes suggest that smoking is 'macho,' new studies indicate that smoking can increase the risk of impotence. In a study of 116 men with impotence caused by vascular problems, done at the University of Pretoria, South Africa, 108 were smokers. Two independent studies, one done by the Centre d'Etudes et de Recherches de l'Impuissance in Paris, and reported in the British medical journal *Lancet*, and the other done by Queen's University and Kingston General Hospital in Ontario, found that almost two-thirds of impotent men smoked.

"To test whether smoking has an immediate effect on sexual response, a group of researchers from Southern Illinois and Florida State universities fitted 42 male smokers with a device that measures the speed of arousal. The men were divided into three groups, one group given high-nicotine cigarettes, one group cigarettes low in nicotine, and one group mints. After smoking one cigarette or eating a mint, each man was placed in a private room and shown a two-minute erotic film while his sexual response was monitored. Then he waited ten minutes, smoked two more cigarettes or ate another mint, and watched a different erotic film, again being monitored.

"The results: Men who smoked high-nicotine cigarettes had slower arousal than those who smoked low-nicotine cigarettes or ate mints."

—adapted from Reader's Digest

10. "A study published in the July 27 *Journal of the American Medical Association* indicates that taking androgen (a male sex hormone) in high doses for four weeks can have important effects on the high density lipoproteins (HDLs) in the blood, which are believed to protect against the clogging of vessels that supply the heart. Ben F. Hurley, an exercise physiologist from the University of Maryland in College Park who conducted the study at Washington University, monitored the levels of HDL in the blood of sixteen healthy, well-conditioned men in their early thirties who were taking androgens as part of their training program with heavy weights. Prior to use of the hormone, all had normal levels of HDLs. After four weeks of self-prescribed and self-administered use of these steroids the levels dropped by about 60 percent.

"Hurley is cautious in interpreting the data. 'You can't say that low HDL levels mean that a specified person is going to have a heart attack at an earlier age. All you can say is that it increases their risk for heart disease.'"

—D. Franklin, Science News

11. "New studies reported in the *Journal of the American Medical Association* indicate that vasectomy is safe. A group headed by Frank Massey of UCLA paired 10,500 vasectomized men with a like number of men who had not had the operation. The average follow-up time was 7.9 years, and 2,300 pairs were followed for more than a decade. The researchers reported that, aside from inflammation in the testes, the incidence of diseases for vasectomized men was similar to that in their paired controls.

"A second study done under federal sponsorship at the Battelle Human Affairs Research Centers in Seattle compared heart disease in 1,400 vasectomized men and 3,600 men who had not had the operation.

Over an average follow-up time of fifteen years, the incidence of heart diseases was the same among men in both groups."

—Edward Edelson, New York Daily News; reprinted in Reader's Digest

12. "A new study shows that the incidence of cancer tumors in rats exposed to high doses of X-rays dropped dramatically when the food intake of the rats was cut by more than half. Dr. Ludwik Gross of the Veterans Administration Medical Center noted that this study is the first to demonstrate that radiation-induced tumors can be prevented by restricting diet.

"The experimenters exposed a strain of laboratory rats to a dose of X-rays that produced tumors in 100 percent of the rats allowed to eat their fill—about five or six pellets of rat food a day.

"When the same dose of X-rays was given to rats limited to two pellets of food a day, only nine of 29 females and one of 15 males developed tumors, the researchers reported.

"The weight of the rats on the reduced diet fell by about one-half, but they remained healthy and outlived their counterparts who died of cancer, Gross said. He noted that the restricted diet also reduced the occurrence of benign tumors. There is no evidence that restriction of food intake will slow the growth of tumors that have already formed in animals, he said."

—Paul Raeburn, Sacramento Bee

13. "Encephalitis, or sleeping sickness, has declined greatly in California during the past thirty years because more people are staying inside during prime mosquito-biting hours—7:00 P.M. to 10:00 P.M., researchers said. Paul M. Gahlinger of San Jose State University and William C. Reeves of the School of Public Health at UC Berkeley conducted the study. 'People who watch television on warm summer evenings with their air conditioners on are less likely to be exposed during the peak biting period of mosquitoes that carry encephalitis,' Reeves said.

"The researchers found that those counties in California's Central Valley with the highest television ownership had the lowest encephalitis rates for census years. Of 379 Kern County residents interviewed by telephone, 79 percent said they used their air conditioners every evening and 63 percent said they watched television four or more evenings a week during the summer.

"The percentage of residents who spend more time indoors now because of air conditioning than in 1950 more than doubled, from 26 percent to 54 percent, the researchers said."

—Associated Press, Enterprise-Record (Chico, California)

- ▲ 14. "A study released last week indicated that Type A individuals, who are characteristically impatient, competitive, insecure and short-tempered, can halve their chances of having a heart attack by changing their behavior with the help of psychological counseling.

"In 1978, scientists at Mt. Zion Hospital and Medical Center in San Francisco and Stanford University School of Education began their study of 862 predominantly male heart attack victims. Of this number, 592 received group counseling to ease their Type A behavior and improve their self-esteem. After three years, only 7 percent had another heart

attack, compared with 13 percent of a matched group of 270 subjects who received only cardiological advice. Among 328 men who continued with the counseling for the full three years, 79 percent reduced their Type A behavior. About half of the comparison group was similarly able to slow down and cope better with stress.

"This is the first evidence 'that a modification program aimed at Type A behavior actually helps to reduce coronary disease,' says Redford Williams of Duke University, an investigator of Type A behavior."

—Science News

Exercise 11-17

Researchers from Tenon Hospital in Paris reported to the American Urological Association that dogs can be trained to detect the odor of chemicals released into urine by prostate cancer. The researchers first trained a Belgian Malinois to identify urine samples from patients with prostate cancer and to differentiate them from urine samples from healthy subjects. They then determined whether the dog could select a urine sample from a prostate cancer victim when four urine samples from healthy people were present. The dog was correct in 63 out of 66 tests—more accurate than the PSA test now used to detect prostate cancer. The researchers currently are training other dogs.*

1. Do you think the dog's success rate was coincidental? Why or why not?
2. Do you see any weakness in the experiment?
3. If you were testing the ability of this dog to detect urine from victims of prostate cancer, would you do anything differently?

Exercise 11-18

Let's say you randomly divide 700 men in the early stages of prostate cancer into two groups. The men in one group have their prostates removed surgically; those in the other group are simply watched to let the disease take its course. Researchers did this to 700 Scandinavian men and reported the results in the *New England Journal of Medicine* in fall 2002. As it turns out, 16 of those who underwent surgery died from prostate cancer, as compared with 31 of those who did not undergo surgery. On the face of it, these figures suggest your chances of not dying from prostate cancer are better if you have surgery. But put on your thinking caps and answer the following questions.

1. Suppose that, despite these findings, there was no statistically significant difference in how long the men in each group lived. What would that suggest?
2. The follow-up comparison lasted six years. Suppose that, after ten years, the death rates from prostate cancer were the same for the two groups. What would that suggest?
3. Suppose Scandinavian men are not screened for prostate cancer as aggressively as American men and tend to be older when they get the first diagnosis.

* Reported by Thomas H. Maugh II, *Los Angeles Times*, June 3, 2010.

4. Suppose Scandinavian men are screened more aggressively for prostate cancer than American men and tend to be younger when they get the first diagnosis.

Here, as elsewhere, you need to know the whole picture to make a judgment. How old were the men to begin with? If they were relatively young men, how long did the study last? Was there a difference in how long the men in the two groups lived? (Note that prostate removal has risks and sometimes produces important negative side effects.)

MISTAKES IN CAUSAL REASONING

We've already discussed how thinking critically means rejecting causal explanations that are

- unduly complicated
- incompatible with known facts or theories
- vague, ambiguous, or circular
- for other reasons inherently untestable

In addition, we noted that causal explanations involving either of the following two fallacies should be rejected:

- *Post hoc, ergo propter hoc* (thinking the fact that one thing immediately precedes another thing proves that the first thing caused or causes the second thing)
- *Cum hoc, ergo propter hoc* (thinking that correlation between two things proves that one caused or causes the other)

Let's represent these two fallacies schematically:

Cum hoc, ergo propter hoc:

A's are correlated with B's.

Therefore, it has been proved that A's cause B's (or that this particular A caused this particular B).

Post hoc, ergo propter hoc:

A's immediately precede B's (or this particular A immediately preceded this particular B)

Therefore, it has been proved that A's cause B's (or that this particular A caused this particular B).



■ Jeff Fulcher, a former student of ours, read this book and then flew airplanes in Alaska. See what an exciting career can come from reading this book? (This is an example of *post hoc, ergo propter hoc*.)

Why are these mistakes in reasoning? Because they do not establish the improbability of the following three possibilities:

1. That the connection between A and B is coincidental. *Illustration 1:* You took Zicam and a cold didn't develop; does that prove that Zicam was the cause? No; that result might be just coincidence. *Illustration 2:* The cancer rate is notably higher in the vicinity of a dry-cleaning business. Does that prove that the dry-cleaning business was a causal factor in the high cancer rate? No; the elevated cancer rate might be due to chance (cancer cases aren't distributed evenly throughout a region).
2. A and B both result from a third thing (an "underlying cause"). *Illustration 1:* Suppose you notice that, whenever you go to bed without brushing your teeth, you wake up with a headache. Does this prove that not brushing caused the headaches? No; the headache and the not brushing might both be the result of an underlying cause, such as going to bed too late or drinking too much. *Illustration 2:* Chimney fires increase just as purchases of long underwear increase. Does this mean that one causes the other? No; there is an underlying cause of the covariation: People increase their use of warm clothes and fireplaces as the result of an underlying cause, the weather turning colder.
3. B caused A, rather than the other way around ("confusing effect with cause"). *Illustration:* Having a positive attitude is associated with good health. Does this prove that having a positive attitude contributes to good health? No; it could be the other way around: Being healthy might give you a positive attitude.

Notice that, if B came *after* A, then it cannot be said to have caused A. So, *post hoc, ergo propter hoc* reasoning is not guilty of confusing effect with cause.

■ *The Golden Compass.* Just as it was supposed to, this picture makes us want to see this movie. We don't know why it has that effect, but we do not need an argument to know that it does have that effect.



Confusing Conditional Probabilities in Medical Tests

The probability of X given Y is distinct from the probability of Y given X. The probability the toilet is leaking given there is water on the floor is distinct from the probability there is water on the floor given the toilet is leaking. The probability Priglet has fleas given she itches is distinct from the probability she itches given she has fleas. The probability you are drunk if you get into a car accident is distinct from the probability you will get in a car accident if you are drunk.

These points seem plain enough, but they are easy to forget when it comes to medical tests. People sometimes assume that the probability they have a medical condition is high if they score high on a test for that condition. For example, suppose you are a male and you get a positive result on a test for male bladder cancer. The test is reported to be 90 percent accurate. Do you have a 90 percent chance of having bladder cancer? You might think so, but read on.

Testing positive for a medical condition (or for any other condition) is the *effect* of having that condition. If a test for male bladder cancer is 90 percent accurate, that means that 90 percent of those who have the cause—bladder cancer—will have the effect, meaning a positive test result. If you are a male, and you test positive, to determine your chances of having bladder cancer, you need to know two additional things: (1) what percentage of males who *don't* have bladder cancer test positive ("false positives"), and (2) what percentage of males have bladder cancer in the first place ("base rate").

To continue with this example, if 10 percent of males who do not have bladder cancer test positive, and the base rate for male bladder cancer is, for example, 1 percent, then out of every 1,000 males:

- 10 males will have bladder cancer
- 9 of them will test positive
- 990 will not have bladder cancer
- 99 of them will test positive

Hence: out of every 1,000 males, 108 (99 + 9) will test positive; and out of the 108, only 9 will actually have bladder cancer. So, given these data, if a male tests positive on this test, his chances of having this condition are not 90 percent but 8 percent (9/108).*

People make this mistake not only when it comes to medical tests but also with other known symptoms of medical conditions. But symptoms are *effects* of a condition, not causes, and remembering this may save you unnecessary grief. That 90 percent of heart attack victims experience symptom X does not mean that 90 percent of people who experience X are having a heart attack.

Overlooking Statistical Regression

"Statistical regression" and "regression to the mean" refer to a statistical property of measurements of mean values of populations. Let's say (to use

If you look at the new cases of death from AIDS, the fastest-growing category could be ladies over the age of 70. If last year one woman over 70 died from AIDS and this year two do, you get a 100 percent increase in AIDS deaths for that category.

—JOHN ALLEN PAULOS

Percentage increases from a small baseline can be misleading.

*This is a modified example of "frequency" calculations of probability in medical tests, given by Gerd Gigerenzer, *Calculated Risks: How to Know When Numbers Deceive You* (New York: Simon & Schuster, 2002). See, for example, Chapter 4.

the classic example) that the average (mean) height of a forty-year-old male is 5 feet 10 inches. Suppose you measure the average height of the children of forty-year-old male fathers whose average height is over 6 feet 4 inches. The average height of the children will be closer to 5 feet 10 inches. In other words, the children of unusually tall fathers are apt to be closer than their fathers to average height. One might wonder why the children of tall fathers are apt to be shorter than their dads. The explanation, however, does not involve cause and effect. The fathers of unusually tall *children* are also apt to be shorter than their kids, a fact that, obviously, cannot be explained by cause and effect.

Likewise, suppose you give a true/false test to the freshmen at your university and have them guess at the answers. Some test-takers will score above 50 percent and some will score below 50 percent, but the average of all the scores will be around 50 percent. If those who scored above 60 percent took another true/false test and guessed at the answers, their average on the second test would be closer to 50 percent. If you compare these two examples, you will see that they illustrate the same principle, statistical regression.

With these examples in mind, you might ponder why it so often happens that, say, a basketball player who has an unusually great game and shoots well above his average usually won't repeat the performance the next game. Or why the major league baseball Rookie of the Year, who has an unusually high batting average, usually doesn't do as well in his second season. Frequently, people propose explanations of these regressions: Did success destroy his concentration? Did other players start keying on him? Was there a coaching change? However, the regression could simply be statistical.

From time to time, the sexual activity of a large sample of young people is measured, in terms of, say, reported frequency of sex and number of partners over a period of time, say, six weeks. Suppose you then ask those whose reported sexual activity was in the top 10 percent to attend church more frequently and report their sexual activity during the following six weeks. Chances are that their reported sexual activity will be lower, closer to the mean for the original study. Did going to church explain the reduction? You might think so, until you remember the examples cited earlier. Chances are that their reported sexual activity would be lower if you had had them adopt a pet or drink extra water or do nothing at all.

Regression to the mean can happen whenever you encounter a phenomenon like either of those just mentioned. Two examples: Was the average daily total of American soldiers killed in Iraq in July 2007 exceptionally high? August's daily average will probably be lower—with or without a "surge" or another particular intervention. From a group of heart patients, select those whose average of blood pressure readings is atypically high. Administer a medication to these individuals, and retake their blood pressure. The second average will probably be lower, that is, closer to the mean for the entire group. (This example should explain why, in the Zicam experiment previously discussed, potential cold sufferers are randomly selected into experimental and control groups.)

This is not to say that attending church, troop surges, or heart medications cannot be known to be working. In the heart medication case, for example, subjects will be randomly selected into experimental and control groups, which means that those patients with atypically high blood pressure readings will be more or less evenly divided between the two groups. Without such

In the Media

Decoding Your Handwriting Style

M's and N's

How you mind your M's and N's is a reflection of your temperament and how you relate to others, experts say. They have four terms for your style:

- **Garland.** The garland looks like a bowl and is ready to receive. This means you have a willingness to please, and are kind and compassionate. The home and hearth is very important to you.
- **Arcade.** The arcade closes off everything underneath, symbolizing your emotional impenetrability—you are an emotional person but don't want anybody to know.
- **Angle.** Like the jarring shape of your M's and N's, you are combative with little room for flexibility. If things are going too smoothly, you feel unsettled and will make waves. But when you use your power for good, you can be incredibly effective.
- **Thread.** With your M's and N's flat and wavy, you think and act fast. You're adaptable and can fit in wherever you are, like a chameleon.



Garland



Arcade



Angle



Thread

This handwriting sample shows former President John F. Kennedy's "visionary" t's.

T's

There are two parts of the T that represent your work and your goals. The stem is a reflection of your self-image as it relates to your work, and the crossbar represents your ability to set goals.

*citizen of the world - ask not
what America will do for you -
or others*

A regular stem like you are taught in school shows you are conventional and happy to go along with the crowd. A looped stem means you're emotional and sensitive, especially to criticism of your work. A very tall stem means you are proud of your accomplishments, while a short one means your own

► HANDWRITING, Page L3

Handwriting analysts (graphologists) think of handwriting the same way cardiologists think of heart symptoms: as the effect of a cause. However, the skeptics that we are, we'd bet the associations between handwriting "symptoms" and their supposed causes (personality traits) are not as well established as the associations between cardiac symptoms and causes. Among other problems, we find it difficult (though perhaps not impossible) to imagine how a personality trait could cause a particular handwriting style.

Real Life

See What Happens When You Watch the Tube?

Recent research indicates that people who watch several hours of TV each day, as compared with those who don't watch very much, express more racially prejudiced attitudes, perceive women as having more limited abilities and interests than men, overestimate the prevalence of violence in society, and underestimate the number of old people. Does this suggest to you that these attitudes and misconceptions are the *result* of watching a lot of TV, that TV *causes* people to have these attitudes and misconceptions? If so, that's fine. But remembering not to overlook possible underlying common causes should lead you to contemplate another idea. It's possible that what accounts for these attitudes and misconceptions isn't too much TV but rather *ignorance*, and that ignorance is also what makes some people happy spending hours in front of the tube. An underlying common cause?



safeguards, one cannot conclude from the fact that a "remedy" was followed by an improvement in something, that the remedy caused the improvement. The improvement could be simple regression.

Proof by Absence of Disproof

Sometimes you will hear a person say something like this:

"Well, nobody's proved that Zicam doesn't prevent colds. . . ."

Sometimes, what the person has in mind when he or she says something like this is that the absence of disproof of a causal hypothesis increases the likelihood of the hypothesis. Is it true that the absence of disproof of a causal hypothesis increases the likelihood of the hypothesis?

Cases do arise in which one attempts to disprove a causal claim. For example, if a teacher has good reason to think a student's high score was the result of cheating, the student may attempt to disprove the hypothesis. The most famous argument in the history of philosophy is the Argument from Evil, which attempts to disprove that a good and all-powerful God created our universe, on the grounds that our universe contains evil within it.

However, in general, a failure to disprove a causal hypothesis only leaves intact whatever reasons there already were for thinking the hypothesis is true: The absence does not create a new and additional reason for thinking the hypothesis is true.

Appeal to Anecdote

In Chapter 10, we discussed the mistake of trying to generalize on the basis of an anecdote or story. Anecdotes are sometimes also used to prove or disprove causal hypotheses. Thinking that port prevents colds because Uncle Charlie drinks it and rarely catches cold would be an instance of this type of reasoning. Someone who submits that smoking pot doesn't hurt your lungs because she has a friend who smokes pot who has never had a lung problem employs similar reasoning. One could, of course, counter these arguments simply by pointing out that one knows someone who drinks port or smokes pot who does catch colds or have lung problems. So, the arguments don't really show anything and are really just hasty generalizations or *post hoc* reasoning.

Confusing Explanations with Excuses

After the September 11 suicide attacks on the World Trade Center, a speaker at our university attempted to explain the causes of the attacks. Some assumed him to be excusing or justifying the attacks; Rush Limbaugh invited him to move to Afghanistan.

If you assume without thinking about it that anyone who tries to explain the causes of bad behavior is trying to excuse it, you commit the fallacy we might call **confusing explanations with excuses**. For example, someone may try to explain why many Germans adopted the views of the Nazi Party during the 1930s. The speaker may point out that the German economy was in a mess, that the country still suffered from terms imposed on it at the end of World War I, and so forth. To assume without further reason that the speaker must be trying to excuse or muster sympathy for Nazi supporters would be to make this mistake. One can propose an explanation in order to excuse bad behavior, but one isn't necessarily trying to do so.

CAUSATION IN THE LAW

In concluding this chapter, we direct your attention to an arena in which a great deal of money and sometimes even human life depend on establishing causation. In the law, causation is the connection between action and harm. Only if your action causes harm (or contributes to its cause) can you be said to be responsible for that harm. In civil law, it is a necessary condition of tort liability that a person's action caused the harm in question. It is also a necessary condition for some, but not all, kinds of criminal liability. (Not all crimes involve harm—attempted crimes, for example.) It may seem simple to say that X caused Y, but, as we'll see, there is almost always a lot more to be said than that.

The broadest sense of the word "cause" is that of *conditio sine qua non* ("a condition without which nothing"). Such causes are often called "but for" causes. Y would not have happened but for X's having happened. If the gun had not fired, Ernest would not have been killed. Clearly, *sine qua non* causes are relevant. It would be silly to punish a person for causing harm Y by doing X when Y would have happened even if X had not been done.

But a cause, in this sense, can have effects that go on indefinitely. We might say, for example, that a physician's having written a prescription in 1925 caused the assassination of John F. Kennedy in 1963. This is because that prescription led to a man's going into a drugstore in 1925, where he met the woman he was to marry and with whom he was to have a child, Lee Harvey

On Language

The Great 9/11 Mystery

How could all these facts be mere coincidence?

- The day was 9/11 (9 plus 1 plus 1 equals 11).
- American Airlines Flight 11 was the first to hit the World Trade Center.
- 92 people were on board (9 plus 2 equals 11).
- September 11 is the 254th day of the year (2 plus 5 plus 4 equals 11).
- "New York City" has 11 letters in it.
- "The Pentagon" has 11 letters in it.
- "Saudi Arabia" (where most of the 9/11 terrorists were from) has 11 letters in it.
- "Afghanistan" has 11 letters in it.
- And get this: Within 11 months of September 11, 2001, 11 men, all connected to bioterror and germ warfare, died in strange and violent circumstances: One suffocated; another was stabbed; another was hit by a car; another was shot dead by a fake pizza delivery boy; one was killed in an airplane crash; one died from a stroke while being mugged; and the rest met similar ends.

Could this possibly be coincidence? What are the odds against all these things happening and being connected by the number 11?

Well, if you think these events must somehow be causally interconnected, you have a lot of company. But it doesn't include mathematicians—or us. Why not? In a world where so many things happen, strange and seemingly improbable coincidences are bound to happen every second of every day.

Not convinced? Ask each of your classmates to think of as many events or things connected with the 9/11 attack that involve the number 11 as possible. Give each person a week to work on this. We'll bet the collected list of "suspicious" coincidences is very long. There are even websites devoted to 9/11 coincidences.

As for the men connected with bioterrorism and germ warfare, you might be interested to know that the American Society for Microbiology alone has 41,000 members, and the total number of people "connected" in some way or another with bioterrorism and germ warfare would be indefinitely larger than that. We'd bet our royalties that in the eleven months following September 11, a lot more than just eleven people connected with bioterrorism and germ warfare died mysteriously and/or violently.

Lisa Belkin of the *New York Times Magazine* wrote an article on this subject (August 18, 2002), from which we learned about the coincidences mentioned above.

Incidentally, "Moore/Parker" has eleven letters.

Oswald, who would in November 1963 shoot John Kennedy from the School Book Depository Building in Dallas, Texas.

Clearly, we don't want to trace causes back this far in order to assign liability for a harm. In order to identify a **legal cause** (or a "proximate cause," as it is sometimes known) of an event, we need to put severe restrictions on the notion of cause *sine qua non*.

On Language

AC and IBE

If the surge had been successful, we would have seen a reduction in violence in Baghdad.

A reduction in violence in Baghdad was seen.

Therefore, the troop surge was successful.

This looks very much like Affirming the Consequent (AC), which is listed inside the back cover (and in Chapter 9) as a mistake in logic. (We say "very much like" because the second premise isn't 100 percent identical to the second part of the first premise.)

However, it would be more charitable to interpret the argument as an IBE, an Inference to the Best Explanation:

Violence was reduced.

The most likely explanation of that is that it was due to the surge.

Therefore, it was due to the surge.

Often, reputed real-life examples of AC can more charitably be interpreted as examples of IBE, where the second premise is accepted on the basis of a comparison of assumed (or calculated) probabilities of alternative explanations.

Whereas a *sine qua non* or "but for" cause is a matter of fact, a legal or proximate cause is generally said to be a combination of fact and decision or fact and policy. This is because deciding what is "important" or "significant" requires that we make a decision of some sort or that we have a policy that indicates what is important. In a famous essay on the subject,* H. L. A. Hart and A.M. Honoré try to show that common sense can guide the necessary decisions. They argue that, in order for a person to be legally responsible for a harm, we must be able to trace the harm caused back to that person's action. Let's say Smith throws a lighted cigarette into some roadside brush. The brush catches fire, a breeze causes the fire to spread, and eventually much of San Diego County burns up. We do not excuse Smith because of the intervention of the breeze, because that is a "common recurrent feature," a part of what we might call the "causal background," something like the presence of oxygen in the air. Such features are not seen as intervening forces that mitigate Smith's responsibility.

But say that Jones comes along and pours gasoline on the fire, which might have gone out otherwise. Here, because Jones's intervention is voluntary, it contravenes Smith's causal role. Here, we are content to say that Jones caused the destruction.

Sometimes coincidence intervenes: Moore punches Merton, who falls to the ground. At that moment, a tree falls over in the wind and strikes Merton, killing him. Because the tree's falling is pure coincidence, not foreseen by Moore, we cannot hold Moore responsible for Merton's death. We can

*H. L. A. Hart and A. M. Honoré, *Causation and the Law* (Oxford, 1959), esp. pp. 59–78.

say that Moore caused his bruises, but not his death. The idea here is that we do not hold a person responsible when coincidence intervenes in this way.

Obviously, there is more to say about this subject, but at least here you have seen some of the directions that the discussion on causation in the law takes.

Recap

- Explanations are different from arguments. They are used to elucidate a phenomenon. Arguments are used to support or prove a claim.
- Sentences that can be used as explanations can also be used to state the conclusion or a premise of an argument.
- Explanations serve a variety of purposes. Two important purposes are (1) to provide physical causal explanations of something and (2) to provide behavioral causal explanations of something.
- What counts as an adequate explanation is relative to one's purposes and needs.
- Nevertheless, an adequate explanation shouldn't be unnecessarily complicated, inconsistent, incompatible with known fact or theory, or untestable due to vagueness, circularity, or other reasons.
- Arriving at a causal hypothesis involves an Inference to the Best Explanation.
- Methods of arriving at causal hypotheses (IBE methods) are the Method of Difference, the Method of Agreement, and the Best Diagnosis Method.
- These methods are guided by one's background knowledge of causal mechanisms, what causes what, and how things work.
- Confirming a causal hypothesis consists primarily in rigorously applying a combination of the Methods of Difference and Agreement.
- Two important mistakes in causal reasoning are *post hoc, ergo propter hoc*, and *cum hoc, ergo propter hoc*.
- These are mistakes because they do not eliminate the possibility of coincidence, an underlying cause, or confusion between effect and cause.
- An important case of confusing effect and cause is forgetting that symptoms are effects.
- Changes due to statistical regression are sometimes mistakenly assumed to be due to causation.
- Absence of disproof of causation is not equivalent to proof of causation.
- Using an anecdote to establish causation or to refute a general causal claim involves hasty generalizing.
- Explanations of bad behavior are not always intended to excuse the behavior.
- In the law, in its broadest sense, a "cause" is that "but for" which an effect would not have happened, but the legal cause of an effect often requires a judgment regarding what causal agent is most relevant.

Additional Exercises

Here are additional exercises to help you tell when an explanation is part of an argument, and when an explanation overlooks the possibility of coincidence or other problems. Another exercise gives you an opportunity to propose a causal hypothesis.

Exercise 11-19

Match each item to a concept on this list:

- A = Confusing conditional probabilities
- B = Overlooking statistical regression
- C = Proof by Absence of Disproof
- D = Appeal to Anecdote
- E = *conditio sine qua non*
- F = Confusing explanations with excuses

Every concept is used at least once.

- ▲ 1. The Amazing Vikings had an off night. Their shooting was poor, their defense uninspired. Everything was reflected in the lopsided score. "Laps," Coach Snort said after the loss. "Nobody showers before he does ten laps!" When the guys won their next game, the coach knew he had done the right thing. "You just gotta motivate them," he thought.
2. If your eyes are extremely sensitive to light, there is better than a 50-50 chance you have bacterial meningitis, since light sensitivity almost always accompanies the disease.
3. Wood smoke a health hazard? You kidding? We been using wood our entire lives to heat with. You gonna tell me we wouldn't know about it if it had hurt us?
- ▲ 4. Eat plenty of carbohydrates before an intense workout. Nobody has ever shown that carbo-loading doesn't enhance athletic performance.
5. The research team administered Deconolate to the men whose recent PSA readings were highly elevated, and then rested them. The average PSA reading for the group had declined markedly, suggesting that Deconolate may be useful in the fight against prostate cancer.
6. It is ridiculous for the FDA to ban ephedrine. I used the stuff for years to help with allergies, and I am as healthy as a horse.
- ▲ 7. SPOKESPERSON FOR BRITISH PETROLEUM: Halliburton cemented the drill in place, not BP.
CONGRESSMAN: Don't try to put the blame on someone else.
8. "It's your fault!"
"What? I didn't run over the sprinkler! You did!!"
"Yeah, but if you had remembered the milk, I wouldn't even be going to the store."
9. After an evening when the mosquitoes were particularly bad, Tony rushed out to Ace and bought a Mosquito Magnet. That evening the mosquitoes didn't seem as bad. "It works," Tony told his wife.
- ▲ 10. If the HDL reading of a male over 50 is low, the odds are he has heart disease, since most men over 50 with heart disease have low HDL readings.

Exercise 11-20

Into which category do each of the following items fall? Keep your wits about you. This exercise set and the next one are challenging.

A = An explanation appears as a premise.

B = An explanation appears as a conclusion.

C = An explanation stands by itself as an unsupported claim.

- ▲ 1. Awww, don't get on her, Mom. She didn't rake the leaves because her stomach was hurting and she had to lie down.
- 2. The garage gets cluttered because we never throw anything away. So, if we want a neat garage, we'd better change our habits.
- 3. Mr. Snork is taking French so he can speak the language when he goes to Europe in the spring.
- ▲ 4. The reason the door keeps banging is that the windows are open on the south side of the house, and there is a strong breeze.
- 5. We eliminated the other possibilities. The puddle was caused by a leaking wax ring.
- 6. I am sure Professor York will end on time this evening. He always ends on time because he likes to watch the 11:00 news.
- ▲ 7. You think the mower won't start because it's old? That's not why. You let gas sit in the carburetor all winter, and it gums up the works. That's why it won't start. It has nothing to do with its being old.
- 8. All eleven Taco Bells implicated in an *E. coli* outbreak in New York and New Jersey used the same food distributor. It seems likely the source of the bacteria was the distributor.
- 9. The coffee I drink in the evening must explain why I can't sleep. The only other things it could be are sweet desserts and anxiety, and I don't eat dessert, and I'm not worried about anything.
- ▲ 10. I believe God exists. That's the best explanation for why there is life.

Exercise 11-21

Into which category does each of the following items fall?

A = An explanation appears as a premise.

B = An explanation appears as a conclusion.

C = An explanation stands by itself as an unsupported claim.

- ▲ 1. Yes, I know Emily doesn't go out much, but you can hardly blame her. She doesn't go out because she wants to study.
- 2. The zucchini grows better than the eggplant because it gets more fertilizer.
- 3. Why didn't the tomatoes do better? I don't think we were fertilizing them enough. Right after I gave them Miracle-Gro, they did fine.
- ▲ 4. You don't believe me when I say sometimes you can see Pluto with the naked eye? Just think of how the solar system works. The planets all orbit the Sun, and at a certain point, Pluto's orbit gets close to ours.
- 5. Just look at the cat hair on this keyboard! Where do you let your cat sleep? No wonder your computer doesn't work right.

- 6. Given your symptoms, Charles, I'd say your pain is due to a sprain, not a break. Plus, your X-rays don't show a broken bone.
- ▲ 7. Maria can tell what note you are playing because she has perfect pitch.
- 8. Give 'em a break. That kind of work makes noise, and they gotta start work early to get it done.
- 9. Why did Dr. York give a test on Friday? He wanted to surprise us.
- ▲ 10. Harold didn't return the book on time, but he couldn't help it. Someone broke into his car and stole his backpack.
- 11. TV watching leads to violent behavior. Studies show that adolescents who watch more television are more prone to act violently.

Exercise 11-22

Using your background knowledge of how things work and what causes what, classify each of the following as probably

A = coincidence

B = confusing effect with cause

C = a case in which an implied cause and an implied effect are really the effects of an underlying cause

D = legitimate cause and effect

- ▲ 1. Whenever I mow the lawn, I end up sneezing a lot more than usual. Must be gas fumes from the mower.
- 2. Maybe the reason he's sick is all the aspirin he's taking.
- 3. The only thing that could possibly account for Clark and his two brothers all having winning lottery tickets is that all three had been blessed by the Reverend Dim Dome just the day before. I'm signing up for the Reverend's brotherhood.
- ▲ 4. What else could cause the leaves to turn yellow in the fall? It's got to be the cold weather!
- 5. Perhaps Jason is nearsighted because he reads so many books.
- 6. First, Rodrigo gets a large inheritance. Then Charles meets the girl of his dreams. And Amanda gets the job she was hoping for. What did they all have in common? They all thought positively. It can work for you, too.
- ▲ 7. It's common knowledge that osteoarthritis of the knee causes weakness in the quadriceps.
- 8. Ever since the country lost its moral direction, the crime rate has gone through the ceiling. What more proof do you need that the cause of skyrocketing crime is the breakdown in traditional family values?
- 9. Wow! Is Johnson hot or what? After that rocky start, he has struck out the last nine batters to face him. That's what happens when ol' Randy gets his confidence up.
- ▲ 10. Research demonstrates that people who eat fish are smarter. I'm going to increase my intake.
- 11. What a night! All those dogs barking made the coyotes yap, and nobody could get any sleep.

12. Isn't it amazing how, when the leaves drop off in the winter, it makes the branches brittle?
- ▲ 13. What explains all the violence in society today? TV. Just look at all the violence they show these days.
14. On Monday, Mr. O'Toole came down with a cold. That afternoon, Mrs. O'Toole caught it. Later that evening, their daughter caught it, too.
15. Retail sales are down this year. That's because unemployment is so high.
- ▲ 16. Yes, they're saying electric blankets aren't really a health threat, but I know better. A friend had cancer, and know what? He slept with an electric blanket.
17. At finals time, the bearded man on the front campus offers prayers in return for food. Donald is thinking, "Sure. Why not?—can't hurt anything." He approaches the bearded man with a tidbit. Later: The bearded man prays. Donald passes his finals. To skeptical friends: "Hey, you never know. I'll take all the help I can get."
18. It is an unusually warm evening, and the birds are singing with exceptional vigor. "Hot weather does make a bird sing," Uncle Irv observes.
- ▲ 19. Why did Uncle Ted live such a long time? A good attitude, that's why.
20. Studies demonstrate that people who are insecure about their relationships with their partners have a notable lack of ability to empathize with others. That's why we recommend that partners receive empathy training before they get married.
21. Lack of self-confidence can be difficult to explain, but common sense suggests that stuttering is among the causes, judging from how often the two things go together.
- ▲ 22. When I went to Munich last summer, I went to this movie, and who was there? This guy I went to school with and hadn't seen in fifteen years! No way that could be coincidence!
23. It's odd. I've seen a huge number of snails this year, and the roses have mildew. Don't know which caused which, but one of them obviously caused the other.
24. Her boyfriend is in a bad mood, you say? I'll bet it's because she's trying too hard to please him. Probably gets on his nerves.
- ▲ 25. Many people note that top executives wear expensive clothes and drive nice cars. They do the same, thinking these things must be a key to success.
26. "... and let's not underestimate the importance of that home field advantage, guys."
"Right, Dan. Six of the last seven teams that had the home field advantage went on to win the Super Bowl."
27. On your trip across the country, you note that the traffic is awful at the first intersection you come to in New Jersey. "They certainly didn't do anyone a favor by putting a traffic light at this place," you reflect. "Look at all the congestion it caused."

Exercise 11-23

Here's a news report on the costs of drug abuse that appeared during the administration of George H. W. Bush. See if you can find any flaws in the reasoning by which the figures were reached.

J. Michael Walsh, an officer of the National Institute on Drug Abuse, has testified that the "cost of drug abuse to U.S. industry" was nearly \$50 billion a year, according to "conservative estimates." President Bush has rounded this figure upward to "anywhere from \$60 billion to \$100 billion." This figure would seem to be a difficult one to determine. Here's how Walsh arrived at it. After a survey of 3,700 households, a NIDA contractor analyzed the data and found that the household income of adults who had *ever* smoked marijuana daily for a month [or at least twenty out of thirty days] was 28 percent less than the income of those who hadn't. The analysts called this difference "reduced productivity due to daily marijuana use." They calculated the total "loss," when extrapolated to the general population, at \$26 billion. Adding the estimated costs of drug-related crimes, accidents, and medical care produced a grand total of \$47 billion for "costs to society of drug abuse."

Exercise 11-24

Men are involved in far more fatal automobile crashes than are women. List as many plausible explanations for this as you can.

Writing Exercises

1. Construct a brief essay in which you (a) support the claim that cheating is widespread in high school (or was widespread in your high school), (b) offer an explanation of why it is widespread, and (c) show why your explanation is a good one.
2. Are women less competitive than men? In a brief essay, (a) explain what you think the investigations in the box on the following page show, if anything; or (b) set forth alternative explanations for the results; or (c) describe what implications you think these investigations have.
3. Which of the following causal hypotheses do you accept? Select one that you accept and, using the Internet or other sources, marshal evidence that supports your position. Limit yourself to one page unless instructed otherwise.

Marijuana use is a gateway to hard drug use.
The death penalty is/isn't a deterrent to murder.

Welfare makes people lazy.

Beer is better/not better/worse for you after a workout than water.

Rap music/TV/movies/pornography promotes violent crime.

Real Life

Are Women Less Competitive?

Studies Uncover a Striking Pattern

Although women have made huge strides in catching up with men in the workplace, a gender gap persists both in wages and levels of advancement. Commonly cited explanations for this gap range from charges of sex discrimination to claims that women are more sensitive than men to work-family conflicts and thus less inclined to make sacrifices for their careers.

Now, however, two new studies by economists Uri Gneezy of the University of Chicago and Aldo Rustichini of the University of Minnesota suggest that another factor may be at work: a deeply in-grained difference in the way men and women react to competition that manifests itself even at an early age.

The first study focused on short races run by some 140 9- and 10-year-old boys and girls in a physical education class. At that age, there was no significant difference between the average speeds of boys and girls when each child ran the course alone. But when pairs of chil-

dren with similar initial speeds ran the race again, things changed. Boys' speeds increased appreciably when running against either a boy or a girl, but more so when paired with a girl. Girls showed no increase when running against a boy and even ran a bit more slowly when paired with a girl.

The second study, by Gneezy, Rustichini, and Muriel Niederle of Stanford University, involved several hundred students at an elite Israeli technical university. Groups of six students were paid to solve simple maze problems on a computer. In some groups, subjects were paid 50¢ for each problem they solved during the experiment. In others, only the person solving the most problems got rewarded—but at the rate of \$3 for each maze solved.

Regardless of the sexual makeup of the groups, men and women, on average, did equally well when students were paid for their own performance. But when only the top student was paid, average male performance rose sharply—by about 50%—while female performance remained the same.

The authors conclude that females tend to be far less responsive to competition than males—a tendency with important implications for women and business. It may hurt women in highly competitive labor markets, for example, and hamper efficient job placement—especially for positions in which competitiveness is not a useful trait.

That's something companies with highly competitive atmospheres may need to consider, says Rustichini. If they don't, the results could be "both a subtle bias against women and, in many cases, foregone worker productivity."

—Gene Koretz

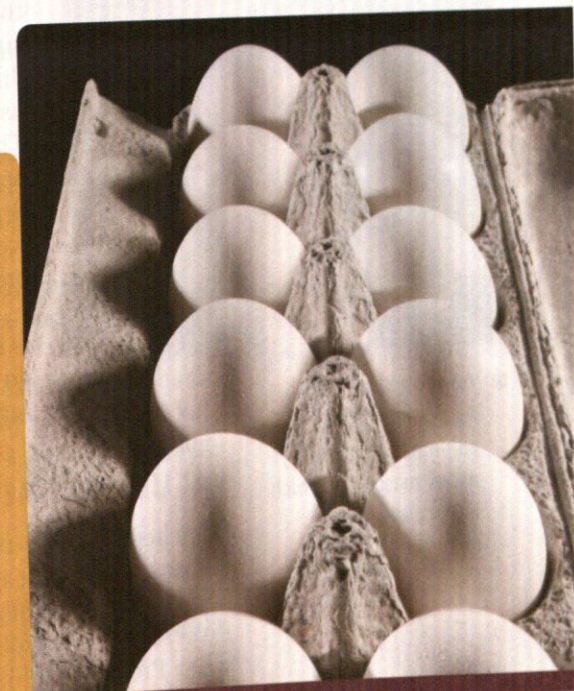


Let's race: Boys' speeds went up.

Source: *Business Week*, December 9, 2002.

12

Moral, Legal, and Aesthetic Reasoning



Students will learn to . . .

1. Distinguish moral value judgments from value judgments
2. Apply the principles of moral reasoning
3. Recognize the problem of inconsistency in moral judgment
4. Explain the most influential frameworks for moral reasoning in Western thought
5. Recognize the place of perspectives in moral deliberations
6. Recognize principles that underlie legal reasoning and argument
7. Explain various definitions of aesthetic value and judgment

Her fiancé had been in Iraq for eleven months, and his tour of duty had been extended for four more. While he was away, she met someone else. Should she tell her fiancé immediately, or wait until he returned? "Feeling Guilty" asked Dear Abby what to do.

Abby* didn't mince words. "Grow up and think about someone other than yourself," she began (somewhat harshly, we thought). Feeling Guilty's number one duty, Abby said, is making sure not to distract her fiancé. "Under no circumstances should you write him a 'Dear John' letter or tell him anything that could unnerve or depress him."

Was "Dear Abby" correct about this?

From time to time, we all face tough moral decisions. A mother must decide whether her daughter's softball game has a higher priority than her professional responsibility. A president may have to decide whether to take a nation to war. When he was governor of Texas, George W. Bush had to decide whether to bestow clemency on Karla Faye Tucker, an ax murderer who became a likable born-again Christian in prison and whose execution some said would be hugely wrong.

When people think abstractly, sometimes they believe that moral issues are subjective. You hear them say such

*Actually, Jeanne Phillips, the original Abby's daughter, writes the column. This column was printed September 6, 2006.