gotten the treatment when he or she had "hit bottom." Consequently, there was no place to go but up.

12. Maturation refers to inner, biological changes that occur in people merely as a result of time. In some cases, becoming more mature—not the treatment—accounts for people changing from pretest to posttest.
13. History refers to outside events—other than the treatment—that may influence participants' scores. Events that occur in the participants' world between pretest and posttest can cause participants to change from pretest to posttest.
14. Testing effect refers to the fact that taking a pretest may affect performance on a posttest.
15. Instrumentation occurs when the measuring instrument used in the posttest is different from the one used in the pretest.
16. External validity is the degree to which the results from a study can be generalized to other types of participants and settings.
17. Internal and external validity are different but not necessarily incompatible. For example, if men dropped out of your treatment group but not your no-treatment group, that might hurt your internal validity. If all the men in both groups quit your study, that would hurt your external validity, but not your internal validity. If nobody dropped out of either group, that would be good for both your internal and external validity.

KEY TERMS

extraneous factors *(p. 332)*
history *(p. 349)*
instrumentation (bias) *(p. 351)*
internal validity *(p. 331)*
matching *(p. 338)*
maturation *(p. 348)*
mortality *(p. 346)*
pretest–posttest design *(p. 348)*
regression (toward the mean) *(p. 343)*
selection (or selection bias) *(p. 335)*
selection by maturation interaction *(p. 340)*
testing effect *(p. 349)*

EXERCISES

1. What questions would you ask a researcher who said that the no-treatment and treatment groups were identical before the start of the study?
2. In all of the following cases, the researcher wants to make cause–effect statements. What threats to internal validity is the researcher apparently overlooking?
   a. Employees are interviewed on job satisfaction. Bosses undergo a 3-week training program. When employees are reinterviewed, dissatisfaction seems to be even higher. Therefore, the researcher concludes that the training program caused further employee dissatisfaction.
   b. After completing a voluntary workshop on improving the company's image, workers are surveyed. Those who attended the workshop are now more committed than those in the no-treatment group who did not make the workshop. Therefore, the researcher concludes that the workshop made workers more committed.
   c. After a 6-month training program, employee productivity improves. Therefore, the researcher concludes that the training program caused increased productivity.
   d. Morale is at an all-time low. As a result, the company hires a "humor consultant." A month later, workers are surveyed and morale has improved. Therefore, the researcher concludes that the consultant improved morale.
   e. Two groups of workers are matched on commitment to the company. One group is asked to attend a 2-week workshop on improving the company's image; the other

is the no-treatment group. Workers who complete the workshop are more committed than those in the no-treatment group. Therefore, the researcher concludes that the workshop made workers more committed.

3. A hypnotist claims that hypnosis can cause increases in strength. To "prove" this claim, the hypnotist has participants see how many times they can squeeze a hand-grip in 2 minutes. Then, he hypnotizes them and has them practice for 2 weeks. At the end of 2 weeks, they can squeeze the hand-grips together many more times than they could at the beginning. Other than hypnosis, what could have caused this effect?
4. How could a quack psychologist or "healthcare expert" take advantage of regression toward the mean to make it appear that certain phony treatments actually worked? Why should a baseball team's general manager consider regression toward the mean when considering a trade for a player who made the All-Star team last season?
5. How could a participant's score on an ability test change even though the person's actual ability had not?
6. Suppose a memory researcher administers a memory test to a group of residents at a nursing home. He finds grade-school students who score the same as the older patients on the memory pretest. He then administers an experimental memory drug to the older patients. A year later, he gives both groups a posttest.
   a. If the researcher finds that the older patients now have a worse memory than the grade-school students, what can the researcher conclude? Why?
   b. If the researcher finds that the older patients now have a better memory than the grade-school students, what can the researcher conclude? Why?
7. Suppose there is a correlation between the use of night-lights in an infant's room an increased incidence of nearsightedness later. What might account for this relationship?
8. What is the difference between
   a. testing and instrumentation?
   b. history and maturation?
9. Suppose a researcher reports that a certain argument strategy has an effect, but only on those participants who hold extreme attitudes. Why might the researcher be mistaken about the effects of the persuasive strategy? (Hint: Whereas magic caused Cinderella to return to normal when the clock struck 12, this causes scores return to normal on retesting.)
10. What is the difference between internal and external validity?

WEB RESOURCES

1. Go to the Chapter 9 section of the book's student website and
   a. Look over the concept map of the key terms.
   b. Test yourself on the key terms.
   c. Take the Chapter 9 Practice Quiz.