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Chapter 2: Conducting Psychological Research

LEARNING OBJECTIVES

LO1 Describe some of the limits of everyday thinking and observation.
LO2 Explain what makes psychology a science.
LO3 Compare and contrast the different kinds of descriptive studies and explain the importance of random sampling.
LO4 Describe the strengths and weaknesses of correlational studies and define positive and negative correlations.
LO5 Describe the main characteristics of an experimental study that allow researchers to isolate cause and effect.
LO6 Differentiate among the various measurement scales used to operationally define variables.
LO7 Compare and contrast commonly used measures of psychological research.
LO8 Explain how to use descriptive and inferential statistics to analyze and interpret data.
LO9 Discuss some research challenges that involve the ethics of studying humans and animals.

BRIEF CHAPTER OUTLINE

The Nature of Science
- Common Sense and Logic
- The Limits of Observation
- Scientific Principles in Psychology
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  - Science Is a Process More than a Product
  - Science Is an Attitude
- The Scientific Method
- What Science Is Not: Pseudoscience

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EXTENDED CHAPTER OUTLINE

- Zimbardo's Stanford Prison Experiment is outlined in detail.
    - Set out to examine whether normal people might behave in extreme ways when thrust into situations that place certain demands of them.
    - Zimbardo screened 21 male student volunteers and assigned them to be either "guards" or "prisoners" in a simulated prison environment for two weeks. All were briefed beforehand about what conditions would be like in the mock prison. All the students signed a form consenting to participate.
    - Six days into the simulation, however, Zimbardo ended the study, because the students were playing their roles too well.
        - Prisoners went back and forth between plotting riots and having emotional breakdowns, such as getting sick and crying.
        - Guards became extremely authoritarian, restricting almost all personal freedom of the prisoners.
- One of the goals of modern psychological research is to understand human behaviour in a sound, objective, and scientific manner while observing guidelines for the physical and emotional well-being of the people or animals being studied.
    - Formal ethical guidelines, however, were first proposed in the United States in 1966 and only became law in 1974 (*Institutional Review Board Guidebook,* 1993). In Canada, research ethical guidelines were first proposed in the early 1970's by the Medical Research Council of Canada, and the Canada Council. Both of these events occurred *after* Zimbardo conducted his study. You may want to ask students if they think that his study would have been approved by REBs.

THE NATURE OF SCIENCE

Common Sense and Logic

- **Common sense** is the intuitive ability to understand the world.
    - **CONNECTION:** How do psychologists tease apart the question of how much of a personality trait is influenced by genetics and how much by environment? A common approach is to study twins (both identical and fraternal) who are reared

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apart or reared together. (See Chapter 3.)

- One of the problems with common sense is that we often use **hindsight bias** to confirm what we believe. Predicting the outcome of an event after the outcome is already known, makes common sense unreliable.
- **CONNECTION**: What other biases may hinder our ability to think scientifically? The confirmation bias can lead people to pay attention to information that is consistent with their beliefs while ignoring evidence that contradicts their beliefs. (See Chapter 8.)

- **Logic** tells us how the world *should* work.

The Limits of Observation

- Our knowledge of the world comes through our five senses, but the way in which the brain organizes and interprets sensory experiences may vary from person to person, making observation potentially faulty.
- Another problem with observation is that people tend to generalize from their observations and assume that what they witnessed in one situation applies to all similar situations.

Scientific Principles in Psychology

- Some people do not view psychology as a science in the same way as other sciences such as physics; however, as psychology shares the same systematic, empirical methods of observations as the natural sciences, it is indeed a science.
  - As mentioned in Chapter 1, psychology is a *social* science.
- B.F. Skinner concluded that science is (1) cumulative, (2) a process more than a product, and (3) an attitude (1953)
  - Cumulative: scientific knowledge builds upon itself, and advances cumulatively.
  - Science is a process more than a product:
    - Science is a way of exploring how the world operates, what causes events to occur, and predicting what might happen in similar conditions.
  - Attitudes:
    1. Question authority. Be skeptical and don't just accept the words of experts. You must scrutinize and test ideas yourself.
    2. Show open skepticism. While you should be skeptical, you should also, ultimately, be open to accepting whatever the evidence reveals.
    3. Intellectual honesty. Accept the data – whatever it suggests.
  - **CONNECTION**: As a neuroscientist working on Parkinson's disease, Helen Mayberg found something unexpected about brain circuitry. Initially, she was skeptical. But because she was also curious and open to the evidence, she decided to pursue it further. Her curiosity and openness led to her discovery that placing an electrical stimulator deep inside the brain could turn off depression. (See Chapter 16.)

The Scientific Method

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- The **scientific method** is made up of five basic processes that you can remember by the word OPTIC: Observe, Predict, Test, Interpret, and Communicate.
- In the *observation* phase researchers examine previous research findings and/ or make personal observations of some phenomena in the world. During the *prediction* stage of a study, researchers develop expectations about an observed phenomenon.
    - A **theory** is a set of related assumptions from which testable predictions can be made. They organize and explain what we have observed and guide what we will observe.
    - A **hypothesis** is a specific, informed, and testable prediction of what kind of outcome should occur under a particular condition.
- The third stage is the testing of these hypotheses. To do this, researchers select both an appropriate method of testing and the appropriate measurement techniques.
- In the fourth stage, researchers use statistical techniques to *interpret* the results and determine whether they are beyond chance and a close fit to their prediction or not. You may want to use this as an opportunity to explain why psychology majors need to take statistics!
- The fifth stage of the scientific method is to *communicate* the results. Generally, scientists publish their findings in an established, peer-reviewed, professional journal but they can also give talks and poster presentations. Written communications follow a standardized format (called APA [vs. MLA] style) whereby the researchers report their hypothesis, describe their research design and the conditions of the study, summarize the results, and share their conclusions.
    - **Replication** is the repetition of a study to confirm the results. The advancement of science hinges on results being replicated. This is how the process of scientific discovery is cumulative. Previous knowledge builds on older knowledge.

What Science Is Not: Pseudoscience

- **Pseudoscience** refers to practices that appear to be and claim to be science, but in fact do not use the scientific method to come to their conclusions.
- Pseudoscience practitioners:
    1. make no real advances in knowledge,
    2. disregard well-known and established facts that contradict their claims,
    3. do not challenge or question their own assumptions,
    4. tend to offer vague or incomplete explanations of how they came to their conclusions, and
    5. tend to use unsound logic in making their arguments.
- Examples of pseudoscience include alchemy, creation science, intelligent design, perpetual motion machines, astrology, psychokinesis, and some forms of mental telepathy.

RESEARCH METHODS IN PSYCHOLOGY

Principles of Research Design

- Research designs are plans for how to conduct a study.

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- A general goal of psychological research is to measure change in behaviour, thought, or brain activity. A **variable** is anything that changes or "varies" within or between people. Psychologists do research by predicting how and when variables influence each other.
    - Examples: age, personality traits, gender, mental disorders
- Researchers must pay attention to how they obtain participants for their studies.
    - The first step in obtaining a sample is for the researchers to decide the makeup of the entire group or **population** in which they are interested (e.g., all college students, all men, all teenagers, all African Americans, etc.).
    - Populations are too large to survey or interview directly so researchers draw on small subsets from each population to study, called **samples**.
        - If researchers want to draw valid conclusions or make accurate predictions about the population, it is important that they have samples that accurately represent the population in terms of age, gender, ethnicity, or any other variables that might be of interest.
    - Researchers must also consider what kinds of questions they are asking and how those questions might influence the responses they receive. For example, if the topics are controversial, sensitive, and personal (e.g., sexual behaviour, drug use, prejudice) people may exhibit the **social desirability bias**. That is, they respond in ways that may not honestly reflect their true beliefs but in ways that make them look good.
    - **CONNECTION**: What are the four main goals of psychological research? (See Chapter 1.)

Descriptive Studies

- Single events and single cases often lead to new ideas and new lines of research (for example, the Kitty Genovese murder).
- In **descriptive designs**, the researcher makes no prediction and does not control or manipulate any variables. Rather, the researcher defines a problem and describes the variable of interest.
- These types of studies generally occur during the exploratory phase of research.
- **CONNECTION**: The "bystander effect" explains why individuals in crowds may not help others in need. When in a group, individual responsibility is diffused and people tend to think that helping is someone else's responsibility. (See Chapter 14.)

Case Studies

- Involves a psychologist observing one person often over a long period of time.
- Offer deep insights into remarkable and rare events.
- **Psychobiographies** examine in detail the lives of historically important people.
- They do not test hypotheses but can be a rich source for hypotheses.
- Caution! Not all cases are generalizable to other people. That is why we don't stop with case studies, but use them to develop testable and more general predictions.

Naturalistic Observation

- The researcher (trying to be as unobtrusive as possible) observes and records behaviour in the real world.

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- Naturalistic observation is more often the design of choice in comparative psychology by researchers who study non-human behaviour (usually primates) to determine what is and is not unique about our species. A good example is Jane Goodall.
- Developmental psychologists occasionally also conduct naturalistic observations. For example, Pepler and Craig (1995) detailed naturalistic observations of bullying on school playgrounds. The advantage of naturalistic observation is that it gives researchers a look at real behaviour in the real world, rather than in a controlled setting where people might not behave naturally.
- Some researchers conduct **archival research**, examining previously compiled information (e.g., government documents, newspaper clippings, etc.) Others observe **physical traces** of behaviour in the environment. For example, Gosling, Ko, Mannarelli, and Morris (2002) examined people's university dorm rooms and work spaces to gain insights into their personality.

- Caution! Because conditions cannot be controlled and cause and effect relationships between variables cannot be examined, these studies are rarely done.

Interview and Survey

- Both involve asking people directly or indirectly what they think, feel, or have done.
- They also both involve specific questions, usually asked precisely the same way, but answers can be open-ended or restricted to a rating (Likert) scale.
- Interviews can be conducted face-to-face, over the phone, or online.
- Pitfalls include sampling problems (not being representative) and biased responses.
    - Ideally, researchers want to have a **representative sample** in which the sample truly represents the population of interest.
    - Representative samples can be obtained through **random sampling** in which every member of the population has an equal likelihood of being included in the study.
- Kinsey's surveys of male and female sexual behaviour provide good examples of the power and weakness of survey research (Kinsey, Pomeroy, & Martin, 1948; Kinsey, Pomeroy, Martin, & Gebhard, 1953).
    - He didn't use representative sampling and oversampled people in Indiana (his home state) and prisons, for example.
    - He interviewed people face-to-face about their most personal and private details of their sexual behaviour, making it more likely they would not be perfectly honest in their responses.

Correlational Studies

- **Correlational designs** measure two or more variables and their relationship to one another (e.g., how is variable X related to variable Y).
- Correlational studies are useful when the variables cannot be manipulated (for example, you can't randomly assign a child to live with its mother or its father any more than you can manipulate whether someone has schizophrenia or not).

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- The major limitation of the correlational approach is that it does not establish whether one variable actually causes the other or vice versa. Correlation is not causation!
- **CONNECTION:** What type of research design can a researcher use if he or she is interested in how certain thoughts or behaviours change with age? Developmental psychologists often use cross-sectional or longitudinal designs. (See Chapter 10.)
- A **correlation coefficient** is a statistic that tells us whether two variables relate to each other and the direction of the relationship.
    - Correlations range between -1.0 and +1.0, with coefficients near 0.00 telling us there is no relationship between the two variables. As a correlation approaches ±1.00, the strength of the relationship increases.
    - Correlation coefficients can be positive or negative. If the relationship is positive, then as a group's score on X goes up, their score on Y also goes up. With a negative correlation, as a group's score on X goes up, their score on Y goes down.

Experimental Studies

- A true **experiment** has two crucial characteristics:
    1. Experimental manipulation of a predicted cause—**the independent variable—**and measurement of the response, or **dependent variable**.
    2. **Random assignment** of participants to control and experimental groups or conditions – meaning that each participant has an equal chance of being placed in each group.
- The **independent variable** in an experiment is an attribute that is manipulated by the experimenter while other aspects of the study are held constant.
- The **dependent variable** is the outcome, or response to the experimental manipulation.
- **Random assignment** is the method used to assign participants to different research conditions so that each person has the same chance of being in one group as another. Random assignment is critical because it assures that *on average* the groups will be similar with respect to certain variables.
    - Why is this important? Because if the groups are the same on these qualities at the beginning of the study, then any differences between the groups at the end of the experiment are likely to be the result of the experiment.
    - The **experimental group** consists of those participants who will receive the treatment or whatever is thought to change behaviour.
    - The **control group** consists of participants who are treated exactly in the same manner as the experimental group but who do not receive the independent variable or treatment.
        - They may instead be given a **placebo** – a substance or treatment that appears identical to the actual treatment but lacks the active substance.
- **Confounding variables** are additional variables whose influence cannot be separated from the independent variable being examined.
- Experimental design allows us to determine causality if the independent variable caused changes in the dependent variable and everything else is held constant.
    - Random assignment guarantees group equivalence on a number of variables and prevents ambiguity over whether effects might be due to other differences in the groups.
    - Researchers must also be careful to treat the two groups alike and make sure that all environmental conditions (such as noise level and room size) are equivalent.

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- How much participants and experimenters know about the experimental conditions to which participants have been assigned can also affect outcome.
    - **Single-blind studies** are designs in which participants do not know the experimental condition to which they have been assigned. This must be the case in all studies to avoid the possibility that participants will behave in a biased way. **Participant expectancy effects** occur when the behaviour of the participants is influenced by their knowledge of the experimental condition, thereby influencing the results. For example, if participants know they have been assigned to a group that receives a new training technique on memory, then they might try harder to perform well. This would confound the results.
    - In **double-blind studies** neither the participants nor the researchers know who has been assigned to which condition.
        - These designs prevent **experimenter expectancy effects**, which occur when the behaviour of the participants is influenced by the experimenter's knowledge.

Meta-Analysis

- A **meta-analysis** is a research and statistical technique for combining all research results on one question and drawing a conclusion.
- To conduct a meta-analysis the researcher must convert the findings of each study to a standardized statistic known as an **effect size**. The average effect size across all the studies tells us what the literature as a whole says on a topic, and how consistent the findings have been.

Groundbreaking Research: **Experimenter Expectancy Effects**

Can what the experimenter knows change the behaviour of the participants?

How Rosenthal Discovered Experimenter Effects

- Rosenthal hypothesized that people who believed they were successful would be more likely to see success in others.
- To test this idea, he conducted an experiment in which he told one group of participants that they had done well on an IQ test and another group that they had done poorly on an IQ test. Rosenthal randomly assigned participants to be in one of these conditions (there was also a neutral control condition where participants were not given any feedback after the IQ test). Then he asked both groups to examine photographs of people doing various tasks and rate how successful they thought the people in the photos were.
- He compared the average scores of the participants assigned to different conditions *before* doing anything to them. Unfortunately, the groups were not only different at the outset, but they were different in exactly the way that favoured his hypothesis.
- Because he used random assignment, the only difference in the groups at the outset was Rosenthal's knowledge of who was in which group. Somehow, by knowing who was in which group, he unintentionally created behaviours that favoured his hypothesis (i.e., those who were told they did better, actually did scored higher).
- He had to admit that, because he had known who was in each group, he had treated them differently, causing them to perform differently on the test. Rosenthal had discovered

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experimenter expectancy effects. He also found that if the study involves direct interaction between an experimenter and participants, the experimenter's age, ethnicity, personality, and gender can have an effect on the participants' behaviour (Rosenthal, 1976).

- Rosenthal stumbled upon a more general phenomenon known as **self-fulfilling prophecy** – a statement that changes events to cause a belief or prediction to become true (e.g. telling a participant they will do worse on a task, so they do not try as hard, and therefore, do not do well).
- **Discussion**: Ask students when they may have been the victim of this effect. Examples include telling themselves they are going to fail a test and then not studying, or telling themselves that their significant other's parents won't like them and then acting cold and aloof when they meet.

Next: What Questions Remain?

- Within 10 years, more than 300 other studies confirmed Rosenthal's results in both human and animal experiments.
- Their research led to the development of double-blind procedures.
- Expectancy effects have also been found in classrooms. Lenore Jacobson collaborated with Rosenthal in a study to determine whether teachers create "smart" behaviour in classrooms. They found that when a teacher thinks that a certain student is "smart" and "special," he/she may unwittingly treat the student differently, give more detailed feedback, and give the student more challenging material. These actions, in turn, could create a higher-performing, "smarter" student.
- **Discussion**: Ask students about their experiences in middle school or high school when they were assigned to "Basic," "Regular," "Advanced," or "AP" classes. How did those assignments change their behaviours? Did the teachers act differently towards them? Why?

MEASURING VARIABLES

- The tools and techniques used to assess thought or behaviour are called measures**.**
- Researchers' descriptions of the way they measure or manipulate variables are called **operational definitions**.
- When researchers operationally define their variables, they assign categories or numbers to represent different levels of each variable. Taken together, the categories or numbers assigned to each level of a particular variable form a **measurement scale.** There are four different types of measurement scales.
    - In a **nominal (or categorical) scale**, the levels of a variable are represented by categories (e.g., type of prison role is represented by guard or prisoner).
    - In an **ordinal scale**, numbers are used to rank order variable levels (e.g. university grades can be assigned based on A, B, C, and D).
    - On an **interval scale**, the numbers representing the different levels of the variable *are* assumed to represent equal intervals (i.e., the difference between a "1" and "2" is assumed to represent the same quantitative difference as between a "4" and a "5").
    - A **ratio scale** is a numeric scale that has equal intervals and an absolute zero point (i.e., there are no values on the scale below zero).

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- One of the goals of psychological measurement is to develop measures that are both reliable and valid.
    - **Reliability** refers to the consistency of measurement over repeated occasions.
    - **Validity** refers to the degree to which a test accurately measures what it purports to measure, and not something else.

Self-Report Measures

- **Self-reports** are people's written or oral accounts of their thoughts, feelings, or actions.
- Two kinds of self-report measures are commonly used in psychology: **interviews** and **questionnaires**.
    - In an interview, a researcher asks a set of questions and the respondent usually answers in any way he or she feels is appropriate. Answers are either coded into broad categories or simply summarized. The answers are often open-ended and not constrained by the researcher.
    - In a questionnaire, responses are limited to the choices given in the questionnaire.
- **Pros of Self-Report Questionnaires**
    - Self-report questionnaires are easy to use, especially in the context of collecting data from a large number of people at once or in a short period of time.
    - They are also relatively inexpensive.
    - If designed carefully, they can also provide important information on key psychological variables.
- **Cons of Self-Report Questionnaires**
    - People are not always the best sources of information about themselves because of social desirability issues outlined earlier.
    - We have to assume that people are accurate witnesses to their own experiences.
    - **CONNECTION**: How can we measure prejudice occurring outside of conscious awareness? Researchers use the Implicit Associations Test, which measures people's reaction times to word pairings presented on a computer screen. (See Chapter 14)

Behavioural Measures

- **Behavioural measures** are based on systematic observation of people's actions, either in their normal environment (that is, naturalistic observation) or in a laboratory setting. Afterward, trained coders would observe the videotapes and, using a prescribed method, code the level of aggressive behaviour exhibited by each person.
- **Pros**
    - They are less susceptible to social desirability bias than are self-report measures.
    - They provide more objective, direct measurements, because they come from a trained outside observer, rather than from the participants themselves.
- **Cons**
    - If people know they are being observed, watched, and/or measured, they may modify their behaviour.
    - Sometimes, these studies are time-intensive.

Physiological Measures

- **Physiological measures** are used to collect data on bodily responses such as heart rate, sweating, respiration, and brain activity. Chapter 3 will discuss brain imaging techniques.

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- Clearly, the big **con** here is that these technologies require specialized training in the use of equipment, collection of measurements, and data interpretation. They can therefore be quite costly.

Multiple Measurement

- Because each measure has both strengths and weaknesses, it is best to compensate by using more than one type of measure. This is called **multiple measurement**.
- Using the two measures together provides a more accurate portrait of someone's prejudice by building on the strengths of both and offsetting their weaknesses. This type of design might also be used when the phenomenon in question is complicated. One example that will be covered in Chapter 11 is emotion.

MAKING SENSE OF DATA WITH STATISTICS

- Once researchers collect data, they must make sense of them using **statistics** – the mathematical procedures for collecting, analyzing, interpreting, and presenting numerical data.
- Statistics are used to describe and simplify data and to understand how variables are related.

Descriptive Statistics

- The first statistics researchers calculate are called **descriptive statistics**. These tests provide a way of summarizing and organizing data.
    - These statistics can be represented in graphs. One such graph could be a **frequency distribution** which plots the scores on a measure arranged by the number of times each score was obtained.
    - Another way to describe data is to compute the measures of central tendency. These include the **mean** of the data – the arithmetic average; the **median** – the score that separates the lower half of scores from the upper half; and the **mode** – which is the most frequently appearing score.
    - The mean, median, and mode, however, do not reveal anything about how spread out or how varied scores are. The most common way to represent that information is to calculate the **standard deviation** which tells you how much the scores in a sample vary around the mean.

Inferential Statistics

- **Inferential statistics** are used to draw conclusions about populations based on evidence from samples.
    - To compare whether two means are different from one another, we use a statistic known as the **t-test**.
    - A result has **statistical significance** when the statistical test tells us that the findings are real and not just random.
    - The amount of evidence required to accept that a finding did not occur by chance is called the **significance level**. In psychology we would expect chance to be

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responsible for the outcome less than or equal to 5 times out of 100. We write this as $p < .05$.

Psychology in the Real World: Beware of Statistics in Advertising

- **Scenario #1**: A billboard advertising a popular hybrid vehicle: *"The car more people would buy again."*
  - What did the ad actually say? The car more people would buy again. Ask yourself, "*More* than what?" The meaning of this claim depends entirely on what this vehicle is being compared to (other hybrids, all cars, a moped?).
  - Advertisers regularly leave information out and hope you will fill in the blank with what helps them most. In this case, they hope and assume you fill in the blank with "all other cars."
  - Advertisers regularly employ tweak research methodology to get the results they want (Darke & Ritchie, 2007). In particular, they misrepresent study design (as in the case of our hybrid car example) or simply lie with statistics.
- **Scenario #2**: In an ad in the morning paper, Company B reports on research that should really make you want to buy their product. *A recent lab study shows that just a ½ ounce of their new drug killed 37,202 germs in a test tube in less than 15 seconds!*
  - The implication is that it is a great cold medicine—perhaps better than others—on the basis of these hard scientific data. Here are a few things to consider:
    - The fact that a substance works well in a test tube (a controlled environment) does not mean it will work in the human throat or respiratory tract.
    - The ad doesn't say what kinds of germs were killed by their new drug.
- **Scenario #3**: Graphic displays of data can be misleading. Consider Figures 2.15A and 2.15B, both of which depict the billions of dollars spent on education over a one-year period.
  - One seems to show a much bigger increase in spending on education than the other but if you look closely, both depict the same dollar increase in spending.
  - This visual difference stems from how the illustrations' vertical axis is segmented. Companies, journalists, and politicians mislead people all the time by tweaking the graphic depiction of data.

RESEARCH ETHICS

- Some of the most important studies in psychology could not be performed today – including the Stanford Prison Experiment.
- **Ethics** are the rules governing the conduct of a person or group in general or in a specific situation, or more simply, standards of right and wrong.
- Every single psychological study conducted with humans and animals must pass through a rigorous review of its methods by a panel of experts. If the proposed study does not meet the standards, it cannot be approved.
- Another notable example of research that would violate current ethics guidelines is Milgram's research on obedience, which will be discussed in more detail in Chapter 14.
  - Milgram designed an experiment to test systematically the question of whether decent people could be made to inflict harm on other people.

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- His studies involved a simulation in which participants were misled to think they were participating in a study on punishment and learning. They administered what they thought were electrical shocks to punish the "learner," who was in another room, for making errors.
- In spite of protest from the "learner" when increasingly intense shocks occurred, the experimenter pressured the "teachers" to continue administering shocks. Despite his screams, most of the participants continued to shock the learner.
- After the study, Milgram fully explained to his participants that, in fact, the "learner" was never shocked or in pain at all (Milgram, 1974).
- **CONNECTION**: Social psychologists have demonstrated both in the lab and in the real world that otherwise normal folks can be pressured to do cruel things, such as give people electric shocks to the point of knocking them unconscious (or so they believe). (See Chapter 14)

Ethical Research with Humans

- Today all psychological and medical researchers must adhere to the ethical policy statement established in Canada by the three funding agencies (The Tri-Council) and the Code of Ethics, published by the Canadian Psychological Association (CPA). These include the following guidelines:
  1. **Informed consent**: Participants must be told, in general terms, what the study is about, what they will do and how long it will take, what the known risks and benefits are, that they have the right to withdraw at any time without penalty, and whom to contact with questions.
  2. **Respect for persons**: The dignity and autonomy of the individual must be protected.
  3. **Beneficence**: Participants should be told the costs and benefits of participation. The costs should be minimized and the benefits maximized.
  4. **Privacy and confidentiality**: Protect the privacy of the participant, generally by keeping all responses confidential.
  5. **Justice**: The benefits and costs of participation must be distributed equally among participants.
- Tri-Council and CPA believe that participant deception should be avoided whenever possible but recognizes that sometimes it is justified. If deception is used then, when the study is over, participants must be **debriefed** – informed of the exact purposes of the study (including the hypotheses) and all deceptive practices must be revealed and explained.
- Today, to ensure adherence to ethical guidelines, **research ethics boards (REBs)** evaluate proposed research before it is conducted to make sure research involving humans does not cause undue harm or distress.

Ethical Research with Animals

- Biological psychology and learning are the areas of psychology that most often use animals for research.
- Animals cannot consent to research but since animal research has led to many treatments for disease, as well as advances in understanding basic neuroscientific processes, the medical and scientific communities, along with the general public, have deemed such

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research acceptable as long as the general conditions and treatment of the animals is humane.

- In Canada, all research involving the use of animals must adhere to the guidelines established by the Canadian Council on Animal Care (CCAC).
- Laws generally require housing the animals in clean, sanitary, and adequately sized structures.
- Specific REBs evaluate proposals for animal research and require researchers to ensure the animals' comfort, health, and humane treatment, which also means keeping discomfort, infection, illness, and pain to an absolute minimum at all times.
- If a study requires euthanizing the animal, it must be done as painlessly as possible.

EVALUATING CONNECTIONS IN PSYCHOLOGICAL RESEARCH: **Can Experience Change the Brain?**

- Researchers interested in studying the effects of different environments on the brains of rats tend to use a similar design. They randomly assign genetically identical rats to either enriched or impoverished environments for about a month. The type of environment, then, is the independent variable. The dependent variables were change in brain size and/or changes in the growth of brain cells.
    - The enriched environments included many opportunities and apparatus for play and activity, such as running wheels and tubes to climb, as well as food and water.
    - The impoverished environments provided only food and water.
- Researchers have found that rats raised in enriched environments showed evidence of growth in brain tissue compared to the animals reared in the impoverished environments. The fact that these findings have been replicated so many times established that rats raised in the enriched conditions did indeed develop more brain tissue and thicker cortexes.
- Because this finding was based on an experimental design with random assignment we can conclude that enriching experience actually caused their brains to grow.
- One of the main reasons we study these phenomena in animals is to learn how these processes work in humans, but ethical limitations prevent human research. Thus, the animals serve as models for how human brain organization and function might be modified by experience in humans.
- But do rats serve as good models for how things happen in humans? Although there are many similarities between rat and human brains, there are a multitude of differences in anatomy.
- Another criticism of the animal research on enrichment and neurogenesis is that what has been labelled as "enrichment" in animal models may indeed represent a more normal mode of activity and that the so-called standard or more aptly named "impoverished" conditions are seriously sub-par and not at all like what an animal would experience in the wild.
    - Ethical guidelines for the treatment of animals have been modified on the basis of the enrichment findings such that non-stimulating conditions are not considered acceptable housing for primates. Animal rights activists are pushing for the ethical guidelines to be modified for rodents as well.
- The most rigorous design that one could apply in this context is a **quasi-experimental**

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design. This is like an experimental design except it makes use of naturally occurring groups rather than randomly assigning subjects to groups.

- Several recent quasi-experimental studies have focused on differences in brain structure and function among children from families of differing socioeconomic status, or SES (Hackman, Farah, & Meaney, 2010). Researchers use measures of parental income and education to create SES groups (low/ medium/ high) and then compare children in these different groups on brain structure and function. According to studies of brain images, preschoolers who have grown up in low SES environments have less dense front regions of the brain (responsible for planning and control) than preschoolers from higher SES environments, despite starting out with similar brain size and density at birth (Hanson et al., 2013). Further, studies comparing brain activity levels for children from low versus high SES backgrounds reveal less active front regions of the brain when working on tasks requiring attention (Kishiyami, Boyce, Jiminez, Perry, & Knight, 2009). Other studies, using cognitive tests assumed to measure underlying brain systems, reveal that children from low SES environments perform more poorly on tests of language and executive function (i.e., planning and organizing) compared to children from higher SES environments (Farah et al., 2006; Noble, Norman, & Farah, 2005).
    - Because the researchers relied on naturally occurring groups and the groups were not matched, these findings are correlational, *not* causal.

EVALUATING CONNECTIONS

The Nature of Science

- **CONNECTION:** How do psychologists tease apart the question of how much of a personality trait is influenced by genetics and how much by environment? A common approach is to study twins (both identical and fraternal) who are reared apart or reared together. (See Chapter 3.)
    - **Discussion:** A brief overview of behavioural genetics and personality can be found at: http://www.personalityresearch.org/bg.html. It reviews twin and adoptee research on personality and how behavioral genetics has influenced methodology.

- **CONNECTION**: What other biases may hinder our ability to think scientifically? The confirmation bias can lead people to pay attention to information that is consistent with their beliefs while ignoring evidence that contradicts their beliefs. (See Chapter 8.)
    - **Video:** Dr. Kevin deLaplante has created a number of free resources including podcasts and tutorials on how think critically in science. This YouTube video (podcast) deals specifically with cognitive biases: https://www.youtube.com/watch?v=dTJLchCHsrc

- **CONNECTION**: As a neuroscientist working on Parkinson's disease, Helen Mayberg found something unexpected about brain circuitry. Initially, she was skeptical. But because she was also curious and open to the evidence, she decided to pursue it further.

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Her curiosity and openness led to her discovery that placing an electrical stimulator deep inside the brain could turn off depression. (See Chapter 16.)
  - **Website**: The Mayo Clinic's website has a thorough discussion of ECT: http://www.mayoclinic.com/health/electroconvulsive-therapy/MY00129.
  - **Video**: The following link is a case study of a woman who underwent ECT: http://www.youtube.com/watch?v=1JG9eQsjaZY.

Research Methods in Psychology

- **CONNECTION:** What are the four main goals of psychological research? (See Chapter 1.)
  - **Video**: The following YouTube video reviews all research designs and their goals: https://www.youtube.com/watch?v=hFV71QPvX2I

- **CONNECTION**: The "bystander effect" explains why individuals in crowds may not help others in need. When in a group, individual responsibility is diffused and people tend to think that helping is someone else's responsibility. (See Chapter 14.)
  - **Video**: Re-enactment of Darley and Latane's research: http://www.youtube.com/watch?v=KE5YwN4NW5o.
  - **Video**: The Bystander Effect: http://www.youtube.com/watch?v=OSsPfbup0ac.

- **CONNECTION:** What type of research design can a researcher use if he or she is interested in how certain thoughts or behaviours change with age? Developmental psychologists often use cross-sectional or longitudinal designs. (See Chapter 10.)
  - **Discussion:** Outline the differences between cross-sectional and longitudinal designs using an example, such as the relationship between age and reasoning ability. Then ask students if they can identify some advantages and disadvantages in using these designs.

Measuring Variables

- **CONNECTION**: How can we measure prejudice occurring outside conscious awareness? Researchers use the Implicit Associations Test, which measures people's reaction times to word pairings presented on a computer screen. (See Chapter 14.)
  - **Website**: Dr. Mahzarin Banaji of Harvard University investigates this topic and has found that brain regions involved with fear are more active when presented with photos of persons of different races, ages, sexual orientations, and even those who are overweight. Her research and findings were featured in this July 2003 issue of the Harvard Gazette: http://news.harvard.edu/gazette/2003/07.17/15-prejudice.html

Research Ethics

- **CONNECTION**: Social psychologists have demonstrated both in the lab and in the real world that otherwise normal folks can be pressured to do cruel things, such as give people

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electric shocks to the point of knocking them unconscious (or so they believe). (See Chapter 14)

- **Discussion:** Have students discuss how Zimbardo and Milgram's studies might be related to current events (e.g., World War II, Abu Ghraib, cults, hazing, etc.).

INNOVATIVE INSTRUCTION

Additional Discussion Topics

1. Ask the psychology majors in the room what courses they are most and least looking forward too. Generally, they will say they are looking forward to Research Methods and Statistics least. Then ask them why those classes are required for their major. Use this as a jumping-off point for a discussion about the importance of research in psychology.
2. Ask students what the most famous examples of psychological research they know are. Have them identify the methodology of the studies.
3. Ask students if they believe in UFOs. ESP?
4. Ask students if they think it is ethical to use deception in psychological research. Why or why not? If not, how can you test issues about cruelty, obedience, stealing, lying, etc.?
5. Ask students if they believe that animal research is ethical. Encourage them to discuss their opinions and challenge each other.

Activities

1. Students may have difficulty differentiating theories from hypotheses. Tell them of some different theories you have and ask them to pull out testable hypotheses. For example, you can tell them that a researcher believed that frozen foods do not have calories. Calories are measures of heat and frozen food, by definition, can have no heat. Therefore, frozen foods are calorie-free. Explain what events this theory might lead too: diets of frozen candy bars, ice cream, Starbucks Frappacinos, frozen cookie dough, etc., that lead to weight loss. What is the theory? Hypotheses? How can they be tested?

2. Have students get into groups and give them the following theory: media violence and adolescent aggression are related. Assign each group to a different research design (correlation, experiment, survey, case study, and naturalistic observation) and ask them to come up with a testable hypothesis and method of testing.

3. Ask students what the most famous examples of psychological research they know are. Have them identify the methodology of the studies.

4. Have students visit the IRB website for your university and read over its mission statement. If there is a training certificate researchers must obtain to conduct research on your campus, you may want to have students do so and report on their experiences.

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5. Have students read a great article that expands Rosenthal's research into teacher bias. This can be found in: Rosenthal, R., S. L., and Jacobson, L. (1966). Teachers' expectancies: Determinates of pupils' IQ gains. *Psychological Reports, 19*, 115–118. Have them write two paragraphs that summarize the article and then one paragraph that illustrates a personal experience where they have experienced the bias themselves.

6. Ask students when they may have experienced the self-fulfilling prophecy. Examples include telling themselves they are going to fail a test and then not studying, or telling themselves that their significant other's parents won't like them and then acting cold and aloof when they meet.

Suggested Media

1. Zimbardo prison study is described here*:* https://www.youtube.com/watch?v=sZwfNs1pqG0
2. *Sybil* (1976) is a great example of a case study.
3. *Kinsey* (2004) is a racy, but good, example of surveys and interviewing techniques. A clip of the movie trailer can be found here: https://www.youtube.com/watch?v=e19GnyNdC48
4. A great video, *Discovering Psychology: Understanding Research,* from Annenberg with Phil Zimbardo, former president of the APA discussing research methods in psychology can be found at: http://www.learner.org/series/discoveringpsychology/02/e02expand.html

Suggested Websites

1. The Jane Goodall Institute's homepage: http://www.janegoodall.org/
2. Kitty, 40 Years Later – New York Times: http://www.nytimes.com/2004/02/08/nyregion/kitty-40-years-later.html?pagewanted=all
3. Independent and dependent variable practice:
4. http://www.quia.com/quiz/162310.html
5. Correlation practice: http://www.hstutorials.net/dialup/t2/correlation.htm

Suggested Readings

American Psychological Association (1992). Ethical principles of psychologists and code of conduct. *American Psychologist, 47*, 1597-1611.

Baumrind, D. (1964). Some thoughts on ethics of research: After reading Milgram's 'Behavioural study of obedience.' *American Psychologist, 19,* 421-423.

Burkley, E., & Burkley, M. (2009). Mythbusters: A tool for teaching research methods in psychology. *Teaching of Psychology, 36*, 179–184.

Guthrie, R. V. (2003). *Even the rat was white* (2nd ed.). Allyn-Bacon.

Huff, D. (1954). *How to Lie with Statistics*. New York: Norton.

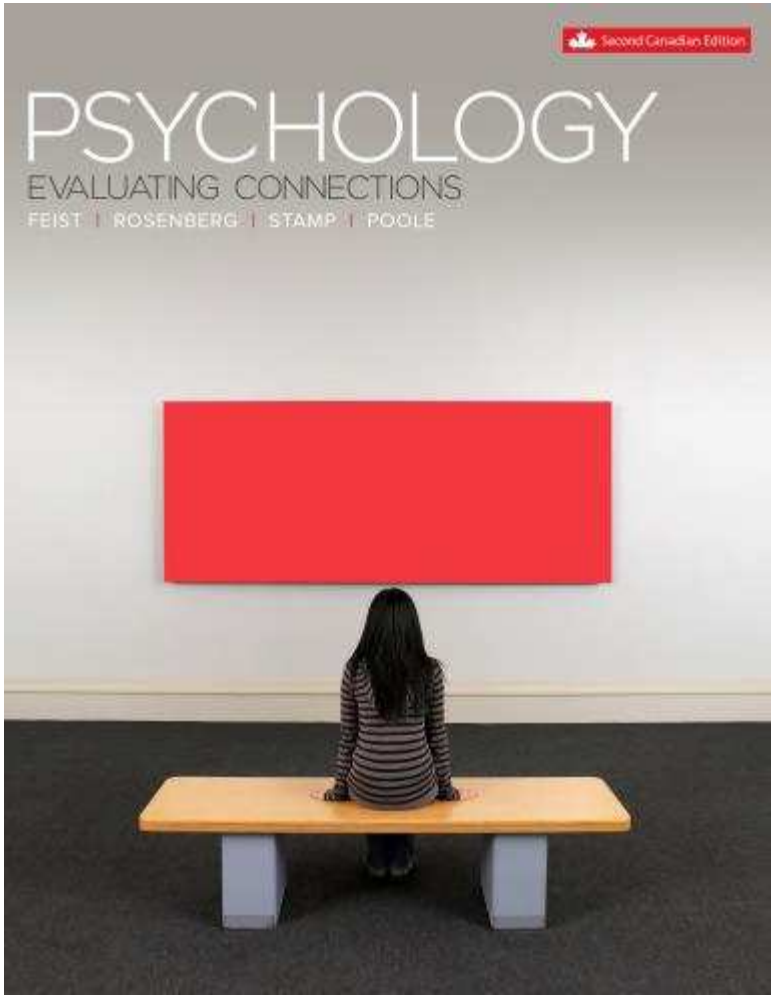
Nisbett, R. E., & Wilson, T. D. (1977). Telling more than we can know: Verbal reports on mental processes. *Psychological Review, 84,* 231-259.

Rosenthal, R. (1976). *Experimenter Effects in Behavioural Research, Enlarged Edition.* New

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York: Irvington Publishers.
Rosnow, R. L., & Rosenthal, R. (1989). Statistical procedures and the justification of knowledge in psychological science. *American Psychologist, 44,* 1276-1284.
Rosenzweig, S. (1933). The experimental situation as a psychological problem. *Psychological Review, 40,* 337-354.
Shermer, M. (1997). *Why People Believe Weird Things: Pseudoscience, Superstition, and Other Confusions of our Time.* New York: W.H. Freeman.
Zimbardo, P.G. (2007). *The Lucifer Effect: Understanding How Good People Turn Evil.* New York: Random House.

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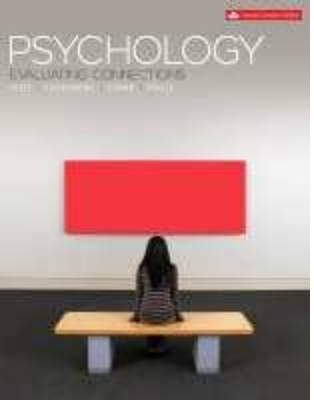
Conducting Research in Psychology

Chapter 2

Slides Prepared by Jennifer Poole, Langara College

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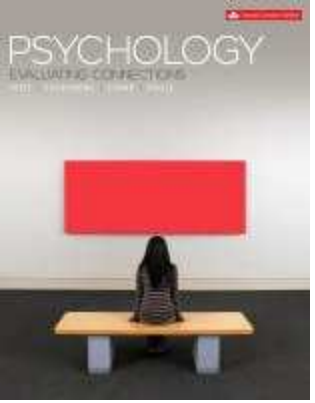
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Learning Objectives

1. Describe some of the limits of everyday thinking and observation.
2. Explain what makes psychology a science.
3. Compare and contrast the different kinds of descriptive studies and explain the importance of random sampling.

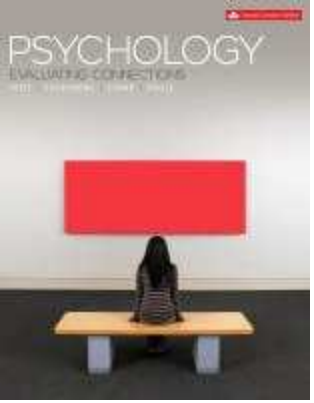
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Learning Objectives, cont'd

4. Describe the strengths and weaknesses of correlational studies and define positive and negative correlations.
5. Describe the main characteristics of an experimental study that allow researchers to isolate cause and effect.
6. Differentiate among the various measurement scales.

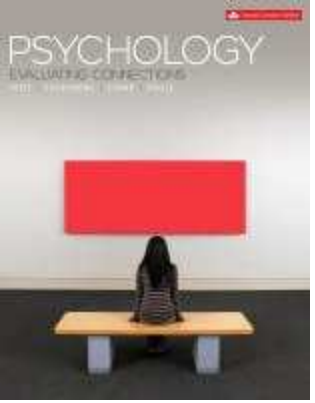
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Learning Objectives, cont'd

7. Compare and contrast commonly used measures of psychological research.
8. Explain how to use descriptive and inferential statistics to analyze and interpret data.
9. Discuss some research challenges that involve the ethics of studying humans and animals.

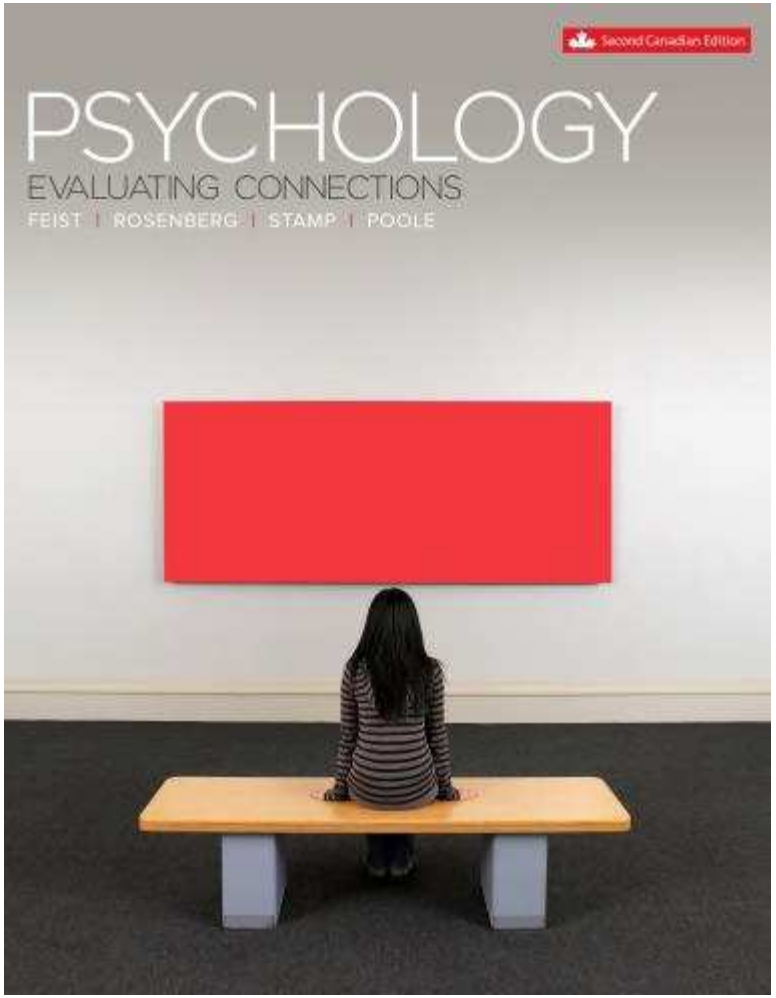
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Chapter Outline

- The Nature of Science
- Research Methods in Psychology
- Groundbreaking Research
- Measuring Variables
- Making Sense of Data with Statistics
- Psychology in the Real World
- Research Ethics
- Evaluating Connections in Psychological Research

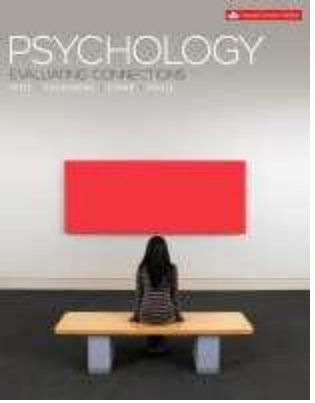
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The Nature of Science

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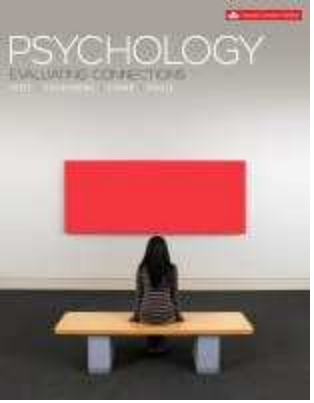
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Common Sense and Logic

- Science must combine logic with research and experimentation
  - It must also involve common sense and observation, while simultaneously recognizing the inherent limitations of both
  - **Hindsight bias** – a limitation of common sense where we overestimate our ability to predict an event, *after* the event outcome is known

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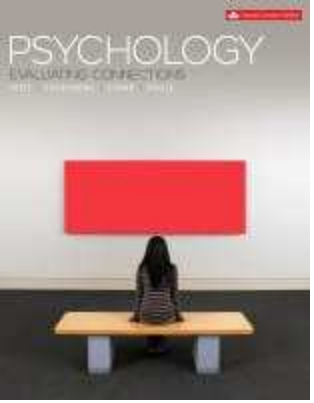
The Limits of Observation

- The senses can be easily fooled – have you ever seen a performance by an illusionist?



- Generalization

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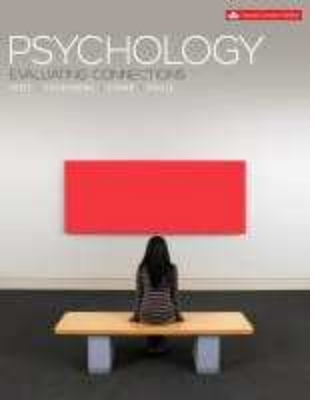


Scientific Principles in Psychology

- Psychology shares the same themes as the humanities
- BUT like the natural sciences, it requires the use of systematic, empirical methods to explore these ideas



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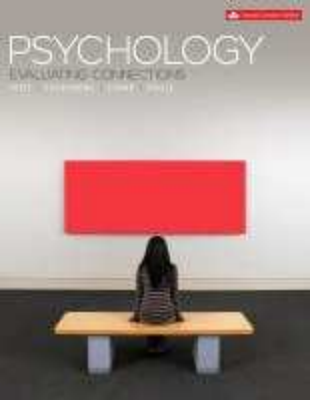


Science Is.....

- Cumulative
- A process more than a product
- An attitude
  - To question authority
  - Open skepticism
  - Intellectual honesty



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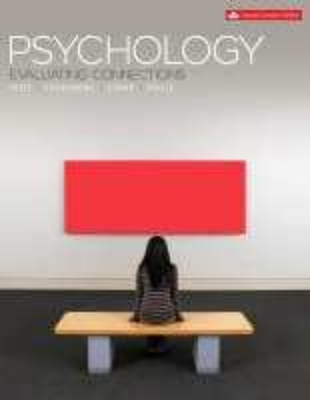
The Scientific Method



OPTIC

- Observe
- Predict
- Test
- Interpret
- Communicate

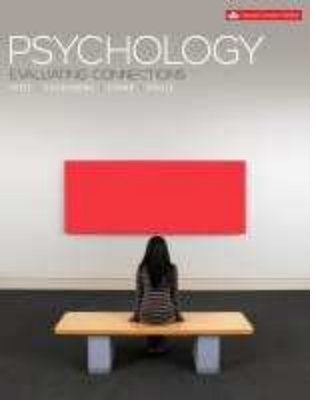
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The Scientific Method

- Expectations are expressed as **theories**
  - A set of related assumptions from which testable predictions can be made
- Theories are constructed after **hypotheses** are made and tested
  - Specific, informed, and testable predictions of the outcome of a particular set of conditions in a research design

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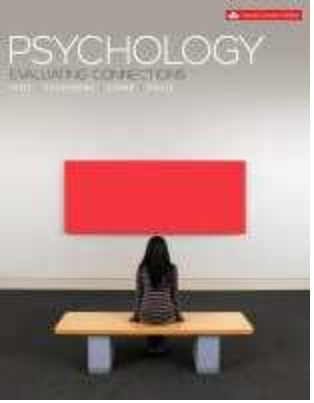


Evaluating Connections

- Many people buy herbal “medicines” like gingko to make them more alert.
- BUT do they actually work?
- How could you apply the scientific method to answer this question?



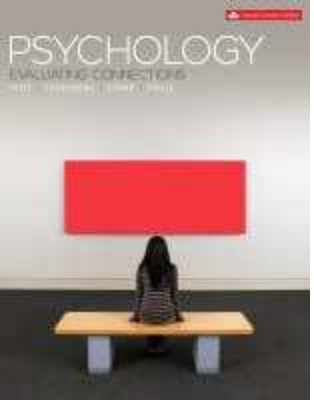
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The Scientific Method

- Science has no value without **replication**
  - The repetition of a study to confirm (or in some cases disconfirm) the results
  - It is possible that a single finding can be achieved by accident or by “chance.” How will we know unless we repeat the study?
  - Science is cumulative - current knowledge builds on past knowledge

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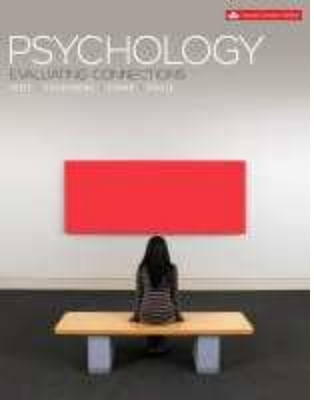


What Science Is Not: Pseudoscience

- **Pseudoscience** refers to claims that are presented as scientific but lack several qualities of science
  - Advances no true knowledge
  - Disregards established facts that contradict their claims
  - Does not challenge its own assumptions
  - Offers vague or incomplete explanations and conclusions
  - Uses unsound or absent logic



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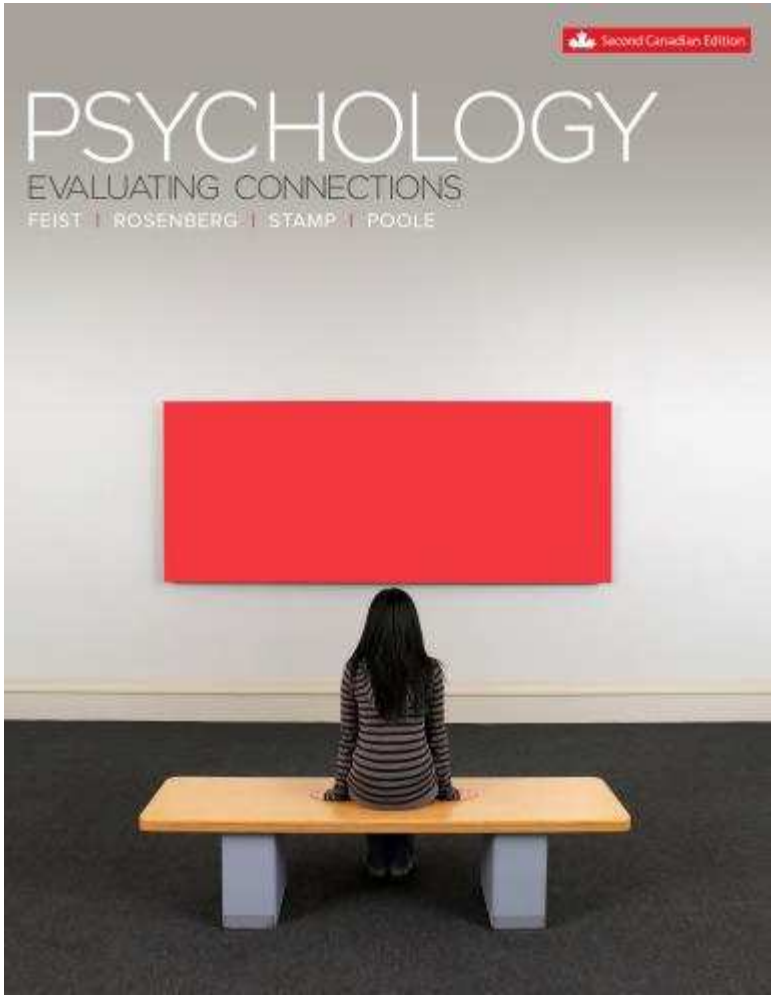


Evaluating Connections

- Is Tarot card reading a pseudoscience?
- Why?
- Can you name some other examples of pseudoscience?

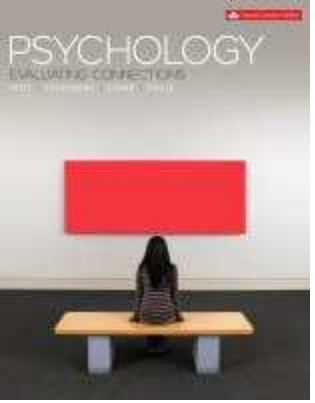


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Research Methods in Psychology

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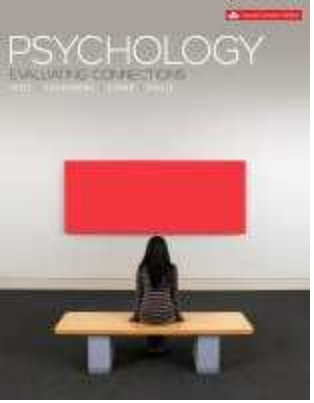


Principles of Research Design

LO2

- Research design involves the plans for how a study is to be conducted
- Includes all of the following:
  - **Variable**
    - Any characteristic that changes, or "varies"
  - **Population**
    - The entire group of interest to a researcher
  - **Samples**
    - A subset of a larger population

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Descriptive Studies

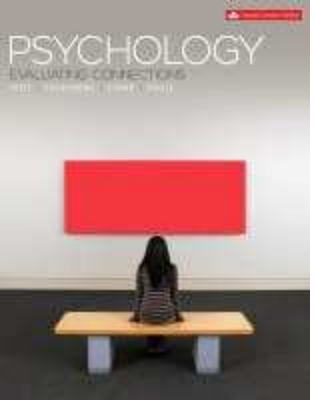
descriptive studies

What type of questions might be researched?	What is the most suitable method for answering the question?	What is the best use for this kind of study?	What is the main limitation of this kind of study?
Single variable, such as: How do people flirt?	Case study	To study rare or unusual phenomena in detail To generate hypotheses for future research	Lack of generalizability to other people Cannot look at cause and effect
	Naturalistic observation	To describe naturally occurring behaviour in the real world To generate hypotheses for future research	Lack of control over variables Cannot look at cause and effect
	Surveys and interviews	To describe thoughts or behaviours of large numbers of people	If sample is non-random, results will not be generalizable Biased responses



- Researcher defines a problem and variable of interest
- BUT doesn't necessarily make a prediction
- Does not control or manipulate anything

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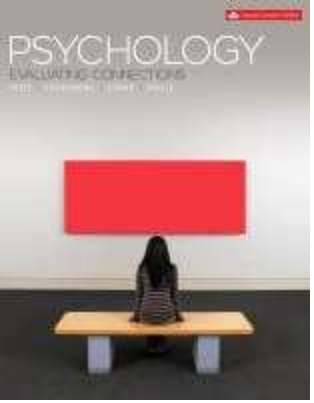
Types of Descriptive Designs

- Case study
- Naturalistic observation
- Interview and survey
  - Representative sample
  - Random sample





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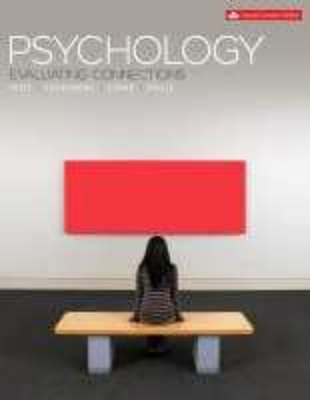


Correlational Studies

- Studies that measure two or more variables and their relationship to one another
- Cannot be used to show cause-and-effect relationships ("causation")



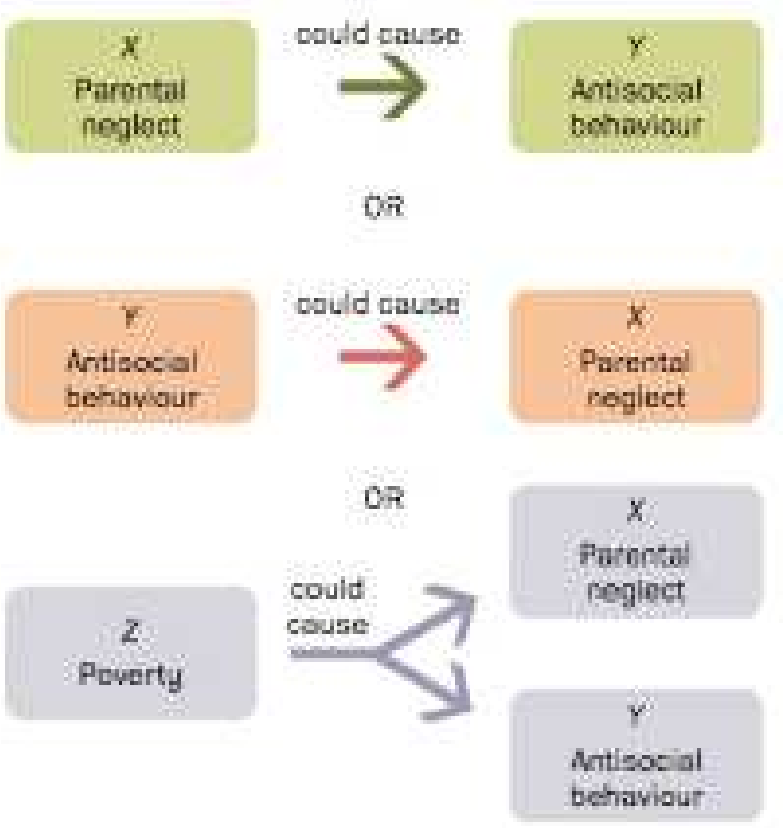
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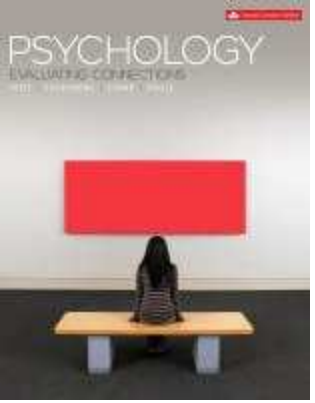
Directionality and Third Variable Problems

LO4

- If we find two variables are correlated, there are at least three possible causal explanations
- Correlation is not causation!



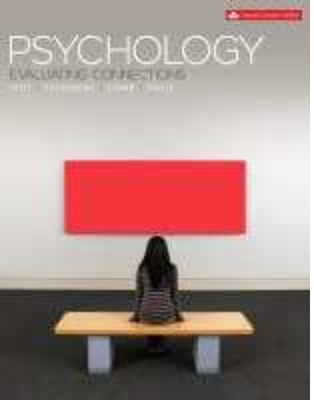
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Relationships Between Variables

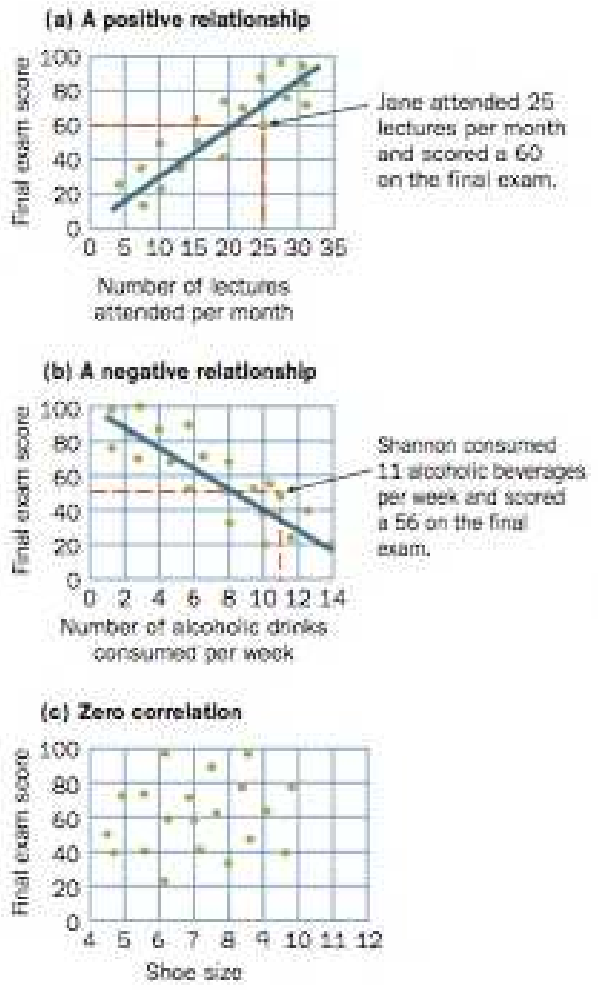
- A **correlation coefficient** is a numerical representation of the *strength* and *direction* of the relationship between two variables
- Can range from -1.00 to +1.00
  - +1.00 is a perfect positive relationship
  - -1.00 is a perfect negative relationship

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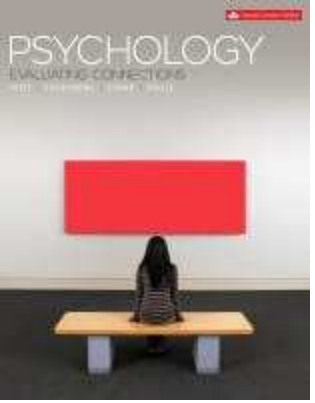


Scatterplots

- Graphs depicting a correlation between two variables



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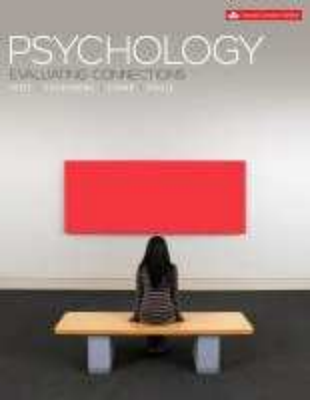


Confusing Correlation with Causation: An Example

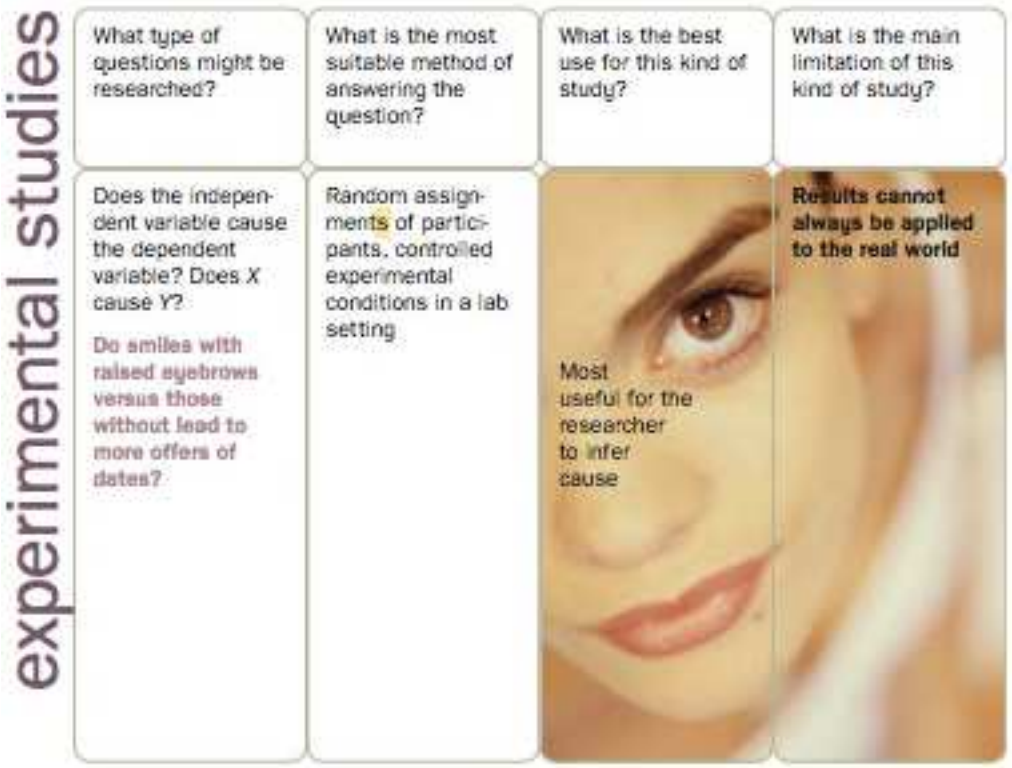
- News headline, "*OMG! Texting and IM-ing doesn't affect spelling!*"
  - Implies causality (texting doesn't cause bad spelling)
- BUT the study described was correlational
  - Examined students' text messages and then measured their performance on a spelling test
  - They actually found a positive correlation between academic spelling and spelling used in IMing

Web link:
http://www.washingtonpost.com/wp-dyn/content/article/2009/10/19/AR2009101902878.html?wprss=rss_technology

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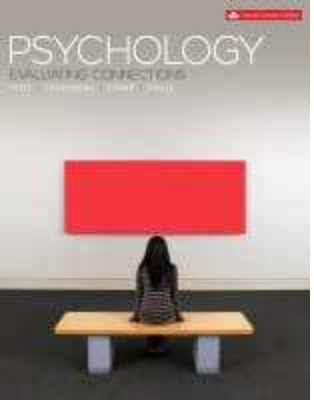


Experimental Studies



- Type of design that allows the most control over the experimental situation
  - Manipulation of a predicted cause
  - Measurement of the response

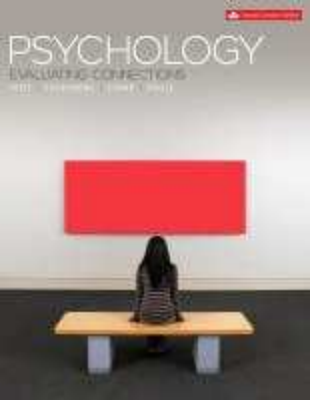
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Experimental Control

- Random assignment
  - Each participant in the study has the same chance of being in an experimental or a control group
- Experimental group
  - The participants who will receive the treatment being investigated
- Control group
  - The participants who do *not* receive the treatment being investigated

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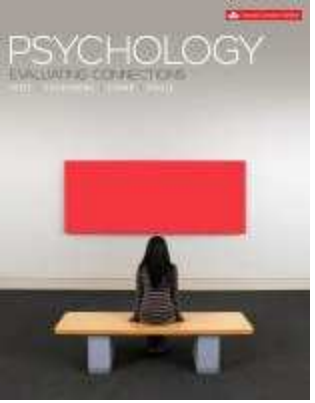


Ensuring Equal Groups

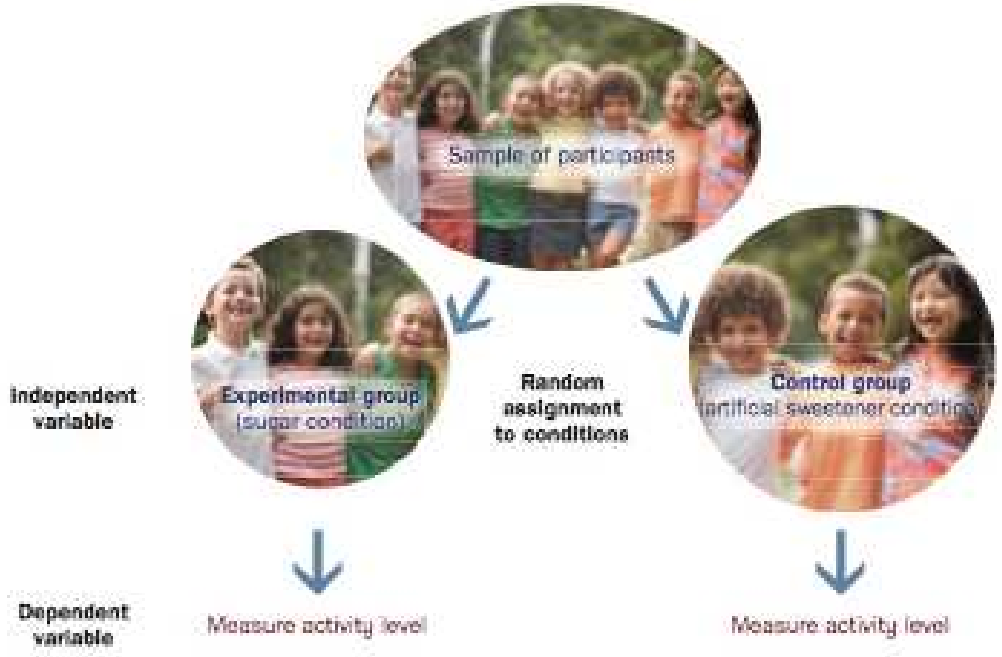
- Placebo
  - A substance or treatment that appears identical to the actual treatment but lacks the active substance
  - Is sometimes given to the control group



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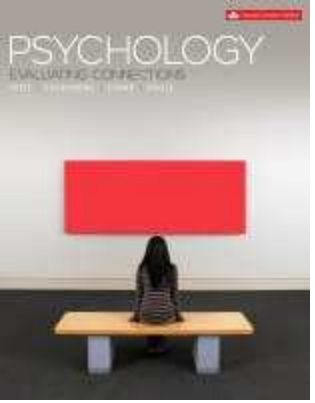


Variable Types



- Independent variable
- Dependent variable
- Confounding variable

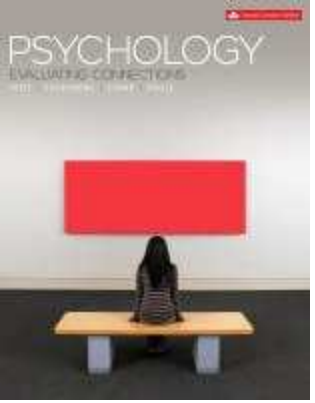
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Evaluating Connections

- A group of college students was given a short course in speed-reading. The instructor was curious if a monetary incentive would influence performance on a reading test taken at the end of the course. Half the students were offered $5 for obtaining a certain level of performance on the test, the other half were not offered money.
- What is the independent variable? Dependent variable? Experimental group? Control group?

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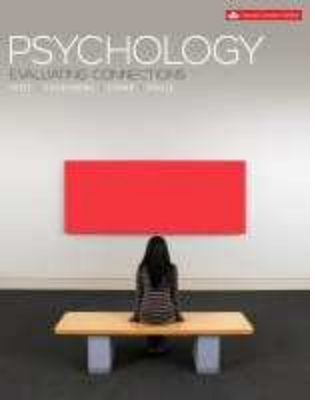


Issues in Experimental Design

LO5

Problems	Solutions
Participant expectancy effects	Single-blind studies
Experimenter expectancy effects	Double-blind studies

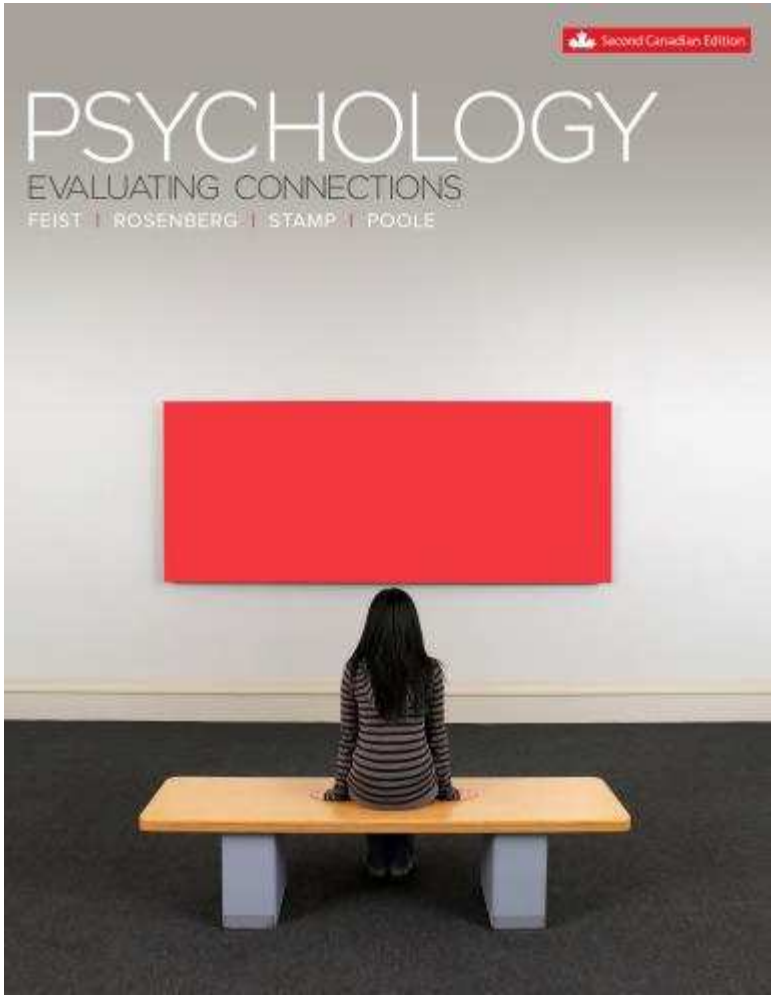
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Meta-Analysis

- A statistical technique for combining all published research results on one question and drawing a conclusion
  - Requires the use of **effect sizes**
    - A measure of the strength of the relationship between two variables or the magnitude of an experimental effect
    - Allows different studies to be compared to each other even if they used different methods or produced different statistics

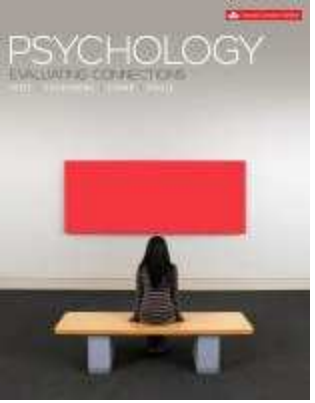
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Groundbreaking Research

Experimenter Expectancy Effects

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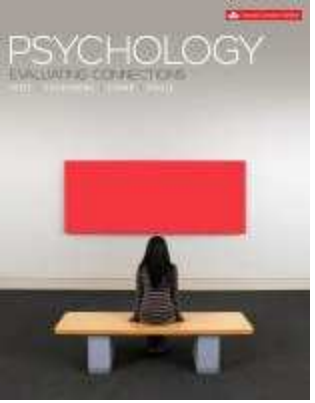
How Experimenters Can Affect a Study's Outcome

LO5



- In the mid-1950s, Robert Rosenthal began research on
  - **Experimenter expectancy effects**
    - Result when characteristics of an experimenter (such as age, personality, etc.) influence participants' behaviour in a study
  - **Self-fulfilling prophecy**
    - When statements you make change events so that your beliefs or predictions come true

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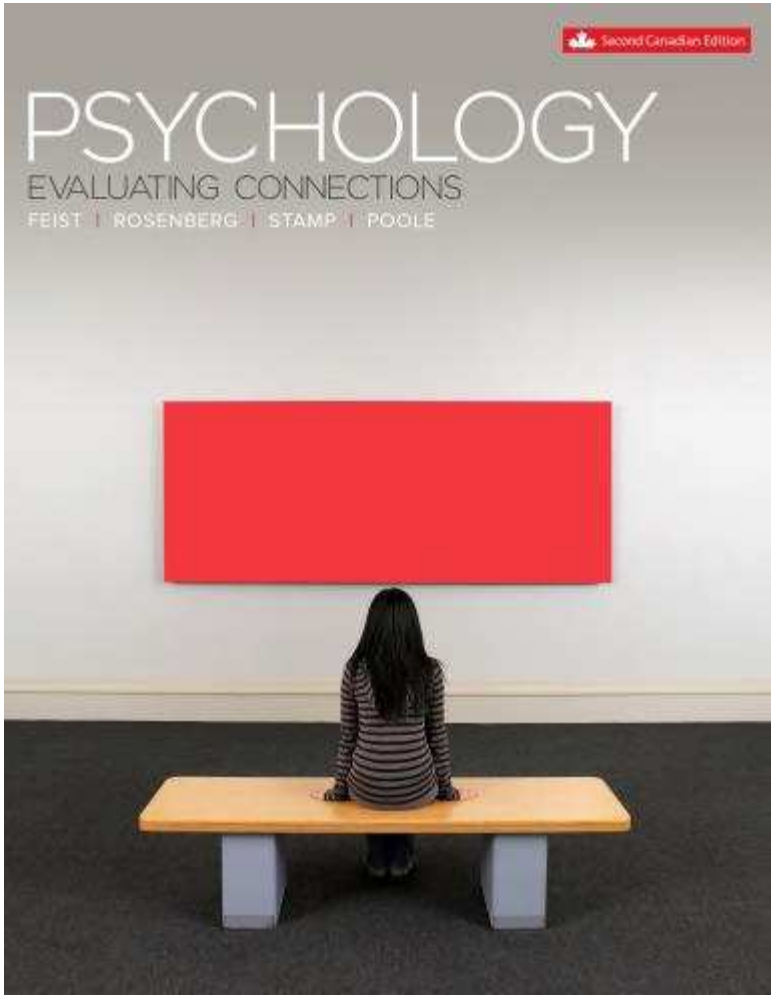


Applications in the Classroom

- Suppose a teacher believes that a student is “not very smart”
  - Teacher may provide the student with more negative feedback
  - Student may respond to this feedback by feeling “less smart” and performing worse

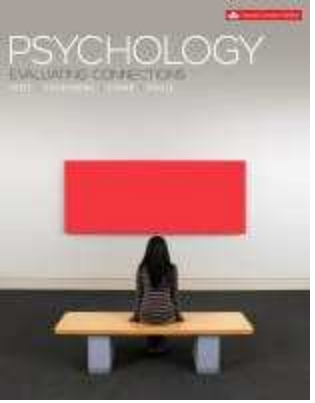


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Measuring Variables

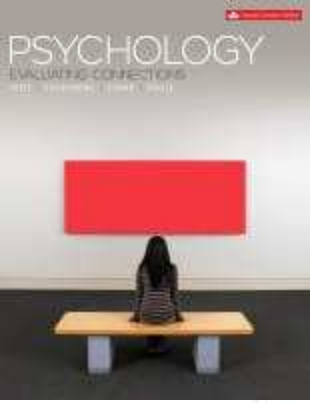
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Measuring Variables

- **Operational definitions** describe the way that variables are measured or manipulated
  - E.g., A researcher may define sugar consumption as 100 gram bag of candy consumed in 1 hour
- A good measure has demonstrated
  - Reliability
  - Validity

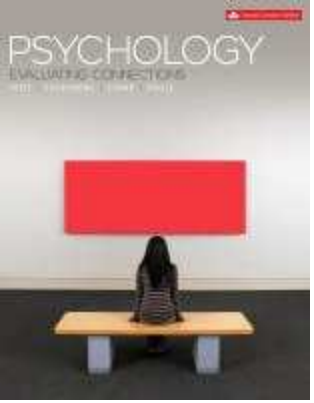
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Measurement Scales

	Scale values have unique meanings	Scale values can be rank ordered	Equal intervals between scale values	Scale has an absolute zero point	Examples	
					Variable	Scale values (operationally defined by researcher)
Nominal	✔				citizenship student status	Canadian/American/ Chinese full-time/part-time
Ordinal	✔	✔			university letter grades socioeconomic status	A/B/C/D low/medium/high
Interval	✔	✔	✔		temperature intelligence	in degrees celsius in IQ points
Ratio	✔	✔	✔	✔	weight reaction time	in kilograms in seconds

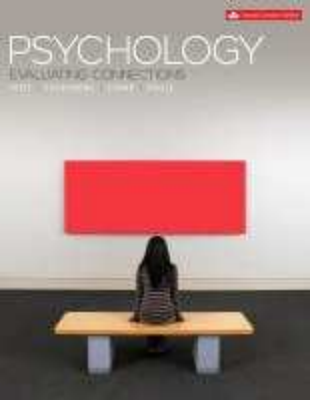
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Self-Report Measures

- Written or oral accounts of one's thoughts, feelings, or actions
  - Interviews
    - A researcher asks a set of questions and the respondent answers in whatever way feels appropriate
    - Usually involves very open-ended questions
  - Questionnaires
    - Taken without an interviewer
    - Answers are limited to the response options given

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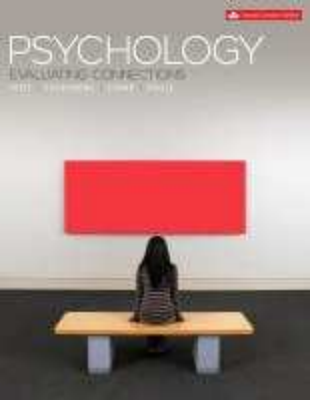


Behavioural Measures

- Based on systematic observation of people's actions, either in their normal environment or in a laboratory setting
  - Reduced social desirability bias



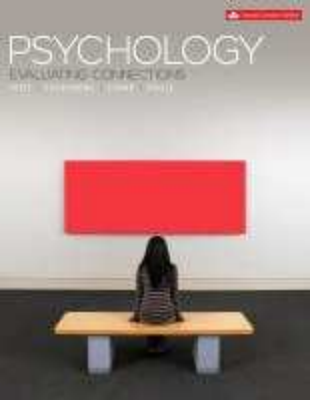
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Physiological Measures

- Measures of bodily responses used to determine changes in psychological state
  - Blood pressure
  - Heart rate
  - Sweating
  - Respiration
  - Brain-imaging technologies

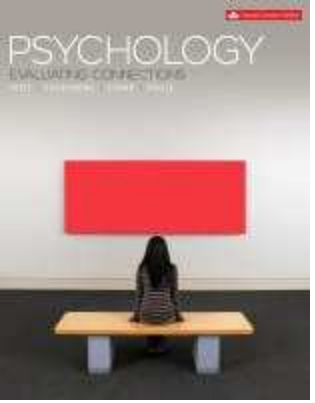
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Multiple Measurement

- Use of several measures to acquire data on one aspect of behaviour
  - Offsets limitation of any single measurement

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In Review



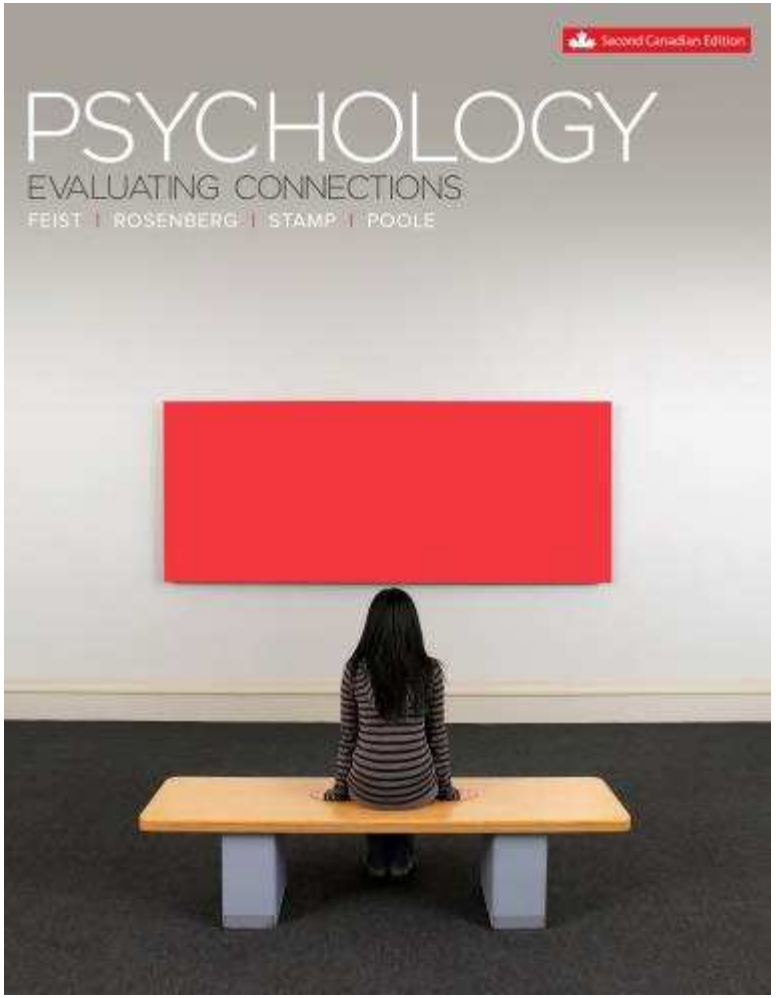


	Description	Use	Limitations
self-reports	Participants' written or oral accounts of thoughts, actions, feelings.	Interviews and questionnaires	Social desirability bias Lack of clear insight into one's own behaviour
behavioural measures	Objective observation of actions in either natural or lab settings.	Small-scale studies on behaviour	Time required to train coders and conduct coding Participants may modify their behaviour
physiological measures	Data collection of bodily responses under certain conditions.	Studies to determine the magnitude of physiological change	Specialized training on expensive equipment, on how to collect measurements, and on data interpretation
multiple measures	Several measures combined to acquire data on one aspect of behaviour.	Offset limitation of any single measurement Complex behaviours to study	Expensive and time consuming



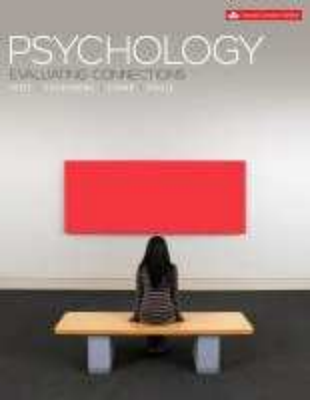
FIGURE 2.13
COMMONLY USED MEASURES IN PSYCHOLOGY. Why does the best research strategy involve using as many techniques as possible to study the same question?

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Making Sense of Data with Statistics

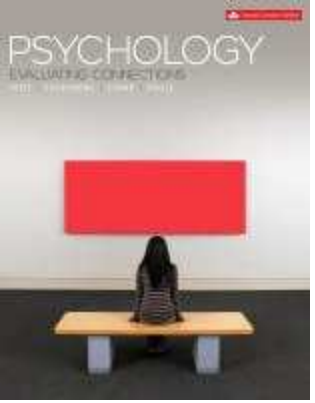
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Summarizing Data

- Statistics
  - Collection, analysis, interpretation, and presentation of numerical data
- Descriptive Statistics
  - Measures used to describe, summarize, and organize data collected in research

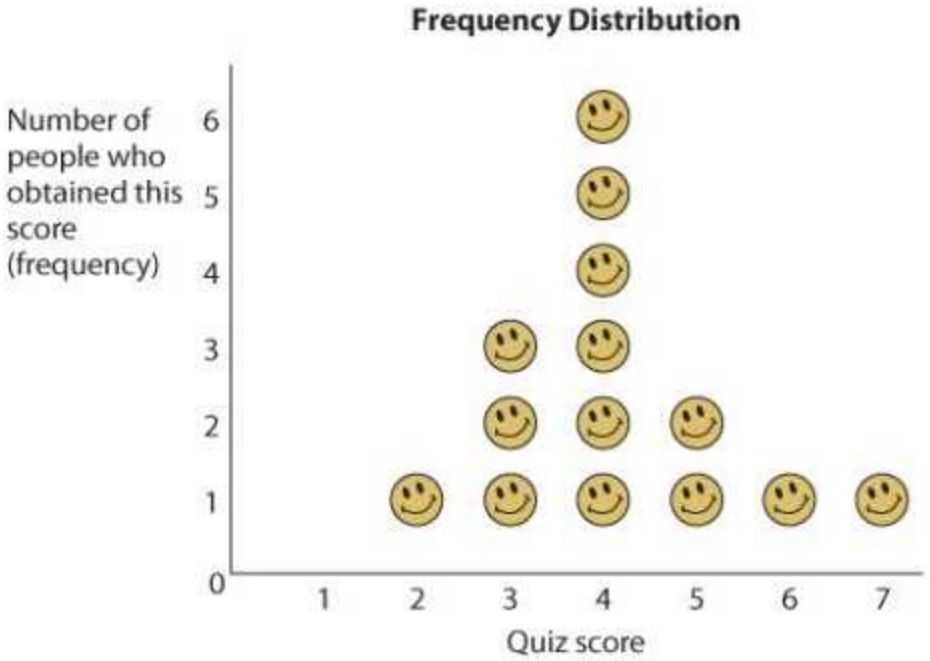
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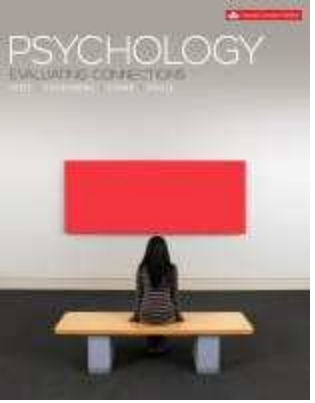
Frequency Distribution

Quiz scores for class of 14 students

Student	Quiz Score (out of 7)
Lee	5
Smith	4
Sandhu	7
Reed	4
Poole	2
Aenderson	3
Chan	6
Alexander	3
Yee	5
Roja	4
Bergeron	3
Roi	4
Iljac	4
Romanov	4



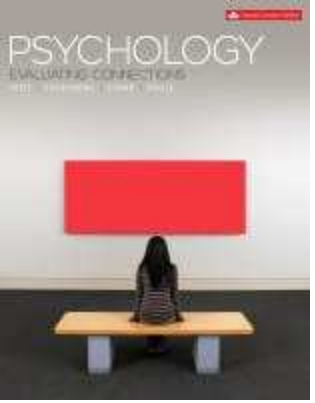
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Descriptive Statistics: Measures of Central Tendency

- Mean
  - Arithmetic average of a data set
- Median
  - A score that separates the upper half from the lower half in a data set
- Mode
  - Most frequently occurring score in a data set

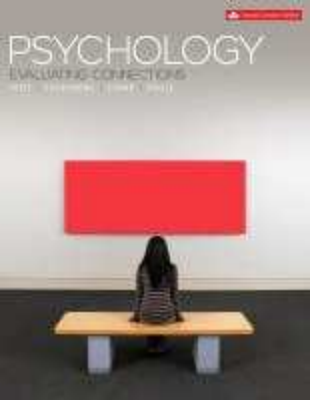
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Descriptive Statistics: Measures of Variability

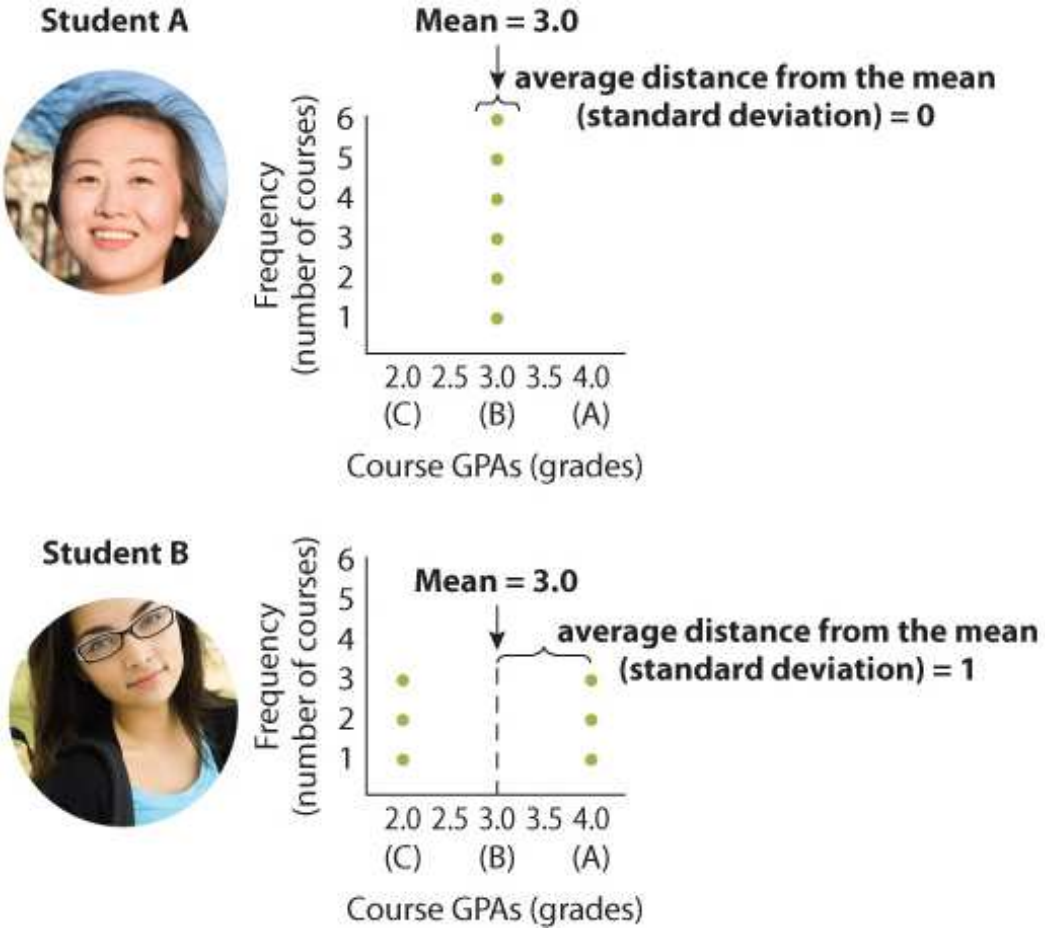
- Range
  - The difference between the highest and lowest score in a sample
- Standard deviation
  - Measure of how much scores in a data set vary around the mean
  - Most common way to represent variability in data

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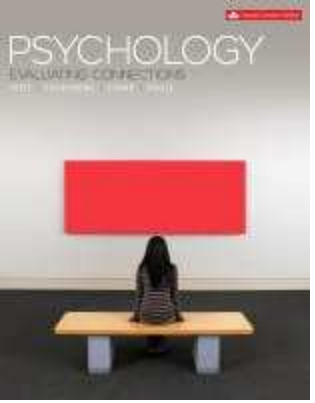


Same Mean, Different Variability

LO8



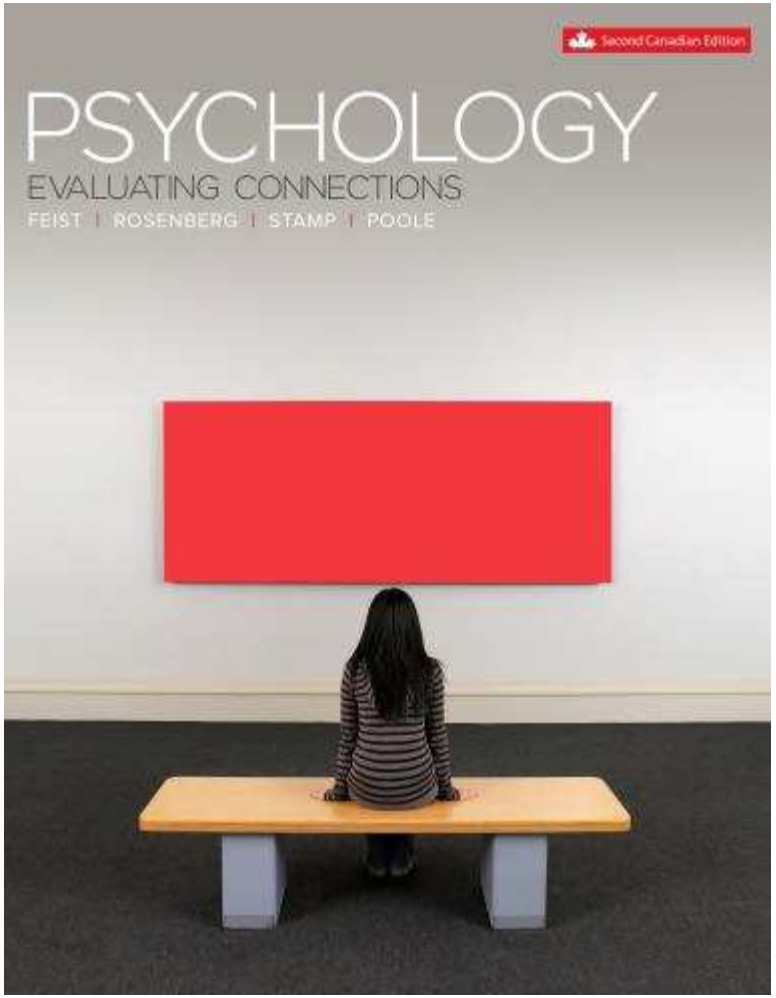
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Inferential Statistics

- Analyses of data that allow for the testing of hypotheses
- Help determine the likelihood that a given finding was the result of chance
  - In psychology, we accept a result as **statistically significant** if we expect it to have occurred by chance less than 5% of the time
  - We report this **significance level** as $p < .05$

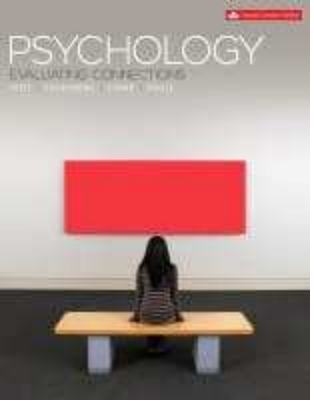
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Psychology in the Real World

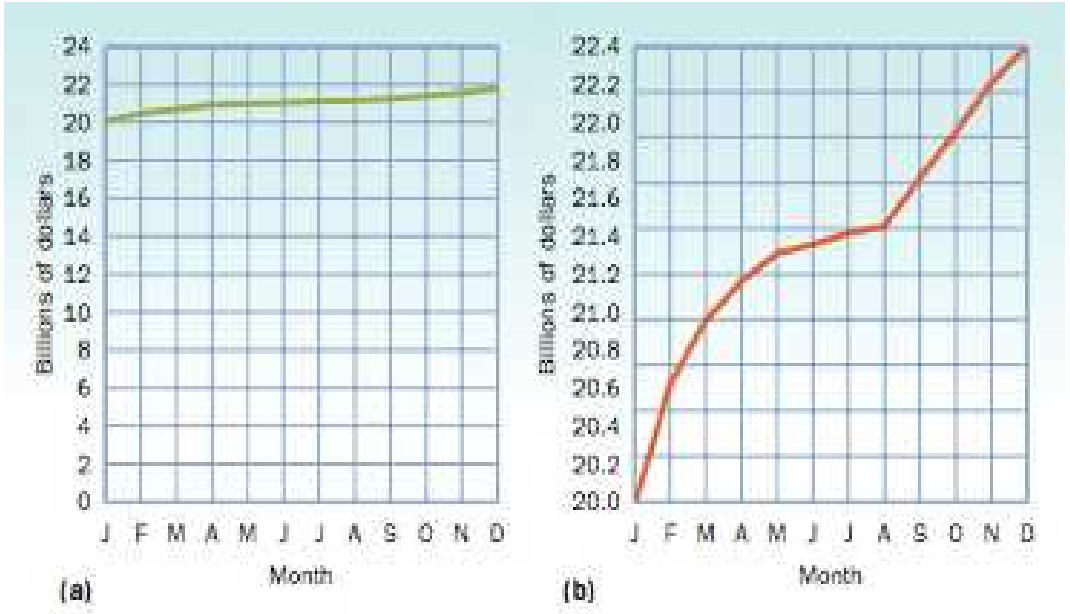
Beware of Statistics in Advertising

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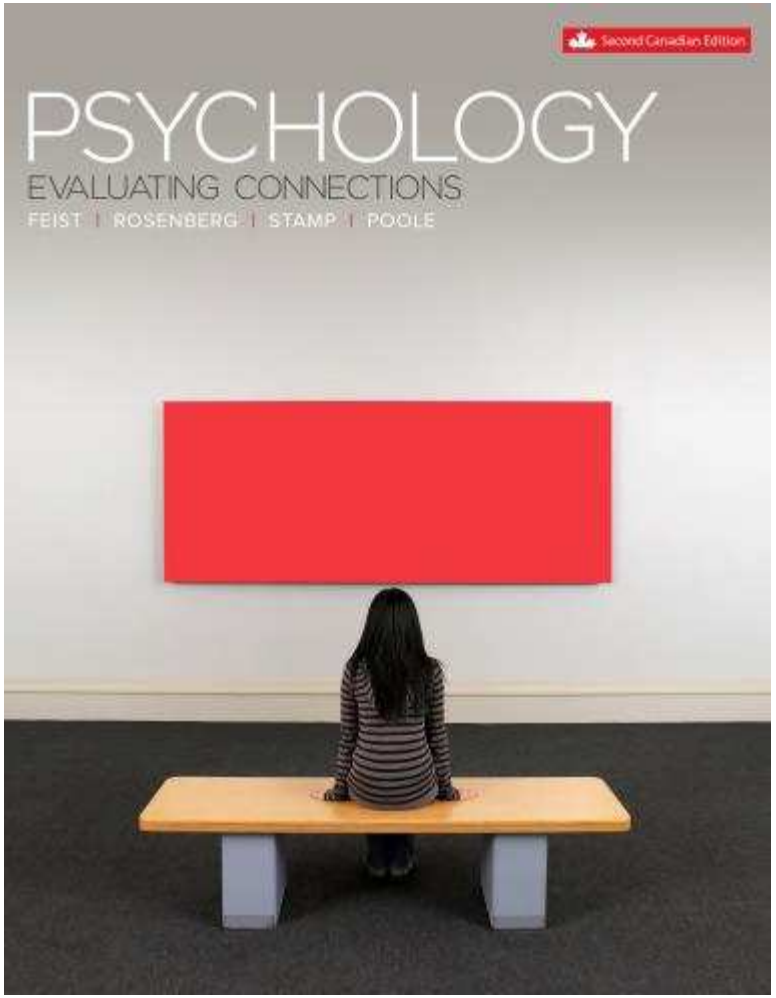


Misleading with Statistics

- Which of the graphs on the right would you use to convince someone that education spending is out of control?

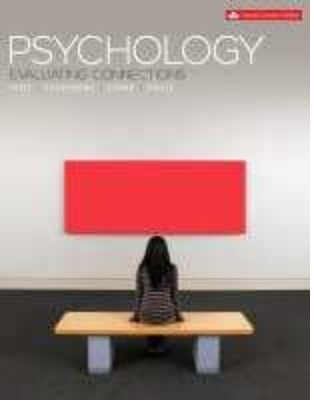


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Research Ethics

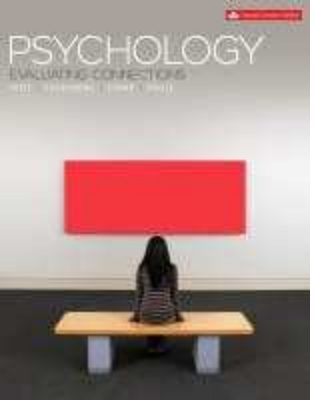
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Ethics

- The rules governing the conduct of a person or group in general or in a specific situation
- Standards of right and wrong
- Essential to conducting research, either with human beings or with animals

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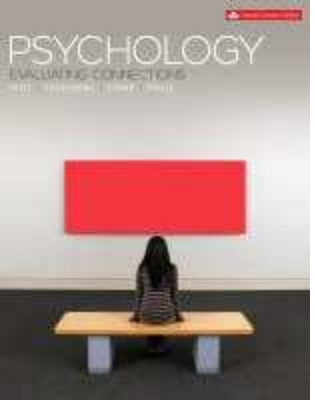
Ethical Research With Humans

LO9

- Informed consent
- Respect for persons
- Beneficence
  - Debriefing
  - Research ethics boards (REBs)
- Privacy and confidentiality
- Justice



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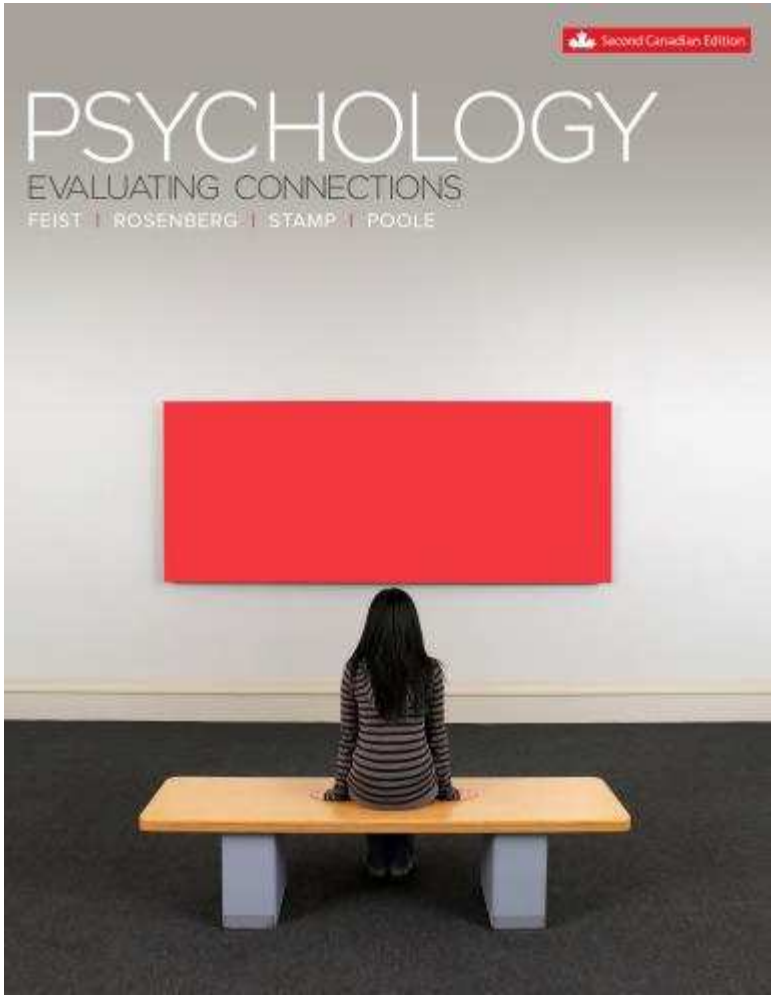


Ethical Research with Animals

LO9

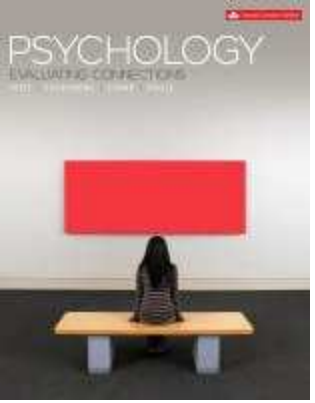
- Very controversial
- Strict laws and standards govern treatment
  - Animals are entitled to be treated in a humane way to the greatest extent possible
  - Pain and suffering must be minimized
  - Euthanasia, when required, must be done as painlessly as possible

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Evaluating Connections in Psychological Research

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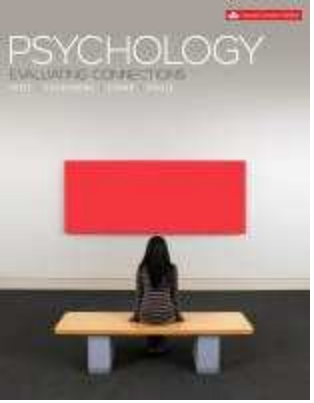


Can Experience Change the Brain?

- Controlled experiments with rats revealed that those randomly assigned to enriched environments developed more brain tissue than rats raised in impoverished environments.
- Can we extend these animal findings to humans?
- How do we study in humans?



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Quasi-experimental Design

- Compare the brains of people from naturally occurring groups (e.g., high versus low SES)
- Studies reveal differences but be careful in the interpretation – correlational data!



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