2/RESEARCH METHODS: SAFEGUARDS AGAINST ERROR

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Web Resources

- **Simeon's Cave of Magic and the Confirmation Bias:** http://www.caveofmagic.com/pickcrd2.htm
- **Discovering Psychology Episode on Decision Making:** http://www.learner.org/discoveringpsychology/11/e11expand.html#

A. Why We Need Research Designs (**Figure 2.2, text p. 45**)

1. "I can see that it works" – often our impressions are wrong.
    a. Without research designs, even intelligent, well-educated people can be fooled.
    b. **Prefrontal Lobotomy** - example of what happens when we rely on our subjective impressions.
        i. Egaz Moniz won the Nobel prize for this procedure.
        ii. Clinical observations led to the rejection of the prefrontal lobotomy procedure.

B. How We Can Be Fooled: Two Modes of Thinking

1. We can all be fooled through two modes of thinking
    a. System-1 or intuitive thinking involves our first impressions and gut hunches; they are quick and reflexive and requires little mental effort.
    b. System-2 or analytic thinking is slow and reflective and takes considerable mental effort.
    c. Intuitive thinking relies largely on heuristics – mental shortcuts or rules of thumb.

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- Small Samples
- Which Method Would You Use?
- Name That Research Method

Web Resources

- **Correlation Is Not Causation:** http://www.msnbc.msn.com/id/19918336/

A. There is no single scientific method; all methods enable us to test hypotheses derived from broader theories

1. Confirmed hypotheses only strengthen our confidence in a theory, they do not "prove" it.

B. Naturalistic Observation: Studying Humans "In the Wild"

1. **Naturalistic Observation:** watching behaviour in real-world settings
2. Robert Provine (1996, 2000) observed human laughter in natural settings; women laughed more than men, speakers laughed more than listeners, and most laughter was not in response to "funny" remarks.
3. The major advantage of naturalistic observation is that studies are often high in **external validity**—the findings may be generalized to real-world settings.
4. The major disadvantage of naturalistic observation is that studies tend to be low in **internal validity** and we are limited in the degree to which we can draw cause-and-effect conclusions.

C. Case Study Designs: Getting to Know You

1. Researchers examine one person or a small number of people, often over an extended period of time.
2. **Case studies** can provide "**existence proofs**" that phenomena can occur and can enable us to generate hypotheses for controlled studies.
3. Caution should be used when coming to conclusions based on case studies; the plural of "anecdote" is not "fact."

D. Self-Report Measures and Surveys: Asking People about Themselves and Others

1. Random Selection: The Key to Generalizability
    a. **Random selection** is a survey approach in which every person in the population has an equal chance of being chosen to participate. This is essential for generalizing survey findings to a larger population.
    b. The Hite Report (1987), a survey with surprising results about women and relationships, is an example of the misleading effect of nonrandom selection. Only 4.5 percent of those contacted responded to the Hite Report; a simultaneous Harris poll using random selection reported nearly opposite findings.
2. Evaluating Measures
    a. **Reliability**—consistency of measurement
        i. *Test-retest reliability*—a measurement yielding similar scores within a group of people over time.
        ii. *Interrater reliability*—the extent to which different people who conduct an interview or make behavioural observations agree on characteristics.
    b. **Validity**—the extent to which a measure assesses what it claims to measure.
    c. Reliability and Validity: The Differences

i. Reliability is necessary for validity, but it is not sufficient for validity.

3. Advantages and Disadvantages of Self-Report Measures
   a. *Self-report measures***:** questionnaires assessing a variety of characteristics (**Text p. 49**).
      i. *Surveys*: measure opinions, attitudes.
   b. Pros are that measures are easy to administer; direct (self) assessment of person's state.
   c. Cons are that accuracy is skewed for certain groups (narcissists); potential for dishonesty.
      i. **Response sets**—tendencies to distort answers to items appear more positive, for example, than they actually are.
4. Rating Data: How Do They Rate
   a. Ratings of others are subject to halo and horns effects in which positive or negative ratings on one characteristic influence ratings of other characteristics

E. Correlational Designs

1. Identifying Correlational Designs
   a. **Correlation desig**n—research design that examines the extent to which variables are associated.
2. Correlations: A Beginner's Guide
   a. Positive correlations indicate that as one variable increases, so does the other.
   b. Negative correlations indicate as one variable increases, the other decreases.
   c. Zero correlations indicate no relation between variables.
   d. Correlations range from –1.00 to +1.00; both of these correlation ratings indicate a perfect relationship; a correlation of 0 indicates no relationship between two variables; the strength of the association between two variables is indicated by the absolute value of the correlation; and the positive or negative sign indicates the direction of the association**.**
3. The Scatterplot
   a. A **scatterplot** is a grouping of points on a two-dimensional graph in which each dot represents a single person's data (**Figure 2.3, text p. 55**).
4. **Illusory Correlation**
   a. Correlations are illusory when we perceive an association between two things that does not exist, such as an association between the full moon and strange occurrences.
   b. We tend to pay too much attention to memorable events, while not attending to non-memorable events.
   c. We can minimize tendencies to make illusory correlations by forcing ourselves to keep track of disconfirming instances.
5. Correlation versus Causation: Jumping the Gun
   a. The most common mistake we make when interpreting correlational data is to draw causal conclusions from them.
   b. Correlational data does allow us to make predictions, but conclusions from this type of research are limited because we can't be sure why these predicted relationships exist.
   c. The news media frequently falls prey to the correlation vs. causation fallacy (**Figure 2.4, text p. 58**).

F. Experimental Designs

1. Experimental designs permit us to make cause-and-effect inferences.

2. Unlike correlational designs, researchers conducting experimental designs manipulate variables to see whether these manipulations produce differences in participants' behaviour.
3. What Makes a Study an Experiment: Two Components
    a. An **experiment** is a research design characterized by random assignment of participants to conditions and manipulation of an independent variable.
        i. **Random Assignment**—experimenter randomly sorts participants into two groups.
            a. The **experimental group** receives the manipulation.
            b. The **control group** does not receive the manipulation.
        ii. If groups contain unique participants, we are using a **between-subjects design**, but if participants serve in all groups, it is a **within-subjects** design
        iii. Manipulation of an Independent Variable
            a. **Independent variable**—the treatment or intervention that the experimenter "manipulates" or varies.
            b. **Dependent variable**—variable that an experimenter measures to see whether the manipulation has an effect.
            c. **Operational definitions** outline the researcher's approach toward measuring the dependent variable
4. Confounds: A Source of False Conclusions
    a. A confounding variable is any variable that differs between the experimental and control groups other than the independent variable.
        i. e.g., patients who received an antidepressant also received psychotherapy not received by the control group; "sessions of psychotherapy" is a confound.
5. Cause and Effect: Permission to Infer
    a. Experiments are distinct because they permit cause-and-effect inferences.
    b. To qualify as an experiment, a study must use random assignment of participants into experimental and control groups**.**
    c. Pitfalls in Experimental Design
    d. The **Placebo Effect**—an improvement resulting from the mere expectation of improvement (Kirsch, 2010). Our expectations can become reality.
        i. Participants should be **blind** to the condition to which they have been assigned. If not, expectations will differ.
    e. Similar to the placebo effect, the nocebo effect results from the mere expectation of harm.
        i. More than two thirds of students reported headaches when led to expect them after exposure to a nonexistent "electric current."
    f. The **Experimenter Expectancy Effect**—phenomena in which researcher's hypotheses lead them to unintentionally bias a study outcome.
        i. It is essential that experiments be conducted in a **double-blind** design in which neither researchers nor subjects know who is in the experimental or control group.
        ii. In a classic example of experimenter expectancy, Clever Hans the horse appeared to know mathematics; in fact, Clever Hans was detecting subtle cues coming from his questioners.
    g. **Demand characteristics**—cues that participants pick up from a study that allow them to generate guesses regarding the researcher's hypotheses.
        i. To minimize the potential for demand characteristics, researchers can disguise the purpose of the study.

III. ETHICAL ISSUES IN RESEARCH DESIGN (Text p. 66)

Lecture Launchers

- Animals in Psychological Research

Web Resources

- **APA Code of Ethics:** http://www.apa.org/ethics/code/index.aspx
- **Ethics and Animal Experimentation:** http://www.apa.org/science/leadership/care/index.aspx
- **A History of Ethical Abuses:** http://www.democracynow.org/article.pl?sid=07/01/19/1432231&mode=thread&tid=25

A. Tuskegee: A Shameful Moral Tale

1. From 1932 to 1972, the U.S. Public Health Service studied the course of untreated syphilis among poor African-American men in the South.
    a. Researchers never informed the men they had syphilis or that effective antibiotics were available.
    b. By the end of the study, 128 men had died as a result of syphilis, 40 wives were infected, 19 children had been born with syphilis.

B. Ethical Guidelines for Human Research

1. Throughout history there have been a variety of ethically questionable studies that had the potential to inflict serious psychological harm.
2. Every major North American research college and university has at least one *research ethics board (REB)* that carefully reviews all research with an eye toward protecting participants against abuses.
3. Informed Consent—informing research participants of what is involved in a study before asking them to participate.
    a. Research Ethics Boards (REBs) now require **informed consent** from participants.
    b. In Milgram's study of obedience (1963), deception was used to induce participants to deliver "shocks" to a learner.
4. Debriefing: Educating Participants
    a. In *debriefing*, participants are informed about the purpose of the study.

C. Ethical Issues in Animal Research

1. Animal research, particularly invasive animal research, generates a great deal of anger and discomfort.
2. About 7–8 percent of published research in psychology relies on animals, usually rodents and birds.
3. Supporters argue that animal research has directly benefited humans, especially in the area of brain function and medication effectiveness.
4. Animal research has yielded important insights about brain and behaviour. Animal researchers must weigh carefully the potential scientific gains of their work against the costs in death and suffering they produce.

IV. STATISTICS: THE LANGUAGE OF PSYCHOLOGICAL RESEARCH (Text, p. 69)

Lecture Launchers

- Oscar the Deathcat: A Case of Illusory Correlation?

Web Resources

- **Rice Virtual Lab in Statistics:** http://onlinestatbook.com/rvls.html
- **VassarStats:** http://vassarstats.net
- **The Practical Significance of Statistical Significance:** http://www.nytimes.com/2007/09/26/business/26leonhardt.html?_r=1&oref=login
- **Oscar the "Deathcat":** http://www.youtube.com/watch?v=9cqiylGLAvg

A. ***Statistics****—the application of mathematics to describing and analyzing data. They help us determine the value of a hypothesis.*
1. **Descriptive statistics**—numerical characterizations that describe data.
2. Inferential statistics—mathematical methods that allow us to determine whether we can generalize findings from our sample to the full population.

B. Descriptive Statistics: What's What?
1. Central Tendency: The 3 Ms.
    a. There are three measures of **central tendency.** (**Table 2.3, text p. 70**).
        i. the **mean**, or arithmetic average;
        ii. the **median**, or middle score;
        iii. and the **mode**, or most frequent score.
    b. If the data are normally distributed, the mean is the better measure of central tendency; if the data are skewed, the median or mode may be more representative (**Figure 2.5, text, p. 71**).
2. Variability (dispersion): How the Data Scatter
    a. Measures of **variability** describe how loosely or tightly bunched the scores are.
    b. The **range** is the difference between the highest and lowest score. (**Figure 2.6, text p. 71**).
        i. But it's key to note that data sets can display very different distribution of scores across the range.
    c. The **standard deviation** takes into account how far each data point is from the mean.

C. ***Inferential Statistics****: Testing Hypotheses*
1. These statistics allow us to determine whether we can generalize our sample findings to a larger population, or whether they just occurred by chance alone.
2. Statistical Significance
    a. A statistically significant finding is one that would occur by chance alone less than 5 percent of the time; if it would occur by chance that rarely, we conclude that the finding we observed in our sample is probably real.
    b. In psychology journals, a statistically significant finding is described using the phrase "$p < .05$".
3. Practical Significance
    a. A finding may be statistically significant, or unlikely to have occurred by chance, yet be so small that the findings do not translate into meaningful consequences in the real world.
    b. All other things being equal, larger sample sizes will increase the likelihood that a finding will be statistically significant, but will not have an effect on practical significance.

D. How People Lie with Statistics
1. If the distribution of data is skewed, reporting the mean as the measure of central tendency can give a false picture of the nature of the majority of the scores.

V. EVALUATING PSYCHOLOGICAL RESEARCH (Text p. 73)

Classroom Activities, Demonstrations, and Exercises

- Give the Doctor Some Advice
- What Do Journals Look Like?

A. Becoming a Peer Reviewer

1. In this process, fellow experts try to identify flaws that could undermine a study's findings and conclusions.
2. Potential flaws include lack of random assignment to groups and lack of a true placebo control group in which participants receive an ineffective treatment.

B. Most Reporters Aren't Scientists: Evaluating Psychology in the Media

1. Most reporters are not trained in psychology, and so fall prey to heuristics and biases that we are all susceptible to.
2. We should consider the source, giving greater credence to reputable science magazines and less to tabloids or popular magazines.
    a. Primary sources such as journal articles are more reliable than secondary sources such as newspapers and Web sites.
3. We should be on the lookout for storytelling techniques, such as sharpening, in which the central gist of a study is exaggerated, and levelling, in which the less central details are downplayed.
4. We should beware of pseudosymmetry, in which reporters present two sides to a controversy, when the evidence strongly favors one side. This gives the appearance of scientific controversy when none exists.

C. Applying the Experimental Method: Extrasensory Perception and Psychic Abilities

1. Many people ask whether there even is evidence of ESP. J. B. Rhine from Duke University offered what he believed was supporting evidence, based on the ability of random subjects to guess what was on the back of a set of Zener cards.
    a. Rhine's studies could not be replicated in later attempts. Moreover, Rhine's studies were also flawed
        i. Some cards were so worn down, you could read the symbol on the other side
        ii. Rhine had not randomized the order of the cards
    b. Similar research using Ganzfeld effects, where participants (with a blinded visual field) try to 'read' a sender's signal sent to them; once again, the effects are small and difficult to replicate.
    c. Daryl Bem's work on stimulus presentation – exposing participants to stimuli after rather before responding to a task – suggested future events seemed to predict past behaviour.
        i. Later researchers were unable to replicate Bem's findings
    d. Despite a lack of evidence for ESP, believers hang on to a series of ad hoc hypotheses to explain away the null findings
2. So with no supporting evidence, why are beliefs in ESP still so strong?
    a. Illusory correlation is one answer – we tend to recall unusual coincidences (like thinking of a friend early in the day, only to randomly run into them later in the day)
        i. The problem is that we forget the usual noncoincidences (when we think of a friend and do not see them)
        ii. Coincidences are remarkably common and largely underestimated by people, like the birthday paradox (see **Figure 2.7, p. 78**), where it only takes 23 people to have a 50% chance that any two share a birthday.

3. Some psychics purport to predict the future, and make outrageous claims that do not surface, yet fail to uncover significant events (like a hurricane disaster) that do.
    a. Other psychics can tell complete strangers rare details of their lives, using a technique called 'cold reading' (see **Table 2.4, p. 78**).

CHAPTER 2

Learning Objectives

On completion of this chapter, students should be able to

2.1 Identify why we need research designs (text p. 44);

2.2 describe the advantages and disadvantages of using naturalistic observation, case studies, self-report measures, and surveys (text p. 47);

2.3 describe the role of correlational designs and distinguish correlation from causation (text p. 53);

2.4 identify the components of an experiment and the potential pitfalls that can lead to faulty conclusions (text p. 58);

2.5 explain the ethical obligations of researchers toward their research participants (text p. 67);

2.6 describe both sides of the debate on the use of animals as research subjects (text p. 68);

2.7 identify uses of various measures of central tendency and variability (text p. 70);

2.8 explain how inferential statistics can help us to determine whether we can generalize from our sample to the full population (text p. 71);

2.9 show how statistics can be misused for purposes of persuasion (text p. 72);

2.10 identify flaws in research designs (text p. 73);

2.11 identify skills for evaluating psychological claims in the popular media (text p. 75);

2.12 analyze the scientific support for and against extrasensory perception (ESP) (text p. 86).

CHAPTER 2: RAPID REVIEW

There are several types of scientific designs, each with advantages and disadvantages. Naturalistic observation (watching behaviour in real world settings) has the advantage of high external validity but the disadvantage that it tends to be low on internal validity. The **case study design** examines one person, or a small number of people in depth often over an extended period of time. The advantages include the existence of proofs, the opportunity to study rare or unusual phenomena, and insights that researchers can later test systematically. A chief disadvantage is that it cannot determine a cause and effect relationship and results are difficult to generalize. **Correlational designs** assess the extent to which two variables are associated and can be positive, negative or zero and range from –1 to +1. Correlations can be plotted on **scatterplots,** which are two- dimensional graphs in which each dot represents a single person's data. Disadvantages to this design are **illusory correlations,** a misperception that there is a statistical association between two variables where none exists. Correlations do not show causation and do not rule out third variable explanations for an association between variables.

Experimental design research is characterized by random assignment of participants to conditions (experimental or control group) and manipulation of an independent variable to determine the effect on a dependent variable. Experimenters try to account for any **confounding variables** or **confound.** The disadvantages in experimental designs include placebo and nocebo effects as well as experimental expectancy effects.

Participant sample selection is based upon **random selection,** the procedure that ensures every participant in a population has an equal chance of being chosen to participate. Measures are evaluated base upon r**eliability,** consistency of measurement, such as **test -retest reliability** and **inter-rater reliability** and **validity,** the extent to which a measure assesses what it purports to measure.

Self-report measures and surveys are used to assess personality traits, mental illnesses, and interests. Surveys are typically used to measure people's opinions and attitudes. Advantages include ease of administration and also the direct questioning regarding personal information that only the respondent would have access to. Disadvantages include the assumptions that people have insight into their own personality characteristics, and that they are honest in their responding. Some participants engage in **response sets,** which are tendencies to distort their answers to questionnaire items. Two types of problematic response sets are **positive impression management** and **malingering.**

Rating data involves asking people who know others well to provide ratings on them. The advantage is having an objective opinion of someone who may be unlikely to give accurate information. The drawbacks of this approach include the **halo effect** and **'horn effect'.** For researchers to conduct studies they must follow the ethical guidelines established by their universities' **research ethics board (REB).** The board reviews all research carefully with an eye toward protecting participant against abuses. REBs insist researchers use **informed consent,** requiring them to tell subjects what they are getting into before asking them to participate, and then **debriefing them,** that is inform, participants about the true nature of the study.

Statistics is the application of mathematics to describing and analyzing data. There are two types of statistics, **descriptive statistics** that describe data and inferential statistics that allow us to determine whether we can generalize findings from our sample to the full population. The two main types of descriptive statistics are central tendency (i.e., the mean, median, and mode) and dispersion (i.e., range, standard deviation). In **inferential statistics** the mathematical method tests for **statistical significance,** a finding is statistically significant if the probability of the finding occurring by chance alone is less than 1 in 20. Statistical significance should not be confused with practical significance. A finding can be statistically significant and yet have no importance or real -world predictions. Statistics can be manipulated in several ways; such as, reporting measures of central tendency that are nonrepresentative of most participants, creating visual representations that exaggerate effects and failing to take base rates into account.

In the media few psychology reporters have formal psychological training. When considering media claims, the source should be questioned. We should consider whether the story was sharpened (the

tendency to exaggerate the central message) or levelled (minimize less central details), and if the story presents a balance between two sides of a controversy.

When the experimental method is applied to rigorously test claims such as Extrasensory perception (ESP), the results often disprove these claims. People may believe in ESP due to the general tendency to underestimate the likelihood of coincidences and thereafter attribute them incorrectly to psychic phenomena.

▼LECTURE LAUNCHERS AND DISCUSSIONS TOPICS

- The Tragedy of Dr. Semmelweis and Childbed Fever
- The Case of Joseph Goldberger and Pellagra
- Correlations and Causal Relationships
- Independent and Dependent Variables
- The Road from Hypothesis to Conclusion
- An Experimental Example
- Applied Experimental Psychology in the Real World
- Animals in Psychological Research
- Oscar the Deathcat: A Case of Illusory Correlation?

Lecture/Discussion: The Tragedy of Dr. Semmelweis and Childbed Fever

The case of Dr. Ignac Semmelweis and childbed fever complements the debacle surrounding the technique of facilitated communication and powerfully illustrates the tragedies that ensue when scientific information is ignored or rejected. It is an extraordinary story that is as much psychological as it is medical. In 1847, Semmelweis attempted to persuade his fellow physicians that they were contaminating women during childbirth with some substance acquired from the cadavers of women who had died from this illness. When his own students washed their hands in an antiseptic, the death toll plummeted, but his fellow physicians disbelieved this clear and objective evidence. Describe the case and ask students why the medical community was so reluctant to accept Semmelweiss's findings. A brief presentation on cognitive dissonance theory may be helpful. That is, after watching women perish from this gruesome infection, the physicians' knowledge that they had caused these deaths may have been too discrepant with their self-concepts as healers to resolve the dissonance. They disparaged Semmelweis and his evidence. The story may be found in the following sources:

http://www.sciencecases.org/childbed_fever/childbed_fever.asp
http://litmed.med.nyu.edu/Annotation?action=view&annid=12179

Lecture/Discussion: The Case of Joseph Goldberger and Pellagra

The case of Joseph Goldberger and pellagra is another powerful, true-life story from the history of medicine that shows how the correlation between this disease and poverty obscured the true causal mechanism: Poor diet. Early in the twentieth century, diets deficient in niacin killed many poor Southerners. Dr. Joseph Goldberger discovered the cause of the disease and generated controversy by demonstrating that it was not caused by germs. Because cases of pellagra were often higher among those with poor sanitation (e.g., no indoor plumbing), contamination by means of germs was the favoured theory, a clear case of mistaking correlation for causation. In his attempt to discover the true cause, Goldberger experimented on himself, his colleagues, his wife, and prisoners. The case also raises important ethical questions; that is, to what extent did prisoners feel coerced into participating? It is worth mentioning that Goldberger exchanged pardons for participation in his medical research. Goldberger's ideas were not universally well received and some were reluctant to accept his findings. For example, Goldberger accurately predicted that the drop in cotton prices in 1920 would lead to increased poverty and cases of pellagra. In anticipation of this outcome, he argued for social programs to improve nutrition in the South. In response, he was accused of impeding tourism and discouraging economic investment in the region by some Southerners, memorably led by then-congressman Jimmy Byrnes.

The following two links lead to information on the case.

http://history.nih.gov/exhibits/Goldberger/docs/ackn_8.htm
http://www.scottsdalecc.edu/ricker/psy101/readings/Section_5/5-2.html

Lecture/Discussion: Correlations and Causal Relationships

There seems to be a general human tendency to attribute causality to correlated events. The lay person, like the psychologist, often imposes patterns of (apparently) lawful regularity on observed events. Given what is perceived as an "effect," we search for causes. Events are more likely to be singled out for attention and analysis when they are unusual, anomalous, and discontinuous with our prior experience. When such events are natural phenomena, they are typically relegated to the status of "cause" and then the search is directed toward their aftereffects.

One of the most persistent instances in which pseudo -correlations of behaviour consequences are reported to flow from salient natural and human events is the "baby boom" syndrome. For example, the allegation of increased births nine months after a major power blackout in New York is well known. So too, is the baby boom in Israel nine months after their war with Egypt.

Invariably, when base rate data are used to compare the assumed "increase in births," the effect vanishes. That is, when seasonal fluctuations in births are taken into account, there is no unusual effect left to relate to the nine-months-earlier unusual event. But that does not deter the correlation seekers.
Three University of North Carolina sociologists attributed a 1955 drop in Southern birth rates to the Supreme Court's 1954 school desegregation decision (Rindfuss, Reed, & St. John, 1978). They theorized that uncertain prospects for the future "demoralize" prospective parents (both whites and, to a lesser extent, blacks), causing them to postpone any children they might otherwise have conceived in the three-or four-month period immediately following the decision. The subsequent recovery in the birth rate is attributed to the realization that desegregation would in fact proceed slowly.

And on it goes. Less than a week after Chicago's "Blizzard of '79," at least one newspaper columnist was speculating on the possibility of a baby boom in the coming autumn (Kup's column, *Chicago Sun-Times*, January 17, 1979, p. 52).

Another example of the temptation to confuse correlation with a causal connection is in the area of extramarital sexual affairs. Biracree (1984) found that for men there was an almost perfect positive correlation between annual income and the percentage of men who had been unfaithful to their wives. This relationship was not true for married women. If this finding is valid, what are the possible explanations for these relationships? Is there any strong evidence to support any of these explanations, or are they, at the moment, speculations?

Biracree, T. (1984). *How you rate: Men* and *How you rate: Women*. New York: Dell.
Rindfuss, R. R., Reed, J. S., & St. John, C. A. (1978). A fertility reaction to a historical event: Southern white birthrates and the 1954 desegregation ruling. *Science, 201*, 178–180.

Lecture/Discussion: Independent and Dependent Variables

In the cereal and fruit example, the cereal and the fruit are independent variables and the rash is the dependent variable. One useful way of thinking about and identifying independent and dependent variables is to remember that the basic hypothesis underlying any experiment is "X causes Y" (colouring a movie [X] changes the way people respond to it [Y]; a cereal [X] caused a rash [Y]; a fruit [X] caused a rash [Y]). To test such hypotheses, X is manipulated in order to determine its effect on Y. Thus, X is the independent variable and Y is the dependent variable. Advise students that, when trying to identify independent and dependent variables (as might happen in the context of an exam question), they should put the variables in the scenario into an "X causes Y" statement.

Lecture/Discussion: The Road from Hypothesis to Conclusion

How do we know that cigarette smoking is dangerous to your health?

Cigarette smoking became common in Europe after French and British soldiers picked up the habit from Turkish soldiers in the Crimean War of 1854 to 1856. The habit was adopted by a few Americans in the next 30 or 40 years. The tobacco was strong and they rolled their own. More American males began to smoke after the automatic cigarette-making machine was perfected in North Carolina in the 1880s. Very few women smoked, at least in public, until after World War I when U.S. tobacco companies began to target women with their advertising.

People must have suspected that cigarettes are dangerous to health long before any research was done. The slang term for cigarettes, "coffin nails," was used during the first half of the century.

The conjecture became a hypothesis when doctors noticed that many people who died of lung cancer had been heavy smokers, and it was also suspected that nicotine affects the circulatory system. Early studies produced high negative correlations between cigarette smoking and age at death: the more people smoked, the younger they were when they died.

This correlational data resulted in the first warning labels on cigarettes in the 1960s: "Caution: The Surgeon General has determined that cigarette smoking may be hazardous to your health." Notice that the warning reads "may be hazardous," rather than "is hazardous." The conservative warning is all that is justified by correlational data. A relationship between variables does not imply that the variables are causally related. The earlier death of smokers could be for reasons other than cigarette smoking.

Perhaps smokers live more stressful lives, and both the smoking and their illness are the result of stress. Also, it is possible that smokers are not as careful of their health in other ways as nonsmokers; maybe they don't exercise or have nutritious diets. Or perhaps both the smoking and the mortality have a genetic basis.

To do a definitive experiment on the effects of smoking, one would need to get a sample of 100 or so young people who have never smoked and assign them randomly to a smoking group and nonsmoking group. The smokers would smoke at least one package of cigarettes a day for life, beginning at age 16 or 18, and the nonsmokers would not smoke at all. The dependent variable is age at death, and the successors of the original researchers could not analyze the data until all the subjects died. If the nonsmokers lived significantly longer, the researchers would be justified in concluding that cigarette smoking *is* hazardous to health.

An experiment like this has not been done, and probably never will be done. In the 1970s the label on cigarette packages was changed to read, "Cigarette smoking is dangerous to your health." The evidence that prompted this change came from several sources. One source was studies that tried to match smokers and nonsmokers on various alternative causes, such as stress, and thus to control for its effects on health. Another source of evidence came from animal studies. The conclusions that cigarettes are truly "coffin nails" is based on large amounts of data and a multitude of studies.

Many studies were required to get from a hypothesis to a firm conclusion in the establishment of a causal link between smoking and disease and death. The reason is that there are humane and ethical constraints that rule out certain types of research. Because humans are the primary focus in psychology, it is often difficult for us to get answers to important questions. As just one example of this, we would like to know if child abuse has permanent effects on personality, and if so, what these effects are. But we cannot assign infants at birth to be abused or not abused, so to study this question we must try to tease out these effects from the mass of environmental variables that affect the development of human personality.

Lecture/Discussion: An Experimental Example

Can vitamins increase IQ?

Suppose you hear about a retarded boy who did better schoolwork after being given a dose of a vitamin-mineral supplement, and you decide to conduct an experiment to see if intellectual functioning of retarded children can really be improved by such a diet supplement. You start with the hypothesis, "A vitamin-mineral supplement (independent variable) added to the diet of mentally retarded children will improve their intellectual functioning (dependent variable)."

Your first task is to define your variables more precisely. What vitamins and minerals will you use, and at what strength? How many times a day and for how many months? You may decide to use an IQ test score as a numerical measure of your dependent variable; you may also decide that you will require a minimum increase in the number of points as acceptable evidence of improvement, because many chance factors can influence test scores.

You draw your subjects from a group of children who have all been tested and diagnosed as mentally retarded, and you randomly assign them to either the experimental group, who will get the supplement, or the control group, who will be given a placebo (some inert substance) instead of the supplement.

There are several precautions you will need to take to avoid bias in your results. Besides controlling for similarity of your two groups at the start, you will want to be sure that the subjects in both groups are exposed to all the same conditions during the experiment except for the exposure to the independent variable, the nutritional supplement. Temperature, timing, instructions, conditions of testing, and other events during the time of the experiment should be as similar as possible for the two groups.

Your own desires to prove or disprove the idea that vitamins may increase school performance may be a possible source of bias. To reduce this bias, would you conduct a single-blind or double-blind experiment?

For a fixed period of time, say four months, the children in the experimental group receive the supplements in tablets at each meal. The control-group children also receive tablets, but they contain nothing of biological value (a placebo). Neither the children nor those working with them or testing them know which child is getting which kind of tablet. At the end of the four months, intelligence tests are given again to see if the groups now differ.

You may find that both groups have higher scores than originally, perhaps from all the extra attention they have been receiving or from some natural development over this period. So you use the control group's scores as a baseline and compare the experimental group's scores with that baseline.

If you find no difference, the study may end there, or you may try variations, perhaps a stronger supplement or a longer time period or subjects who are less retarded.

If you do find a difference in your original study, you will evaluate the probability that your obtained difference could have occurred by chance alone, even without the independent variable. If it is unlikely that it is a chance finding, your confidence in the hypothesis is increased.

Lecture/Discussion: Applied Experimental Psychology in the Real World

Students often have difficulty understanding how general research results can be applied to the real world. In other words, "How does this relate to me?" The following example provides connections between basic research in sensation and perception and possible military or medical errors.

A number of devices use sound (beeps, clicks, etc.) to provide feedback regarding bodies, structures or machines. These sounds are designed to provide people with information about changes in the current situation. For example, in medicine, drops in heart rate or blood pressure are signalled with beeps. Jet pilots receive information regarding positioning in the form of sounds as well. The pupose of these devices is to provide immediate auditory feedback that signals potential problems. The auditory nature allows the surgeon or pilot to be visually focused on something else at the time.

Unfortunately, results of recent research (Neuhoff, Kramer, and Wayand, 2002) suggest that people often misperceive how sounds change when both their pitch and loudness change. Rather than noticing the changes immediately and accurately noting the meaning of the changes, individuals may miss the changes entirely or misinterpret them. Because of this misperception, people can't accurately judge the intended meanings of the sounds. Real-world complications that could arise from this problem range from medical mistakes to serious pilot errors. For example, if a pilot does not accurately identify the sounds of the flight system that are designed to alert him/her of possible mechanical issues, the chances of mechanical failure or crashes may be increased. This result is contrary to the purposes of those feedback systems which are designed to enhance safety. It appears that the initial assumptions of inventors/creators of these systems regarding the accuracy of human interpretations of the sounds may have been incorrect.

http://www.apa.org/news/press/releases/2002/03/auditory.aspx
Neuhoff, J. G., Kramer, G., & Wayand, J. (2002). Pitch and Loudness Interact in Auditory Displays: Can the Data Get Lost in the Map? *Journal of Experimental Psychology—Applied*, Vol. 8. No.1

Lecture/Discussion: Animals in Psychological Research

Should animals be used in psychological research?

A controversial issue in psychology, and in many other fields of study, involves the use of animals in research. Is it ethical to subject animals to unnatural and/or painful situations in the pursuit of knowledge about the human condition? You might present students with some additional information about the use of animals in psychological research and the nature of the debate.

Psychologists who study animals are sometimes interested in comparing different species or hope to learn more about a particular species. Their work generally falls into the area of basic science, but often it produces practical benefits. For example, using behavioural principles, farmers have been able to reduce crop destruction by birds and deer without resorting to their traditional method – shooting the animals. Other psychologists are primarily interested in principles that apply to both animals and people. Because many animals have biological systems or behavioural patterns similar to those of human beings, using animals often allows more control over variables than would otherwise be possible. In some cases, practical or ethical considerations prevent the use of human beings as subjects. By studying animals, we can also clarify important theoretical issues. For example, we might not attribute the greater life expectancy of women solely to "lifestyle" factors and health practices if we find that a male-female difference exists in other mammals as well.

As the text points out, those who support the use of animals in research argue that animal studies have led to many improvements in human health and well-being. In recent years, however, animal research has provoked angry disputes over the welfare of animals and even over whether to do any animal research at all. Much of the criticism has centered on the medical and commercial use of animals, but psychologists have also come under fire. Critics of animal research have pointed to studies that produce no benefits for human beings but involve substantial harm to the animals being studied. A few years ago, for instance, a Maryland psychologist studying the nervous system was convicted of cruelty to animals after he cut the nerve fibers controlling limb sensation in 17 monkeys. The purpose of his research was to find ways to restore the use of crippled limbs in stroke victims. The charges alleged abusive treatment of the animals. The psychologist's conviction was eventually reversed on appeal, but by then the government had withdrawn its funding of the project.

People have staked out extreme positions on both sides of this debate. The controversy has often degenerated into vicious name-calling by extremists on both sides. Some animal rights activists have vandalized laboratories, and threatened and harassed researchers and their families; some scientists have unfairly branded all animal welfare activists as terrorists (Blum, 1994). A more positive result of the debate has been the close examination of the American Psychological Association (CPA too?) ethical

code for the humane treatment of animals and the passage of stricter federal animal welfare regulations governing the housing and care of research animals. Most psychological organizations, however, oppose proposals to ban or greatly reduce animal research. The APA, CPA, and other organizations feel that protective legislation for animals is desirable but must not jeopardize productive research that increases scientific understanding and improves human welfare.

http://www.rgs.uky.edu/ori/univet/resources/Handbook/hb-ethics-history.htm

http://www.the-aps.org/publications/tphys/legacy/1983/issue5/271.pdf

Lecture/Discussion: Oscar the Deathcat: A Case of Illusory Correlation?

Historically, a number of superstitions have been associated with cats. For a brief summary, see the Committee for the Scientific Investigation of Claims of the Paranormal:

http://www.csicop.org/superstition/library/blackcat.html

During the summer of 2007, the story of "Oscar the Deathcat" hit the Internet. The story originated in an article written for the *New England Journal of Medicine* (and also in *Slate Magazine*). It is possible that Oscar can predict the deaths of the elderly and infirm, but extraordinary claims such as this require extraordinary evidence. Students should consider one additional causal mechanism: That Oscar the Deathcat is another superstitious belief due to an illusory correlation. The issue of Oscar may be addressed with reference to the "Great Fourfold Table of Life" presented in the text. Note that although the article on Oscar was published in the *NEJM*, it was NOT a peer-reviewed article! Students may want to consider the degree to which the *Journal*'s prestige and the author's professional status conferred credibility to the story of Oscar. The original *NEJM* and *Slate* articles links are listed here; a link to a video presentation on Oscar is listed in the Media Resources section.

New England Journal of Medicine:
http://content.nejm.org/cgi/content/full/357/4/328?ijkey=PVKerq1VfkJKc&keytype=ref&siteid=nejm

The story was also covered in *Slate Magazine*:
http://www.slate.com/id/2171469/

▼CLASSROOM ACTIVITIES, DEMONSTRATIONS, AND EXERCISES

- The Direction and Strength of Correlations
- Experimental Design
- Equating Groups on Multiple Variables Using Randomization
- Can Science Answer This Question?
- Observational Research in the Dining Hall
- Naturalistic Observation
- Understanding Correlations
- Correlational and Experimental Research
- Testing Random Assignment
- Small Samples
- Which Method Would You Use?
- Name That Research Method
- Give the Doctor Some Advice
- What Do Journals Look Like?

Demonstration: The Direction and Strength of Correlations

This memorable visual demonstration shows incremental changes in scatterplots associated with incremental changes in the strength and direction of correlations. The demonstration is simple, and there is not much to ask in relation to it, but it does allow students to control the size of the correlation (numerically) and thus produce the changes in the scatterplot.

http://www.stat.tamu.edu/~west/applets/rplot.html

Activity: Experimental Design

The overarching goals of the following exercise are to demonstrate how psychology and the scientific method can be used to address issues that interest your students, to teach them how the concepts they are learning influence experimental design, and to impress on them an appreciation for the challenges faced by experimental psychologists. Lead your class through the process of designing an experiment. Start with a hypothesis generated through brainstorming by the class. Allowing your students to provide the hypothesis ensures that it will interest them and that they will stay engaged. Students may start with topics such as alien abduction, crop circles, and the Loch Ness monster. Welcome this, as it gives you a terrific opportunity to talk about alternative explanations, existence proofs, and the fact that some topics, such as the proof of the existence of God, remain firmly outside the boundaries of science. The scientific method is not a panacea; it is a highly structured method for testing measurable factors and relationships. After your class has agreed on an issue to test, lead them toward a consensus and a testable hypothesis about the issue. Once your class has clearly defined a hypothesis, lead them through a discussion of possible alternative explanations. Challenge their hypothesis and their beliefs. Are there other possible explanations that are simpler and more likely? What assumptions and possible biases underlie their hypothesis? How would the hypothesis (and their assumptions and biases) generated by your class be different than explanations put forward by people from different cultures and different times? You might want to mention that spirit possession was a widely held explanation for mental illness until relatively recently. After listing a number of possible alternative explanations, allow your class to suggest a very basic methodology for testing the hypothesis and eliminating the alternative explanations. You might want to give them a head start by suggesting the kind of data that they would need to collect to measure the variables of interest. Depending on the hypothesis chosen and the sophistication of your class, outlining a reasonable experiment may be a difficult process. If the class begins to show signs of

overload, you can quickly switch gears and use the exercise to demonstrate the difficulty in designing and executing well-controlled experiments.

Demonstration: Equating Groups on Multiple Variables Using Randomization

An interesting demonstration of randomization is described in an article by Enders, Laurenceau, and Stuetzle, titled "Teaching Random Assignment: A Classroom Demonstration Using a Deck of Playing Cards." The article is published in *Teaching of Psychology*, (2006), volume 33, No. 4, pages 239–242. The authors describe a simple strategy in which students "randomly assign" cards to two groups. The two groups of card/subjects are then compared with respect to the frequency of specific characteristics such as the number of face cards, red cards, etc. This will help students see how random assignment helps equate groups on characteristics beyond those the experimenter has in mind. Two packs of cards may also be used.

Activity: Can Science Answer This Question?

Students are asked to identify whether specific questions can be addressed using the methods of science. The student handout is included as **Handout Master 2.1.** Suggested answers and explanations are listed below.

1. No. The question as stated is vague and the terms are not defined. What does "bad" mean? (Good and bad are value judgments.) Who or what is "society"? Bad for whom? However, specific correlates and consequences of abortion can be studied.
2. Yes. The independent variable would be "before or after eating" and the dependent variable would be talkativeness, which could be operationally defined (e.g., as the length of replies to questions).
3. Yes, so long as the variables are operationally defined. The independent variable would be jogging versus not jogging (or perhaps the frequency or duration of jogging); the dependent variable would be some measure of mental attitude, such as scores on a psychological test.
4. Yes. This question requires only the computation of a correlation between doctors' GPAs in medical school and their subsequent incomes. Such variables as "years in practice" would have to be controlled and a representative sample would have to be selected.
5. No, probably not; it would be a little like comparing apples and oranges. Physiological measures of emotional strength would not be useful because there is not always a relationship between physiological arousal and subjective experience, and because love tends to be a more enduring emotion than anger.
6. Yes. The independent variable would be "bottle-fed versus breast-fed." The dependent variable would be alertness, which would have to be operationally defined in behavioural terms. If babies were randomly assigned to the two groups, the study would be an experiment. If the researcher used babies whose mothers had already made the decision about feeding method, the study would be correlational, and inferences about cause and effect could not be made.
7. No. "Moral" is a broad, vague term that means different things to different people. Moreover, many unanticipated economic, political, and social developments could affect the outcome. Even if "moral" could be defined adequately, and projections from current trends and conditions could be made, the results might turn out to be meaningless, because definitions of morality change over time. What is "moral" in the 1990s might not be moral in 2020, and vice versa.
8. No. The subjects would be very uncooperative!

Assignment: Observational Research in the Dining Hall

Koschmann and Wesp (2001) provide several research activities for observational research, correlational research, and experimental research. One way to introduce students to research methods is to allow them to become more cognizant of their everyday surroundings and fellow classmates' behaviours. Koschmann and Wesp suggest that the college or university dining hall is an excellent "laboratory" to observe human behaviour. Merely ask students to observe others during meals in the cafeteria, such as seat selection or food choices. You might encourage student research teams to decide which behaviours they wish to observe. Ask students to record their observations, maintain confidentiality, and "debrief" anyone who asked them what they were doing. During the next scheduled class, ask students to share their findings and to generate discussion about potential hypotheses that may provide a better understanding of the behaviours they observed.

Koschmann, N. & Wesp, R. (2001). Using a dining facility as an introductory psychology research laboratory. *Teaching of Psychology*, *28*, 105–108.

Assignment: Naturalistic Observation

Objective: To collect data on spatial relationships
Materials: None
Procedure: Assign students to small groups of four or five individuals. Ask each to collect data on personal space in two distinct social situations, perhaps the student union building or other public areas on campus and a situation such as a party, a bar, or another area where individuals are talking. Ask the students to estimate the distance that individuals stand apart when they talk in this public area, noting any differences between same sex and opposite sex individuals. Encourage students to be creative in their data collection; for example, they could approach the participants with a metrestick, or they could count the number of tiles on the floor. Students will come up with their own ideas on the best methods of data collection. When students bring their data to class, summarize each group's findings in terms of the mean distances individuals stand apart while talking and put the results on the overhead or chalkboard. Break out the data by sex and situation. Discuss any problems the students encountered with this type of data collection.

Activity: Understanding Correlations

This exercise on correlations can be used as a classroom demonstration or as a take-home assignment following a lecture on the nature and uses of correlations. The student handout for this exercise is included as **Handout Master 2.2.** Suggested answers are provided below; however, there are other reasonable explanations.

1. *Positive*. Mutual influence. Similar life experiences.
2. *Negative*. Orphanage environment has an adverse effect on cognitive development. Intelligent children are more likely to be adopted.
3. *Positive*. Violent pornography stimulates violent behaviour. Both the violent crime and the number of stores are related to the size of cities. Violent criminals are attracted to violent pornography.
4. *Negative*. Absent students miss pearls of wisdom from the mouth of the instructor. Students with jobs or other responsibilities find it difficult both to get to class and to find time to study.
5. *Positive*. The money appropriated to control crime was poorly spent. The city grew during the eight years, resulting in more crime and more tax revenues.
6. *Positive*. Both variables are related to socioeconomic factors; children from affluent homes have both intellectual and physical advantages over children from substandard home environments. Age is the third variable that accounts for scores on both variables; older children have bigger vocabularies and are also stronger and better coordinated.

Activity: Correlational and Experimental Research

Many students have difficulty understanding the difference between correlational research and experimental research. It might be useful to walk the class through an example where both kinds of research are illustrated with the same variables. Two examples that could be used this way are the relationship between violent television viewing and aggression, and the relationship between similarity and liking. In both examples either variable could plausibly be caused by the other (or by some third factor); so the step up from correlational to experimental research, where causality can be determined, can be seen as useful. Spend some time discussing how psychologists must be ingenious to turn concepts such as "liking" into measurable variables (this will help students appreciate the scientific process). As examples, you can present actual studies that have been done in these two areas. Byrne (1971) discusses extensive research on the influence of similarity on attraction, and Liebert and Sprafkin (1988) discuss the effects of television on children.

Byrne, D. (1971). *The Attraction Paradigm.* New York: Academic Press.

Liebert, R., & Sprafkin, J. (1988). *The Early Window: Effects of Television on Children and Youth.* New York: Pergamon Press.

Activity: Testing Random Assignment (Group activity)

Students are often distrustful of random assignment, thinking that the people with the best memory or the worst sense of smell will all end up in the same group and make the results of research undependable. This demonstration is designed to show that random assignment does produce equivalent groups.

Provide students with small cards and have them record their height in inches on the card. If the class is small, ask them to record the height of their best friend on a second card. Collect the cards and then randomly assign them to several groups of 20. Have students calculate means for the groups.

The means should be quite close, illustrating that random assignment has produced equivalent groups. You might also explain that random assignment is not infallible and can be a source of experimental error.

This activity can be extended by using groups of different sizes, such as 2, 5, 10, 20, and 50, to show that the probability of getting groups that are not equivalent decreases as group size increases.

Activity: Small Samples

Objective: To discover if small samples can really be representative
Materials: A coin, copies of the chart in **Handout Master 2.3**
Procedure: Sometimes students have a hard time believing that 1,000 people or so can represent the entire population of Canada. This activity will help them see that small samples can be representative. Divide students into small groups and instruct them as follows:

Point out to students that, as *n* gets bigger, the more balanced the percentage of heads and tails becomes. However, they should notice too that *n*=20 isn't much better than *n*=15. And it took a lot longer to collect 5 samples of 20 coin tosses each. In other words, there wasn't much gain in representativeness for the extra cost in time and energy. So, small samples can be representative, and increasing the size of a sample doesn't always pay off when costs are balanced against benefits.

Activity: Which Method Would You Use?

The following examples can be used to generate a class discussion on the research methods used by psychologists. Write the methods on the board: case histories, naturalistic observation, laboratory observation, surveys, tests, correlational studies, and experiments. Then, for each situation, ask students to decide which method is appropriate and briefly describe why.

1. Determining the favourite food of adolescents. Method: Survey
   Explanation: Adolescents constitute a large population and the information sought should be accessible through questionnaires or interviews. Care will be needed to construct a sample that is representative of the population under consideration.
2. Determining whether a person is introverted or extroverted. Method: Psychological test
   Explanation: The goal is to measure psychological qualities within an individual. Other methods (e.g., case history, naturalistic observation) might be employed, but they are more time-consuming and do not offer the degree of standardization, reliability, and validity found in a well-constructed test.
3. Determining if frustration causes aggression.
   Method: Experiment
   Explanation: Cause-and-effect information is being sought. In science this information is obtained through experimentation in which the proposed causal variable is manipulated under controlled conditions.

4. Determining if level of education is associated with crime.
   Method: Correlation
   Explanation: This technique is used to determine if and how strongly two variables are related. Establishing that a correlation exists, however, does not address the problem of why two things are related.
5. Determining how teenagers behave on their first date. Method: Naturalistic observation
   Explanation: A description of behaviour as it occurs in a real-life situation is being sought. Making the observations without arousing suspicion in subjects could be problematic, and the investigator will need to be careful to prevent "guinea-pig" reaction.
6. Determining the behaviour of subjects who are anxious about participating in research. Method: Laboratory observation
   Explanation: The goal here can be readily achieved within an environment artificially set up by the experimenter. The advantage of this approach is that the investigator has greater control over the situation being studied.
7. Determining why a housewife gave up a flourishing career. Method: Case history
   Explanation: Making this determination requires in-depth information about the way a variety of psychological factors, expectations, values, motives, past experiences, and so forth, blend together within the person. This kind of information is unique to the person and could not be assessed through standardized tests.

Activity: Name That Research Method

In this exercise, students are asked to match brief descriptions of research with the name of the method being used. Copy **Handout Master 2.4** and distribute to students as a basis for this exercise. Answers: 1-c, 2-a, 3-e, 4-f, 5-d, 6-b.

Activity: Give the Doctor Some Advice

This exercise describes research on the effects of drinking and driving. However, this study is flawed and students are asked to suggest ways to correct the errors. Copy **Handout Master 2.5** and distribute to students as a basis for this exercise.

Suggested answers:
1. e
2. Possible confounding variables:
   The vodka and the placebo should be mixed in equal amounts of orange juice.
   Subjects should be chosen randomly and also assigned randomly to the different groups. (The same amount of alcohol affects males and females differently.)
   The researcher should not select friends, colleagues, or his own students as the subjects for this research, or any research, because of possible experimenter expectancy and demand characteristics.
   The subjects should participate at the same time of day since their last meal can determine how potent the effects of alcohol can be.
   Informed consent should be obtained before the research, not after.

Given these many possible confounding variables, Dr. Moesteller should be more cautious in his conclusions.

Activity: What Do Journals Look Like?

Scientific journals and peer review are essential to the field, but even after they are fully described, may seem remote and abstract to students (especially when they have just entered college). Bring relatively recent journal issues to the class, pass them around and ask students to examine the tables of contents for articles that address issues that seem personally interesting to them; ask them to read the titles out loud to the class. Journals from the Association for Psychological Science are excellent for this exercise because they address diverse issues in psychology. The exercise is useful for demonstrating that psychological journals present findings that are of wide relevance and interest.

▼HANDOUT MASTERS

- Handout Master 2.1: Can Science Answer This Question?
- Handout Master 2.2: Critical Thinking Exercise: Understanding Correlations
- Handout Master 2.3: Small Samples
- Handout Master 2.4: Name That Research Method
- Handout Master 2.5: Give the Doctor Some Advice

Handout Master 2.1

Can Science Answer This Question?

Psychology is an empirical science; that is, its knowledge is obtained through observation, experimentation, and measurement. Some questions cannot be answered empirically and are, therefore, outside the realm of science.

Decide whether scientific research can answer the questions below and respond "yes" or "no" to each question. Do not try to answer the question itself. Just say whether or not scientific research can, in principle, address the question. Briefly explain why each question is, or is not, a good candidate for scientific inquiry.

For the questions that can be studied scientifically, identify what the independent and dependent variables would be in the experiment.

1. Is abortion on demand bad for society?

2. Do people talk more after they have eaten than they do when they are hungry?

3. Does jogging lead to a positive mental attitude?

4. Are the incomes of doctors related to the grades they make in medical school?

5. Which emotion is stronger, love or anger?

6. Are breast-fed babies more alert than bottle-fed babies?

7. Will people be more moral in the year 2020 than they are now?

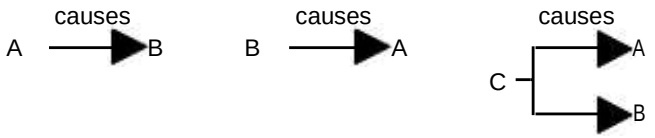
8. Are people who commit suicide sorry after they have done it?

Handout Master 2.2

Critical Thinking Exercise: Understanding Correlations

Correlational studies show relationships between variables. If high scores on one variable predict high scores on the other variable, the correlation is *positive*. If high scores on one variable predict low scores on the other variable, the correlation is *negative*.

Showing that two variables are related does not justify claiming that a causal relationship exists. There may be a causal relationship, but other explanations usually exist. For example, the variables may be related because both have a causal relationship with a third variable.



For each of the correlational studies described below, decide whether the correlation is positive or negative and give two alternative explanations for each finding.

1. A study of married couples showed that the longer they had been married, the more similar their opinions on social and political issues were.
   Positive or negative?

   Explanation 1:

   Explanation 2:

2. An intelligence test was given to all the children in an orphanage. The results showed that the longer children had lived in the orphanage, the lower their IQ scores.
   Positive or negative?

   Explanation 1:

   Explanation 2:

3. In a study of Canadain cities, a relationship was found between the number of violent crimes and the number of stores selling violence-depicting pornography.
   Positive or negative?

   Explanation 1:

   Explanation 2:

4. A college professor found that the more class absences students have, the lower their grade in the course tends to be.
   Positive or negative?

   Explanation 1:

   Explanation 2:

5. A politician running against a candidate who had been in office for eight years pointed out that violent crime had increased steadily during those eight years even though the administration appropriated more and more money to fight crime.
   Positive or negative?

   Explanation 1:

   Explanation 2:

6. It was found that elementary-school children who made high scores on a vocabulary test also tended to make high scores on a test of physical strength and muscular coordination.
   Positive or negative?

   Explanation 1:

   Explanation 2:

Handout Master 2.3

Small Samples

You probably know that when you flip a coin, the chance of getting a head or a tail is 50%. But this probability is based on an infinite number of coin tosses. But how well does tossing the coin twice represent the whole population of tosses, or the infinite number of tosses? If a sample of 2 tosses, or n=2 as a statistician would express it, doesn't represent the population, what about a sample of 5 or 10 or 15 or 20? To answer these questions, you have to take repeated samples of the same size. Toss a coin twice (n=2), and then write the number of heads and tails in the column labeled #1. Repeat the process four more times, recording your results the second time under #2, the third time under #3 and so on until you have a total of five samples, each of which consists of two coin tosses. When the n=2 row is completely filled in, calculate the overall percentage of heads and tails. Now use the same process to collect data on samples of n=5, n=10, n=15, and n=20.

Sample size	Toss #1		Toss #2		Toss #3		Toss #4		Toss #5		Overall %	
	H	T	H	T	H	T	H	T	H	T	H	T
n=2												
n=5												
n=10												
n=15												
n=20												

Handout Master 2.4

Name That Research Method

Here are the major research methods used by psychologists. Match each with one of the following examples of research.

a. case history
b. naturalistic observation
c. laboratory observation
d. survey
e. psychological tests
f. experiment

1. Frank is a full professor who is interested in the factors that affect the performance of rats who are learning to find their way through a complex maze. Every afternoon he gives each of his 50 rats ten trials in the maze, counting the number of wrong turns each rat makes on its way through the maze.

2. Ben is counselling with Fennimore Jones in a small room in the neuropsychiatric hospital. Ben is a graduate student in clinical psychology and Fennimore is his client. Fennimore was admitted to the neuropsychiatric hospital when he came to the student health clinic complaining that he hears voices shouting obscenities at him, and confiding that he thinks he is going through a spontaneous sex change. After each session with Fennimore, Ben writes a report describing Fennimore's verbal and nonverbal behaviour and his interpretations of the behaviour.

3. Carl is a graduate student who plans to become a psychometrician. He, like Ben, is working at the neuropsychiatric hospital. His job is to administer a battery of tests to new patients. He will send the test results, along with his summary and interpretation of them, to the patient's clinical psychologist or psychiatrist.

4. Ada is testing the hypothesis that colour preference can be influenced by associating a colour with a pleasant experience, such as eating. This afternoon she is delivering a supply of red, yellow, blue, green, and white nursing bottles to the mothers of newborns who have consented to let their infants be subjects in her research.

5. Dee is an assistant professor who will teach introductory psychology for the first time next term. She has chosen some films to show to her class of more than 200 students, and is now preparing a questionnaire to administer to her students after each film. She thinks getting student reactions to the films will be helpful next time she teaches the class.

6. Ed is an undergraduate psychology major. For his senior thesis he is investigating the nature of the audience for pornography. This afternoon he is sitting in his car across the street from one of the pornographic bookstores in the area. He is taking notes on the sex, approximate age, and ethnicity of the patrons as they enter and leave the store.

Handout Master 2.5

Give the Doctor Some Advice

Dr. Moesteller has long been interested in the effects of alcohol on human behaviour. His latest experiment involved giving college students one of three kinds of drinks:

3 oz. of 100 proof vodka mixed with a standard size glass of orange juice,
2 oz. of 100 proof vodka mixed with a small glass of orange juice, or
3 oz. of a nonalcoholic but vodka-flavored substance mixed with a standard size glass of orange juice.

Dr. Moesteller recruited some of his subjects from the school's track team, which was easy because he is the assistant coach. He recruited the rest of his subjects from his introductory psychology class. Dr. Moesteller assigned the women on the track team to the 2 oz. vodka group, the men from his class to the 3 oz. vodka group, and the women from his class to the nonalcoholic group.

The women on the track team participated right after they finished practicing, and students from his class participated at various times during the day. After each group had a chance to drink the beverage, he had them sit in an automobile simulator where their task was to step on the brake every time they saw a red light.

Much to his surprise, the 2 oz. group showed slower reaction times to the red light than the 3 oz. group. The nonalcoholic group was the quickest to react. As soon as the experiment was over, he explained to the subjects the true purpose of the experiment and had them sign an informed consent form. From his analysis of the results, Dr. Moesteller concluded that drinking alcoholic beverages can slow reaction time for braking in college students who drive after drinking.

1. Based on his experiment, was Dr. Moesteller's conclusion correct?
   a. No, because he did not randomly select his subjects.
   b. No, because he knew some of his subjects better than others.
   c. Yes, because subjects in both experimental groups had slower reaction times than the control group.
   d. Yes, because his results agree with what we all know from our experience with those who drink and drive.
   e. No, because there were too many confounding variables in his experiment, including both a and b.

2. On the other side of this page, give Dr. Moesteller some advice on how he might improve his research on drinking.

WEB RESOURCES

Simeon's Cave of Magic and the Confirmation Bias: http://www.caveofmagic.com/pickcrd2.htm
Discovering Psychology Episode on Decision Making:
http://www.learner.org/discoveringpsychology/11/e11expand.html#
Correlation Is Not Causation: http://www.msnbc.msn.com/id/19918336/
APA Code of Ethics: http://www.apa.org/ethics/code/index.aspx
CPA – Canadian Psychological Association: http://www.cpa.ca/
Information about the CPA and links to other sites
Ethics and Animal Experimentation: http://www.apa.org/science/leadership/care/index.aspx
A History of Ethical Abuses:
http://www.democracynow.org/article.pl?sid=07/01/19/1432231&mode=thread&tid=25
Rice Virtual Lab in Statistics: http://onlinestatbook.com/rvls.html
VassarStats: http://vassarstats.net/
The Practical Significance of Statistical Significance:
http://www.nytimes.com/2007/09/26/business/26leonhardt.html?_r=1&oref=login
Illusion and Statistical Analysis: http://www.npr.org/templates/story/story.php?storyId=1010470
Oscar the "Deathcat": http://www.youtube.com/watch?v=9cqiylGLAvg

Research Design

Simeon's Cave of Magic and the Confirmation Bias: http://www.caveofmagic.com/pickcrd2.htm
This site presents an amusing and effective example of the confirmation bias, briefly mentioned again in this chapter. In this magic trick, participants pick a card from six, are asked to memorize it and then are shown a second array with their card magically "deleted." The trick works because of confirmation bias; in fact, all of the cards are different, but participants notice only that the card they selected has been deleted. Ask students to figure out how the trick is done.

Discovering Psychology Episode on Decision Making:
http://www.learner.org/discoveringpsychology/11/e11expand.html#
The first 10 minutes of this video features an interview Nobel Prize winner Daniel Kahneman and the late Amos Tversky as they discuss the availability and representativeness heuristics.

Correlation Is Not Causation: http://www.msnbc.msn.com/id/19918336/
Recently, researchers reported that drinking sodas, even diet ones, is related to heart disease and diabetes; some possibilities are suggested in the news story from MSNBC. Students may write a brief paper generating additional possible causal mechanisms underlying this surprising correlation and describing how this association could be investigated experimentally, including the independent and dependent variables, and what difficulties they might encounter creating a double-blind study and ensuring that the experiment is consistent with ethical guidelines.

Ethics

APA Code of Ethics: http://www.apa.org/ethics/code/index.aspx
American Psychological Association's Ethical Principles of Psychologists and Code of Conduct. Your students may be required to participate in experiments as part of their introductory course. Introduce them to this website either at the start of the semester (to allay their fears about participating in studies) or at the end (as a "wrap-up" paper comparing their research experiences with the ethical guidelines stated by APA).

Ethics and Animal Experimentation: http://www.apa.org/science/leadership/care/index.aspx
Read arguments for the importance of animal research for promoting the understanding and welfare of human beings.
The Committee on Animal Research and Ethics (CARE) has produced two videos on the importance of animal research. The first describes research in sensation and perception; the second describes research on pharmacology. Descriptions of the videos may be found at http://www.apa.org/research/responsible/care-video.aspx. They may be ordered through the APA order department: order@apa.org.

A History of Ethical Abuses:
http://www.democracynow.org/article.pl?sid=07/01/19/1432231&mode=thread&tid=25
This interview is a follow -up to the description of the Tuskegee Study presented in the text. In the interview, scholar Harriet Washington is interviewed about her book *Medical Apartheid: The Dark History of Medical Experimentation on Black Americans from Colonial Times to the Present*. The book examines the unethical treatment and abuses of African Americans by the medical establishment. The interview is available in transcript, audio, and video versions.

Research/Statistics

Rice Virtual Lab in Statistics: http://onlinestatbook.com/rvls.html
Includes links to an online statistics textbook, simulations and demonstrations, case studies, and basic statistical analysis tools.

VassarStats: http://vassarstats.net/
Richard Lowry from Vassar College maintains this excellent site for statistical calculations.

The Practical Significance of Statistical Significance:
http://www.nytimes.com/2007/09/26/business/26leonhardt.html? _r=1&oref=login
http://itre.cis.upenn.edu/~myl/languagelog/archives/004969.html
This recent article from the *New York Times* (note: subscription required) describes the differences in overall happiness between men and women. But the critique by a University of Pennsylvania professor regarding the true size and meaning of the effects is well taken.

Illusion and Statistical Analysis
http://www.npr.org/templates/story/story.php?storyId=1010470
Psychological scientist Thomas Gilovich is interviewed during the first 10 minutes of this NPR show. The topic is the illusory "hot hand" in basketball, that is, the much-held belief in "streak shooting." This illusion illustrates well the importance of statistical analyses.

Oscar the "Deathcat"
http://www.youtube.com/watch?v=9cqiylGLAvg
The story was also covered in the news; a brief video clip is available.