Methods of Scientific Research

Chapter 2
Popular psychology topics: Myth or real?

- Most people use only 10% of their brain
- Expressing anger is better than holding it in
- Opposites attract in relationships
- High self-esteem is needed for good psychological health
- Listening to Mozart can make infants smarter
- A full moon can trigger wacky behavior
- Your first guess is the right one on a test
- Most people will have a mid-life crisis
- Handwriting can reveal personality traits
Pseudoscience

“Claims that appear to be scientific but that actually violate the criteria of science.”

“Claims exhibit superficial trappings of science but little of its substance” (Lilienfeld, 2004)

Examples?

- Crop circles, alien abductions, Big Foot, …
- What about… hypnosis for memory recovery, multiple personality disorder, Rorschach inkblot test, handwriting analysis, polygraphs…?

Scientific revolution (new paradigm/theory) or pseudoscience?

- Thomas Kuhn (1970)
- http://www.youtube.com/watch?v=GT3N0GiLyTQ&feature=related
Each has a different approach to evidence

Science seeks out contradictory evidence; and adds it into theory

Good or bad science, NOT good or bad scientist

No scientist is free of biases

But, can be aware of biases and try to control them

Pseudoscience beliefs are not foolish or stupid

Don’t be a critic just to be contrary

There are remarkable theories that appear to be true

Seek out the truth – require good research methods!

Do not confuse pseudoscience beliefs with religious beliefs

“Religious claims cannot be tested empirically so are outside the boundaries of science” (Lilienfeld, 2004)
Goals and Methods of science

- **Description or observation**
  - Describe by careful observation
  - Observational methods

- **Prediction**
  - Identify when event will occur and examine relationships
  - Correlational methods

- **Explanation**
  - Determine causes that determine when and why behavior occurs
  - Experimental methods
Descriptive method and vocabulary

- Three types:
  - Naturalistic vs. Laboratory observation
  - Case study method
  - Survey method

- Who is in the study?
  - Population vs. sample
  - Random sample

- Sampling methods

- Population
  - Quantity (count) = N
  - Mean = \( \mu \)
  - Variance = \( \sigma^2 \)
  - Standard deviation = \( \sigma \)

- Sample
  - Quantity (count) = n
  - Mean = \( \bar{x} \)
  - Variance = \( s^2 \)
  - Standard deviation = \( s \)
Naturalistic observation

- **Question:**
  - How polite are people at Wofford?

- **Hypothesis:**
  - Depends on the situation!

- **Method:**
  - Observe “door holding”
  - How would you score each observation?

- **Reactivity**
  - Is behavior changed b/c it’s being observed?

- **Observer bias**
  - Would your own background and beliefs potentially interfere with conclusions?
Example of an observational study


Examined strategies used by 52 mothers to prevent conflict with 3-year-olds

**Hypothesis**: Mothers of children with behavior problems would use fewer "positive" strategies to resolve conflict, and would use reactive rather than pre-emptive strategies

**Results**: Child conduct problems related to the type of strategy used by parent
Other Descriptive Designs

- Case study
  - Phineas Gage
  - http://www.youtube.com/watch?v=kc213mMSsjY

- Surveys
  - Questionnaires
  - Opinion surveys
  - http://ciser.cornell.edu/info/polls.shtml
Pros and cons: Descriptive research

- **Pros**
  - External validity: observing real life
  - Findings lead to new hypotheses

- **Cons**
  - Reactivity
  - Observer bias
  - Cannot determine causality
Correlational research

- **Scatterplot**: relationship between 2 quantitative variables
- How 1 variable relates to or influences another variable

Individual = dot (X and Y data point)
What type of relationship? Explain the findings.
Perfect correlations

\[ r = +1.0 \]

\[ r = -1.0 \]

Positive correlation

Negative correlation
Use it or Loose it!

- “Mental exercise keeps the brain healthy!”
- **Experiment**
  - Older adults randomly assigned to either mental exercise group or tv group
  - Examine # who develop AD
- **Correlational study**
  - Relationship between # cross word puzzles completed and Alzheimer’s Disease

![Graph showing correlation](image)

$r : +1.0 \text{ to } -1.0$

$r = 0.0 \text{ no relationship}$
Pros and cons: Correlational design

- **Pro**
  - Determine relationship between 2 variables
  - Predict future behavior

- **Con**
  - Correlation ≠ causation
    - “Children in homes with more appliances do better in school. So, appliances improve intelligence.”
    - “Teens involved in violent crimes play more violent video games. So, violent video games get kids involved in criminal behavior.”
  - Shoe size and intelligence
  - Beware of *third variables*!
The Mozart effect

- http://www.mozarteffect.com/
- http://www.amazon.com/Mozart-Sonata-Pianos-Schubert-Fantasia/dp/B000000
- http://www.youtube.com/watch?v=HhQn2qJhLCM

Listening to classical music will help you concentrate and become more creative by stimulating the right side of your brain.
The Mozart effect

- Research question:
  - Does classical music make you smarter?

- Hypothesis:
  - Classical music will increase IQ score.

- Possible methods:
  - Observation or survey
  - Correlation
  - Experiment
Experiment variables

- **Experiment**: variable(s) are manipulated.
- **Independent variable (IV)**
  - Manipulated by researcher
  - Conditions (e.g. groups)
    - Experimental (treatment) group
    - Control group
- **Dependent variable (DV)**
  - Observed or measured
Pennebaker & Francis (1996)

- Does writing about adjusting to college improve students’ grades?
- Participants in one group were asked to write about emotional events, the other was asked to write about superficial topics. Each wrote for 3 consecutive days for about 20min each day. The researchers obtained each participants’ records for number of visits to the health center and their GPA.

- What is the independent variable?
- What is the dependent variable?
- Results: Students that wrote about emotional events visited the health center less and had higher GPA compared to superficial writers.
Haden (1998)

- Do mothers talk to their younger children differently than they talk to their older children?
- Recorded conversations between mother and children (separately) regarding past family event. “Coded” conversation for the type of comments made (elaboration, repetition, etc). Compared conversations of younger and older children.
- What is the independent variable?
- What is the dependent variable?
- Results: Mothers were consistent across children.
Designing GOOD studies

- Try to control all variables
  - Uncontrolled = *confounding variables*

- Definition of the “construct”
  - Operational definition
    - Specific way construct is measured

- **Use** *random assignment*
  - Population: all individuals of interest
  - Sample: subset of whole group
Mozart effect

- If a study was conducted on the Mozart effect:
  - What would be the IV?
  - What would be the DV?
  - What would be the hypotheses?

- **IV**: type of sound prior to test (10min)
  - Mozart’s sonata for 2 pianos in D major, K488 I
  - Relaxation tape
  - Silence

- **DV**: spatial reasoning test score (“paper folding” test)
Rauscher, Shaw, & Ky (1993).

N = 36 college students
How to design a good study

- **Validity:**
  - Did you measure the intended construct?
  - Internal validity
    - Controlled confounding variables
  - External validity
    - Study can be generalized to other situations

- **Reliability:**
  - Get same results again?
  - Control expectancy effects
    - Placebo; Single-blind study; Double-blind study
Replication study!

**IV:** type of sound before test (10 min)
- Mozart’s sonata for 2 pianos in D major, K488 I
- Philip Glass’ (1973) “Music with changing parts”
  - [http://www.youtube.com/watch?v=OUQ_PD5mzPY](http://www.youtube.com/watch?v=OUQ_PD5mzPY)
- Silence

**DV:** Spatial reasoning test
- Same test: “Paper folding and cutting test”

**Procedure:**
- Paper folding pre-test (baseline)
- Random assignment to 1 IV (condition)
- 48hrs after pretest: 10min sound then test
Steele, Bass, & Crook (1999)

- **Pretest:**
  - grps not different

- **Posttest:**
  - grps **not** different

- **Conclusion:**
  - No support for “Mozart effect”

N = 125 (44; 42; 39 respectively)
“Mozart effect”

- What conclusion can be drawn from the Rauscher et al. (1993) study?
  - Spatial reasoning scores increase directly after listening to Mozart’s sonata

- What causes the “mozart effect”? What other variables need to be studied?
  - Other types of intelligence
  - Other types of music
  - Other age groups
  - Other person variables (gender, race, environ.)
**Conclusions about Experimental Method**

- **Goal of research**: Measure behavior to understand internal change or effect.

- **Experimental design**
  - Manipulate variables (IV), observe changes in another variable (DV).

- **Be a careful consumer of info**
  - Closely examine methodology
  - Closely examine conclusions
What is YOUR final conclusion about the Mozart effect?

What future studies need to be conducted?

What other variables should be controlled and how?

What are the pros/cons of each method (observational, correlational, experimental)?
Review 3 overall research methods

- Do pets reduce depression in older adults?
- Create your own study using the following methods.
  - Descriptive method
  - Correlational method
  - Experimental method