Methods of Scientific Research

Chapter 2
Experimental Research: p42 – 49

The Mozart effect

- Do you think listening to classical music can make you smarter?

- http://www.mozarteffect.com/
- http://www.amazon.com/Mozart-Sonata-Pianos-Schubert-Fantasia/dp/B0000CF330
- 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.

Mozart effect

What is science?
**Scientific Method**

“Test our ideas objectively and systematically”
1. Need clear, specific question
2. Need testable *hypothesis*
3. Need **reliable** method to test hypothesis
4. Gather *data*
5. Summarize and evaluate data
   Which supports or does not support hypothesis
   *(we do **not prove** anything!)*
6. Replicate results

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**The Scientific Method Circle**

- **Form Hypothesis** *(from theory, model, or observations)*
  - What does it predict in various situations?
  - What do your findings mean to the big picture?
- Design study to test hypothesis: \( H_1 \text{ vs } H_0 \)
  - Eliminate confounding variables.
  - What do your data imply about your hypothesis?
  - What conclusion(s) do your data compel?
  - Data collection is done.
  - Conduct study

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**The Mozart effect**

- **Question:**
  1. Does classical music make you smarter?
- **Hypothesis:**
  1. Classical music will increase IQ score.
- **Possible methods:**
  1. Observation or survey
  2. Correlation
  3. Experiment

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**Experiment variables**

- **Experiments:** variable(s) are manipulated.
- **Independent variable (IV)**
  1. Manipulated by researcher
  2. Conditions (e.g. groups)
    1. Experimental (treatment) group
    2. Control group
- **Dependent variable (DV)**
  1. 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 between children.
- What type of study is it?
- What is the independent variable?
- What is the dependent variable?
- 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 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 (10 min)
  - Mozart’s sonata for 2 pianos in D major, K488 I
  - Relaxation tape
  - Silence
- **DV**: spatial reasoning test score (“paper folding” test)

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

Rauscher, Shaw, & Ky (1993).


- **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”
    - [YouTube Video](http://www.youtube.com/watch?v=OUQk9D6bP7Y)
  - 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?
  - Do spatial reasoning scores always increase directly after listening to Mozart’s sonata?
- What causes the “Mozart effect”? Is it real? 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 change or effect of IV
- Experimental design
  - Manipulate variables (IV), observe changes in another variable (DV)
- Be a careful consumer of info
  - Closely examine methodology
  - Closely examine conclusions

Methods of Scientific Research

Other designs: p30-42
Ethics of research: p50-52
Research Designs

- Experimental design
  - IV, DV
- Descriptive design
  - Naturalistic observation
  - Single-case design
  - Survey method & tests
- Correlational design
  - Observe 2 variables to see relationship

Descriptive research: Example of 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

Naturalistic observation

- Question:
  - How polite are people at Wofford?
- Hypothesis:
  - Depends on the situation!
- Method:
  - Observe “door holding”
  - How would you score each observation?
- Observer bias
  - Would your own background and beliefs potentially interfere with conclusions?

Other Descriptive Designs

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

- Surveys
  - Questionnaires
  - Opinion surveys
  - [http://ciser.cornell.edu/info/polls.shtml](http://ciser.cornell.edu/info/polls.shtml)
Correlational design

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

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

Correlation ≠ causation

- Shoe size and intelligence
- Storks and babies
  - “...Higher grades directly corresponded to a more positive (student) evaluation.”
- Beware of those confounding variables!

Ethics: Study requirements

- IRB: Institutional review board
  - Application to conduct research
  - Goal: protect humans and animals
    - IACUC – institutional animal care and use committee
- Informed consent
  - What research entails
  - Risks
  - Participants’ Rights
  - Experimenter’s rights
- Debriefing
  - Fully explain study – why completed
  - Remove any harmful effects, misconceptions
Kassin & Kiechel (1996): False confessions

- Would you falsely confess to a crime you didn’t commit?
- HYP: If under stress more likely to falsely confess
- Study: Type with confederate, told not to press “alt” key or computer will crash
- Conditions:
  - Stress IV: fast-paced v. slow paced typing
  - Evidence IV: confederate “witnessed” v. didn’t see
- All denied at first. Asked to sign a “confession”.
- Findings:
  - 69% signed written confession
  - Fast & witness condition: 100% confessed
  - 65% of group really believed their confession

Ethics: Risk

- Risk v. Benefit Ratio
  - Are benefits greater than the risks?
  - Will valid results be produced?
- What is “risk”?
  - Depends on participants/subjects
- Physical risks
- Psychological risks
  - Embarrassment, stress, confidentiality
- “Minimal risk”: same as daily life

Consider

- Pretend that you would like to replicate the false confessions study by Kassin and Kiechel (1996).
- What are the risks to participants?
- What are the benefits?
- Would the study get IRB approval?

Reference in APA format

- Author last name, first initial (year). Title of paper. Name of Journal, volume, page numbers.
- Use the references at the end of your article or at the end of your textbook as examples of APA style references.
How to read an empirical journal article (see handout)

- Structure of article: Abstract, introduction, methods, results, discussion, references, figures.
- Know what each section contains
- Order of reading (see handout!)
- Be able to answer the following:
  - What are the variables?
  - What is the main research question?
  - What is the take-home message?

Methods of Scientific Research

Introduction to Statistics

- Numbers in a context
- Statistics help answer questions
  - Beat anecdotes
- Statistics condense information
  - Averages, charts, graphs, etc!
- Conclusions are not certain
  - "Lies, damned lies, and statistics"MTwain
- Descriptive v. inferential statistics

Descriptive statistics

- A statistical measure that identifies a single value as a summary of an entire distribution
- Three measures of central tendency
  - Mean
  - Median
  - Mode
Graphs!

Death Rates in America

Perfect correlations

Validation

- Validity – whether it is a “good” study
- External validity: extent results generalize to other situations
- Internal validity: extent study has controlled for confounding variables
- Measures
  - Does it measure the intended construct?
  - Is it “realistic” – close to reality?

Error and Bias

- Control by using sound experimental design
- Observer bias
  - Own background and beliefs effect conclusions
- Single-blind design
  - Participant doesn’t know what group assigned to
- Double-blind design
  - Participant and observer aren’t aware of group status