Research, research!

Psych 454 - Clinical Psychology

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Why Research?

Why do I need to know statistics, research design if I want to treat patients?

- PhD degree is a research degree
  - MSW, MFT, PsyD are clinical degrees
  - similar to MD, JD
- Even clinicians need to have research skills to be effective clinicians
  - Evaluate other's research to inform "best practice"

Types of Research

- Experimental research
  - randomization
  - "experimental" manipulation
- Non-experimental research
  - non-random assignment
  - observational

Issues related to Experiments

- Independent Variable
  - Variable that is manipulated by researcher.
  - What you are "really" interested in.
- Dependent Variable
  - Variable that you actually measure.
  - Thought to be related to independent variable.

The effect of the *independent variable* on the *dependent variable.*

Issues related to Experiments

- Key point: random assignment.
  - Every subject has an equal and independent chance of being selected for inclusion in the study.
  - Every subject has an equal and independent chance of being selected for inclusion in either the experimental group(s) or control group(s).
- In reality
  - this rarely occurs
  - although all statistical procedures assume that it does.

Independent Variables and Dependent Variables: Weak Links

- Experimental error
  - Changes in the dependent variable are due to factors unrelated to the independent variable.
  - experimenter bias
    - double-blind designs
    - standardized protocols
- Reliability and Validity

Reliability

- Are you measuring the same thing every time?
- Has nothing to do with validity.
  - Measure "intelligence" by weighing someone's head.
  - Highly reliable, but …
- Usually measured by correlation coefficients of some type.

Validity

- Are you measuring what you think you are measuring?
- Internal validity
  - What's the link between the independent and dependent variable?
- External validity
  - What's the link between your study and the "real world?"

Threats to Internal Validity

- History
  - events outside the experimental condition influence the results of your study.
    - Studying anxiety in children in the SFV prior to November 1994 and after 1994.
- Maturation
  - changes occur in subjects over time that are unrelated to the experimental protocol yet influence the results of your study.
    - Studying the effects of diet on learning math concepts in 1st, 3rd, and 6th graders.

Threats to Internal Validity

- Testing
  - The act of measuring something affects the object being measured.
  - Particularly thorny issue in repeated-measures designs.
  - A problem with the *subjects*.
- Instrumentation
  - The materials you use to measure may not be appropriate for the object(s) being measured.
  - A problem with the *materials*.

Threats to Internal Validity

- Regression to the Mean
  - "Statistical Regression"
  - Subjects who score at the extremes at Time 1 tend to score closer to the mean at Time 2.
    - Regression to mediocrity
    - First observed by Gauss
  - *Statistical* problem; not a problem with subjects or measures.
- Selection Bias
  - Subjects were chosen for research through some systematic, rather than random, process.

Threats to Internal Validity

- Experimental Mortality
  - Non-random attrition of subjects over time in the study.
  - What was wrong with the subjects that left (no-showed for treatment #2, died?!)
- **If significant threats to internal validity are found, your results will be uninterpretable, no matter how eloquent your prose or sophisticated your statistics.**

External Validity - A Critical Balance

- To be meaningful, results from research studies should generalize to some "real world" issue.
- Problem:
  - Most laboratory experiments are highly artificial (low external validity).
  - Most real-world observational studies have hopelessly high levels of experimental error (low internal validity).
  - Need to balance external validity with internal validity.

Threats to External Validity

- Testing
  - The use of a measurement device may influence a subject's responses to subsequent item(s) or responses on additional surveys.
- Reactivity
  - Subjects may respond differently when aware that they are being studied.
  - Social desirability: very common in survey studies

Threats to External Validity

- Multiple-treatment interference
  - Also known as "confounding"
  - Was it the music? Was it the setting? Was it the compassionate interviewer? Was it the treatment? Who knows?
  - Technical definition:
    - Confounding occurs when all subjects are exposed to all levels of the independent variables in such a manner that the effects of individual variables are impossible to determine.

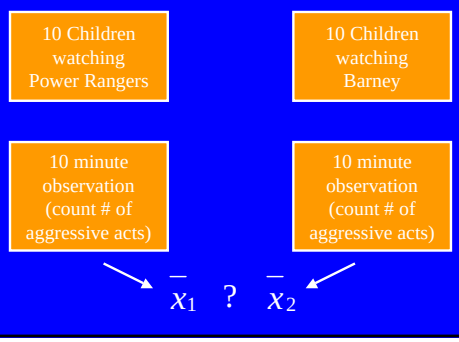
Threats to External Validity

- Interaction of selection biases
  - differential assignment of subjects to conditions
  - Executive Monkey Experiment
- Population characteristics

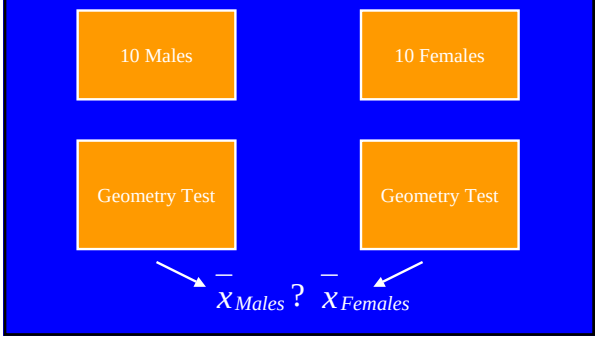
When Experiments Aren't Possible

- Quasi-Experimental Designs
  - Defining characteristic: Lack of random assignment.
  - Typically use some kind of approximately random sampling strategy.
  - Frequently use "wait-list controls"
  - Limit cause-effect conclusions.

Experimental Research Question



Non-Experimental Research Question



More Complicated Experimental Designs

- Between-Group Designs
- Within Group Designs (Repeated Measures)
- Mixed Group Designs
- Factorial Designs
- Analogue Designs

Definitions

- **Between-subjects designs**
  - different subjects serve in different treatment levels
- **Repeated-measures designs**
  - each subject receives all levels of at least one independent variable

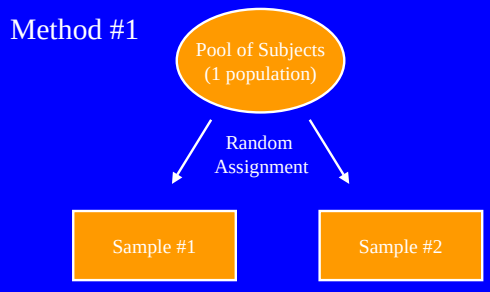
Between-subjects designs

CBT	RET	PA	WLC
10 subjs.	12 subjs.	15 subjs.	11 subjs.

- No subject gets more than one treatment
- No subject receives more than one level of an independent variable
- Different *N*'s in each cell are common.
- Treatments are often conducted at the same time (in parallel).

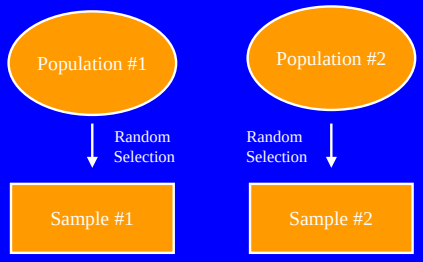
Between-Subjects Methods

Method #1

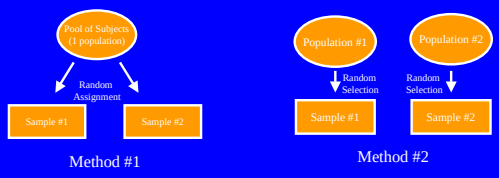


Between-Subjects Methods

Method #2



Statistically, these are the same.



Both are Between-subjects Designs

Definitions

- **Between-subjects designs**
  - different subjects serve in different treatment levels
- **Repeated-measures designs**
  - each subject receives all levels of at least one independent variable

Repeated-measures designs

Prelim 1	Prelim 2	Prelim 3	Final
10 subjs.	Same 10 subjs.	Same 10 subjs.	Same 10 subjs.

- All subjects get all treatments.
- All subjects receive all levels of the independent variable.
- Different *N*'s are unusual and cause problems.
- Treatments are usually carried out one after the other (in serial).

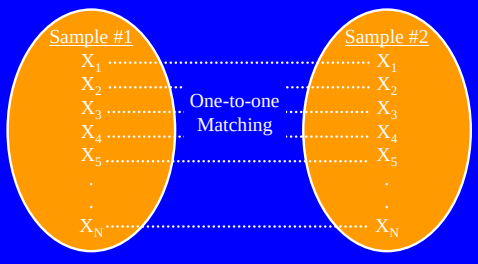
Repeated-Measures Methods

Method #1

The same people taking the pretest are those taking the post-test.

Repeated-Measures Methods

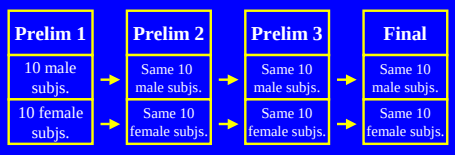
Method #2



Statistically, these are the same.

Both are Repeated-Measures

Mixed Designs



- Include aspects of both between-subjects and repeated-measures designs.

Factorial Designs

- Suppose we want to examine the efficacy of a school-based intervention for learning problems.
  - We might think that different AMOUNTS OF TIME OF INSTRUCTION would be influential, so we might compare 1hr/week vs. 4hrs/week.
  - We might think that SETTING OF INSTRUCTION would be influential, so we might compare pulling students out of class or keeping the student in class.

Factorial Designs

- Which approach should we use?
  - Should we use in-class 1hr vs. 4hr?
  - Should we use pull-out 1hr vs. 4hrs?
  - What about 1hr in-class vs. pull-out?
  - Or 4hrs in-class vs.. pull-out?
- With factorial designs, we don't have to decide. We can do it all.

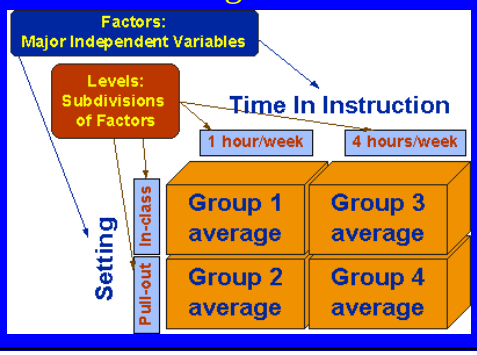
Factorial Designs: Definitions

- **Factor:** another word for an independent variable.
  - In our example, we have two factors:
    - TIME
    - SETTING
- **Level:** a subdivision (or value) of a factor.
  - In our example each factor has two levels.
    - TIME (1 vs. 4 hrs)
    - SETTING (in-class vs. pull-out)

Factorial Designs: Definitions

- SO, a Factorial Design is an experimental design in which every level of every factor is paired with every level of each other factor.
- We describe the numbers and levels of our factors systematically:
  - 2 x 2 factorial design indicates
    - We have TWO factors (the number of numbers)
    - Each factor has TWO levels (the value of the numbers)

Factorial Designs: Definitions



Other Examples

- A 2 x 5 ("Two by Five") factorial design:

	CBT	DT	RET	PA	WLC
Anxiety					
Depression					

Other Examples

- A 2 x 5 x 2 ("Two by Five by Two") factorial design:

	CBT	DT	RET	PA	WLC	
Anxiety						Males
Depression						

	CBT	DT	RET	PA	WLC	
Anxiety						Females
Depression						

Analogue Designs

- Studies are designed to "mirror real-life" conditions or characteristics.
  - Want to know what panic disorder looks like? Make people anxious.
  - Want to know what depression looks like? Make people sad.
- High internal validity.
- External validity?

Case Studies & Single Subject Designs

- In-depth study of a single individual or situation.
- Advantage: tells you about *a single person.*
- Case studies are becoming increasingly rare in PhD programs.
  - Training & exposure to case studies but
  - few opportunities to exercise skills.
  - Traditional medical model approach.

Case Studies & Single Subject Designs

- Single-Subject Designs
  - More frequently used than case studies, but still rarer than the experimental designs.
  - Used to monitor treatment results, plan additional interventions.
  - Designs
    - ABAB
      - Try something, withhold something, try something again, withhold something again.
      - Did it [something] work?

Case Studies & Single Subject Designs

  - Designs
    - ABAB
      - Try something, withhold something, try something again, withhold something again.
      - Did it [something] work?
    - Multiple Baseline Designs
      - Record baseline.
      - Try intervention at one site.
      - Record response.
      - Unethical to withhold intervention, record baseline at another site.
      - Try intervention at second site.
      - Record response.

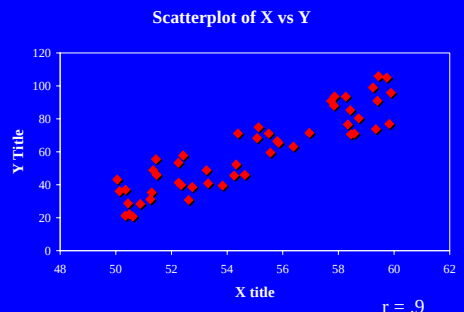
Correlational Studies

- Examine the degree of association between two or more variables.
- ***Correlation does not imply causation.***

Three kinds of correlations

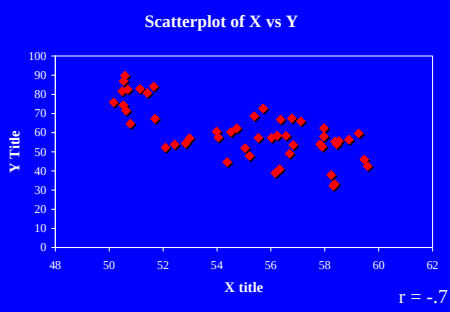
- Positive correlation
  - High values of X tend to be associated with high values of Y.
  - As X increases, Y increases
- Negative correlation
  - High values of X tend to be associated with low values of Y.
  - As X increases, Y decreases
- No correlation
  - No consistent tendency for values on Y to increase or decrease as X increases

Positive Correlation



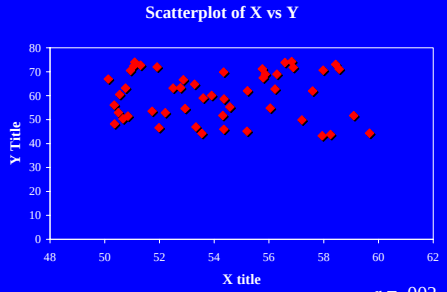
r = .9

Negative Correlation



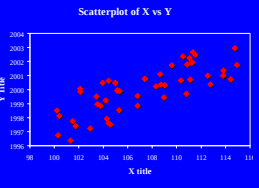
r = -.7

No Correlation

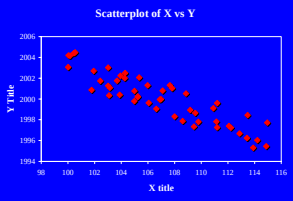


r = .002

Strong Correlations

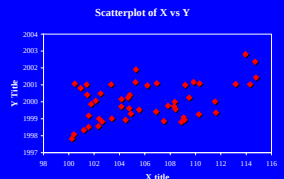


r = +.8

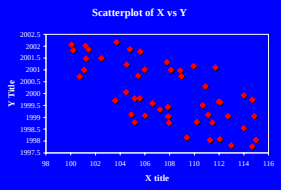


r = -.9

Moderate Correlations

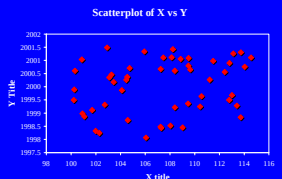


r = .44

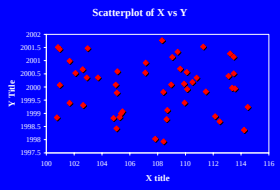


r = -.67

Low Correlations

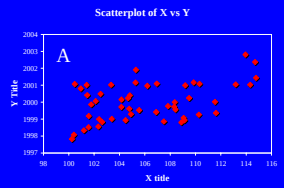


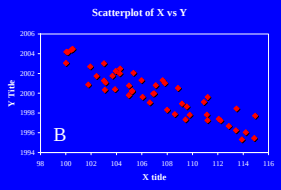
r = .22



r = -.07

Which of the two graphs has the stronger relationship?





Correlation Coefficients & Significance

- So you have a big correlation. Now what?
- In terms of magnitude, how big is big?

- Small correlations in large samples are "big."
- Large correlations in small samples aren't always "big."

But what does it MEAN?

- **Correlation does not imply causation!**
  - X can cause Y
  - Y can cause X
  - A third variable can cause X & Y
  - the relationship is due to chance