PSY 501: Sampling and Control

Week 7

Outline

Outline

Sampling

Experimental Control

Some poorly designed experiments

Sampling

- Why do we care about sampling methods?
  - Can't test everybody!
- **Population**: everybody that the research tries to make conclusions about
- **Sample**: the subset of the population that actually participates in the research.

Sampling

Goals:

- **Maximize**:
  - Representativeness: to what extent do the characteristics of those in the sample reflect those in the population?
- **Reduce**:
  - Bias: a systematic difference between those in the sample and those in the population

Sampling Methods

Type 1: Probability sampling

1. Simple random sampling
2. Systematic sampling
3. Stratified sampling

Type 2: Non-probability sampling

1. Convenience sampling
2. Quota sampling

Probability sampling

1. Simple random sampling – every individual has an equal and independent chance of being selected from the population

2. Systematic sampling – selecting every n^{th} person

3. Stratified sampling – identify groups, then randomly select from each group

Non-probability sampling

1. Convenience sampling – use the participants who are easy to get
2. Quota sampling – identify specific subgroups, then take from each group until desired number of individuals

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Experimental Control

Goal:

- to test how the variability in our IV affects our DV
- Control is used to minimize excessive variability
- Need to minimize possible **confounds**
  - if there are other variables that influence our DV, how do we know that the observed differences are due to our IV and not some other variable?

Experiment: Color and Words

1. Divide into two groups:
   - Men
   - Women
2. Instructions: Read aloud the COLOR that the words are presented in. When done, raise your hand.
3. Women go first...

List 1

Blue
Green
Red
Purple
Yellow
Green
Purple
Blue
Red
Yellow
Blue
Red
Green

Experiment: Color and Words

- Now it is time for the men to go...
- Remember, read aloud the COLOR that the words are presented in. When done, raise your hand
- Ready?

List 2

Blue
Green
Red
Purple
Yellow
Green
Purple
Blue
Red
Yellow
Blue
Red
Green

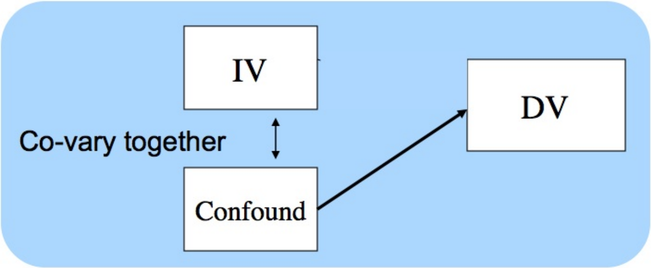
Our results

- So, why the difference between men and women?
- Is this support for a theory that proposes:
  - "Women are good color identifiers, men are not"
  - Why or why not? Let's look at the two lists.

List comparison

List comparison

- What resulted in our performance difference?
  - Our manipulated IV (men vs women)?
  - The other variable (match vs mismatch)?
- Because the two variables are perfectly correlated **we can't tell**
- This is the problem with **confounds**



List comparison

- What DIDN'T result in the performance differences?

- Extraneous variables
  - Control
    - # words on the list
    - The actual words that were printed
  - Random
    - Age of participants in groups
    - Majors, class level, seating in classroom, ...
- These are not confounds, because they do not <u>co-vary</u> with the IV

Experimental Control

Our goal:

- To test the possibility of a systematic relationship between the variability in our IV and how that affects the variability of our DV

A little math...

Total (T) variability can be expressed as follows:

$$T = NonRandom_{exp} + NonRandom_{other} + Random$$

- $NonRandom_{exp} \rightarrow$ variance due to manipulation in independent variables (IVs)
  - Our hypothesis is that changes in the IV will result in changes in the DV
- $NonRandom_{other} \rightarrow$ extraneous variables (EV) which covary with IV
  - other variables that also vary along with the changes in the IV, which may in turn influence changes in the DV
- $Random \rightarrow$ random variability
  - imprecision in manipulation (IV) and/or measurement (DV)
  - randomly varying extraneous variables (EV)

A little math...

Total (T) variability can be expressed as follows:

$$T = NR_{exp} + NR_{other} + R$$

- Our goal is to reduce R and NR_{other} so that we can **detect** NR_{exp}.
- That is, so we can see the changes in the DV that are <u>due to the changes in the IV</u>

A weight-based analogy

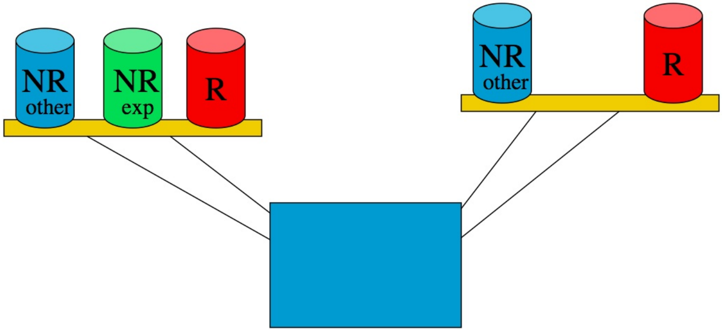
Imagine the different sources of variability as weights:

Treatment group

Control group

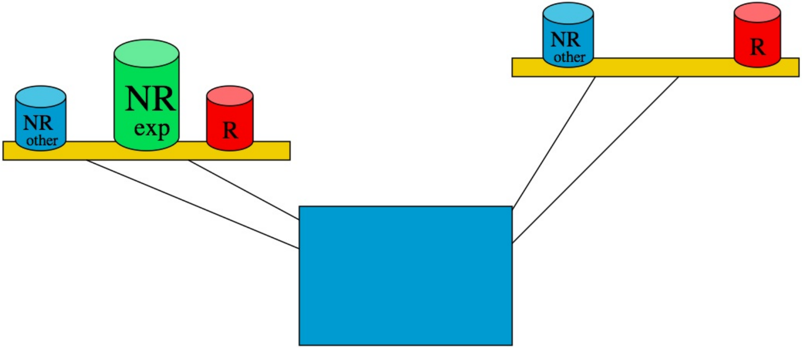
A weight-based analogy

If NR_{other} and R are **large** relative to NR_{exp}, then detecting a difference may be difficult.



A weight-based analogy

But if we reduce the size of NR_{other} and R relative to NR_{exp}, detecting the difference becomes **much** easier



Methods of Controlling Variability

1. Comparison
2. Production
3. Constancy/Randomization

Methods of Controlling Variability

Comparison:

- An experiment always makes a comparison, so it must have at least two groups
  - Control group + experimental (treatment) group
  - Groups $\rightarrow$ range of values of IV
    - e.g., low anxiety, moderate anxiety, high anxiety

Methods of Controlling Variability

Production:

- The experimenter selects specific values of the IVs
  - as opposed to allowing the levels to freely vary as in observation studies

- Need to do this carefully
  - Suppose that you don't find a difference in the DV across your different groups?
  - Is this because IV and DV aren't related?
  - Or, were your levels of IV not different enough?

Methods of Controlling Variability

Constancy/Randomization:

- If there is a variable that may be related to the DV that you can't (or don't want to) manipulate, then you should either
  - **hold it constant** across all experimental conditions
  - let it **vary randomly** across all experimental conditions

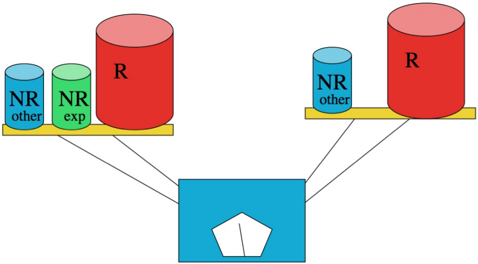
Potential Problems with Experimental Control

1. **Excessive random variability**
2. **Confounding**
3. **Dissimulation**

Potential Problems

Excessive random variability

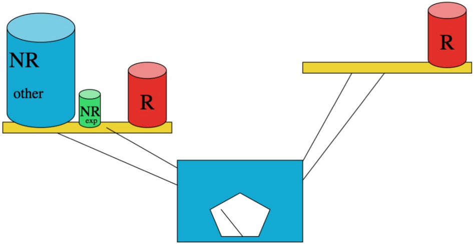
- If control procedures are not applied, then R component of data will be excessively large, and this may make NR_{exp} undetectable
- So, try to minimize this by using good measures of DV, good manipulations of IV, etc.



Potential Problems

Confounding

- If relevant EV covaries with IV, then *NR* component of data will be significantly large, and this may lead to misattribution of effect to IV
- Hard to detect the effect of NR_{exp} because the effect looks like it could be from NR_{exp}, but is really (mostly) due to NR_{other}



Potential Problems

Dissimulation

- If EV which interacts with IV is held constant, then effect of IV is known only for that level of EV, which may lead to overgeneralization of IV effect.
- Ex: Math students with high working memory capacity do worse in high pressure situations than in low pressure situations ("choking under pressure").
  - Generalization? – high pressure negatively affects math performance
  - BUT: Participants with low working memory capacity don't tend to choke!

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Poorly designed experiments

Example: Does standing close to somebody cause them to move?

- So, you stand closely to people and see how long before they move.

Poorly designed experiments

Example: Does standing close to somebody cause them to move?

- So, you stand closely to people and see how long before they move.
- Problem: no control group to establish the comparison group (this is sometimes called a "one-shot case study design")

Poorly designed experiments

Example: Does a relaxation program decrease the urge to smoke?

- One group pretest-posttest design
  1. Pretest (rate desire to smoke)
  2. Give treatment (relaxation program)
  3. Posttest (rate desire to smoke)

Poorly designed experiments

Example: Does a relaxation program decrease the urge to smoke?

- One group pretest-posttest design
  1. Pretest (rate desire to smoke)
  2. Give treatment (relaxation program)
  3. Posttest (rate desire to smoke)
- Problems include:
  - History
  - Maturation
  - Instrument decay
  - Statistical regression
  - Etc.

Poorly designed experiments

Example: Smoking example again, but with <u>two</u> groups. Subjects get to choose which group (relaxation or no treatment) to be in.

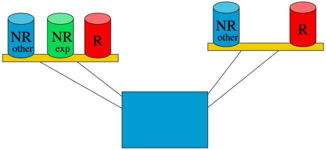
Poorly designed experiments

Example: Smoking example again, but with <u>two</u> groups. Subjects get to choose which group (relaxation or no treatment) to be in.

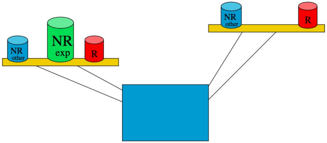
- Groups are likely not equal with respect to extraneous variables (selection bias)
- Need to do <u>random assignment to groups</u> to “average out” the non-experimental variance

The key to well-designed experiments

Which measurement scenario do you want as a scientist?



or



Regardless of the overall design (which we'll cover next week), you'll want to minimize (control) the extraneous variability in your experiment.

Thus, a well-designed experiment must include <u>random group assignment</u>.