Week 11 Lecture - Experimental Confounds

Undergraduate Research Methods in Psychology

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1 Chapter Overview

1.1 Learning Objectives

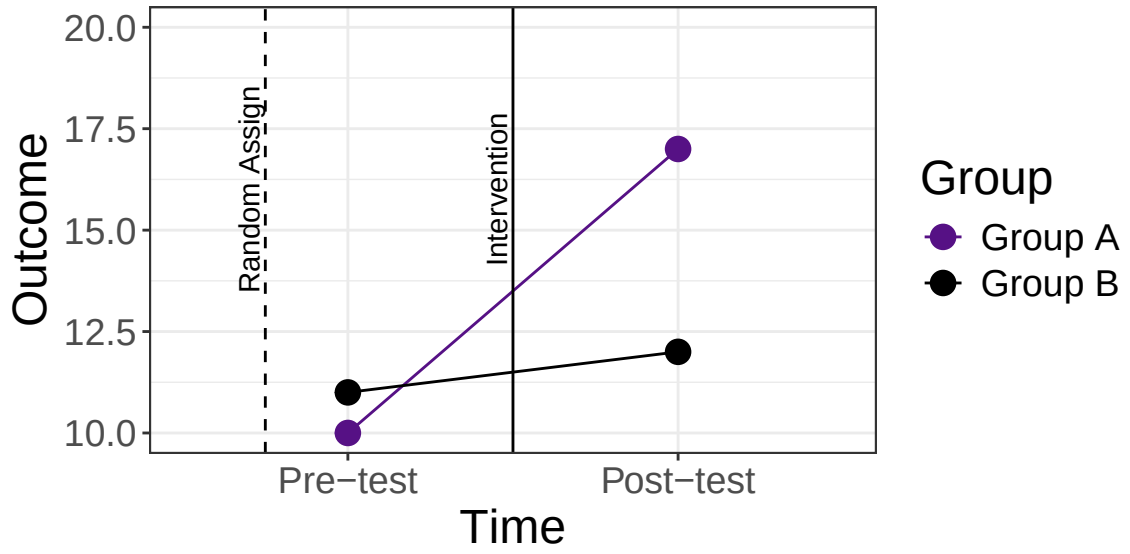
- Interrogate a study and decide whether it rules out twelve potential threats to internal validity.
- Describe how researchers can design studies to prevent internal validity threats.
- Interrogate an experiment with a null result to decide whether the study design obscured an effect or whether there is truly no effect to find.
- Describe how researchers can design studies to minimize possible obscuring factors.
- Describe the importance of comparison groups in ruling out threats to validity
- Explain an example for each type of validity threat

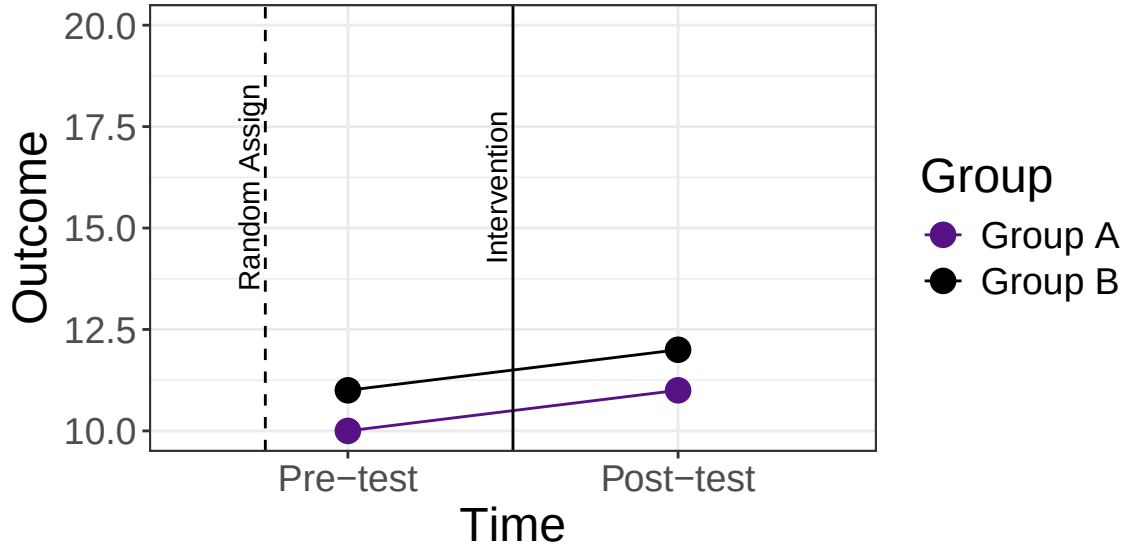
1.2 Chapter Overview

- Because of the _____ required to investigate causal claims, we must be cautious of a number of internal validity threats
- We may have to be especially mindful in our _____ in order to ensure our finding are “real”. Design flaws may manifest as third variables.
- Failure to design around these threats may lead to confounds in our _____ validity, and therefore, may hurt our claims

2 More Internal Validity Threats

2.1 Working Example





2.2 Overview

- We have already discussed _____ effects, design confounds, and order effects - as well as how they impact the _____-subjects and within-subjects designs differently
- These all result from a lack of random _____ not being implemented

Discuss: We used two different names for experiments based on whether the intervention was done on separate groups or the same groups - what were the names of those types?

- However, there are many other _____ to also be concerned with…

2.3 For One-group & Pretest/Posttest Designs

- Some threats are a particular concern in our _____-subjects designs:

2.3.1 Maturation

- Certain behaviors may simply _____ by themselves - we may describe this change as being "spontaneous" and unexpected
- This is change that is _____ explainable by our intervention or lack-thereof

Discuss: What is an example of a behavior that we would expect goes away naturally over time, not necessarily due to a specific intervention?

- *Prevention:*
  - Our _____ group! Perhaps there is a maturation effect, but because we have a comparison group, we can see if there is a difference despite the maturation.
  - However, this can be most accurately demonstrated with a pretest/posttest design, to look at the trend of change over _____.

2.3.2 History

- An effect may occur due to some _____ that creates an unexpected change in our groups.
- However, to be a true history threat this must be _____, i.e., happening in a outsized manner on only one of the groups.

? Which of the following seems to be the best example of a history threat?

- (•) A) All members of one condition are older than another condition
- ( ) B) The order of our conditions effects how participants respond to an intervention
- ( ) C) Some participants in both orders change their behaviors as they discover the hypothesis
- ( ) D) Some folks in one condition become extremely ill due to living all together

Explanation:

- *Prevention:*
  - Once again, our comparison group saves the day! If both groups deal with the same event, then the effect is _____ and not of major concern for the differences between the groups.
  - However, if the event somehow has a _____ impact on one group, the experiment may have to be re-done under “normal” conditions.

2.3.3 Regression

- This threat revolves around regression to the _____, where, over time, extreme scores tend to naturally converge towards the central tendency of the data
- Thus, extremely high scores naturally trend downward as time passes, and extremely low scores naturally trend _____.
- *Example:* Over time, extreme IQ scores tends to converge to the mean as children develop more
- *Prevention:*
  - Guess what saves us here? _____ groups! (Notice a trend?)
  - If we see groups equal at the start, and a difference in trend, we know that one group did indeed have an effect above and beyond the effects of _____.

2.3.4 Differences Between Maturation, History, & Regression

- *Maturation* threats deal with _____ and unexplainable change in behavior
- *History* threats are due to a _____ event or know outside environmental influence
- *Regression* threats come form naturally _____ scores converging on the mean or center of a scale.

2.3.5 Attrition

- Attrition occurs whenever we have some systematic _____ from our sample (may also be known as “mortality”)
- If attrition happens among all groups and _____ of people, then concern is low.
- But, If there is high attrition among one of the groups, we have a differential effect that could _____

Discuss: Other than death, what are some other reasons why a participant may leave the sample?

- *Prevention:*
  - It is often impossible to fully prevent people from not completing the study (because research is _____ !)
  - Instead, we may opt to _____ delete, or completely remove the data corresponding to those who dropped out.

2.3.6 Testing

- As we learned with _____ effects, participants may grow more skilled if they take an assessment more than once, not due to intervention, but just due to natural growth.

- *Prevention:*
  - Don't use a _____ - ironically, this makes investigating the other threats more difficult
  - Use two different, but equivalent forms of the same test! But how do we know they measure the same thing? $\rightarrow$ _____

2.3.7 Instrumentation

- This occurs when something about the _____ instrument changes over time.
- Put another way, our measurement is not behaving _____!

Discuss: Try describing the different between a testing and an instrumentation threat

- *Prevention:*
  - We may use only a post-test design. The _____ can't change over time if it is only used once!
  - We may use construct validity statistics (e.g., _____ α) to assess validity and reliability of the measures at both time points
  - We may counterbalance order of two _____ forms

2.3.8 Combined Threats

- Our selection effects may _____ with any of the threats described here, or even multiple threats may be present.
- As a general rule, we are looking for sources of systematic _____ that may affect one comparison group, but *not* the other.

? I have found that members of all 3 conditions in my experiment vary greatly in their personality types, regardless of the group they are in - what type of variance is this and should I be concerned?

- (●) A) Unsystematic, and should be concerned
- ( ) B) Systematic, and should be concerned
- ( ) C) Unsystematic, and should not be concerned
- ( ) D) Systematic, and should not be concerned

Explanation:

2.4 Any Study

- Even with good and proper use of _____ groups, we are not entirely out of the woods of threats.

2.4.1 Observer Bias

- When we described observational measures, we broached the problem of potential bias in how our research observers _____ and record measurements.
- This is still a _____ concern in experiments, even despite the rigorous procedures - effectively, a part of construct validity impacts the internal validity

Discuss: Try explaining how the construct validity issues presented by observer bias also contribute to problems in internal validity

- **Prevention:**
  - Remember to _____ your observers, i.e., make them unaware of the experiments groups and purpose prior to the recording.

2.4.2 Demand Characteristics

- *Review:* a demand characteristic is when a participant changes their behavior unnaturally due to _____ then nature of the experiment
- *Prevention:*
  - Ideally, both participants and observers should be blinded to study goals and hypotheses, to prevent possible _____ from arising.
  - Little detail about the conditions should be shared until _____

2.4.3 Placebo Effect

- Placebo effects occur when the mere _____ in a treatment produces a pronounced positive effect - this is *extremely common*

? I give one condition a sugar pill with no medication and another condition with a novel medication, but I do not tell them which people got which. Which are the types of comparison groups?

- (●) A) Sugar pill - placebo; medication - treatment
- ( ) B) Sugar pill - control; medication - control
- ( ) C) Sugar pill - treatment; medication - treatment
- ( ) D) Sugar pill - treatment; medication - placebo

Explanation:

- *Prevention:*
  - We can use double-blinding and measure whether the _____ group sees a more pronounced effect than the placebo group

2.5 Validity in the Face of Many Threats

- Despite the numerous challenges discussed above, experiments are still _____ and rigorous designs
- A comparison group already does wonders for preventing many of the threats discussed, and further issues can usually be addressed with specific attention paid to the _____ methods above.

3 Null Effects

3.1 Overview

- Sometimes, we _____ find a difference where we expect, as evidenced by a p > 0.05 or a 95% CI that contains 0. What gives?!
- This is actually very common in research, and not necessarily indicative of something having been done _____.
- However, we should investigate whether changes to the design would have changed the statistical _____ of the results

3.2 Not Enough Differences Between Groups

- One root cause of having null effects is having insufficient evidence of difference between the independent variable _____.

3.2.1 Weak Manipulation

- It is possible that our manipulation (i.e., the difference between the two conditions) is simply not impactful enough to create a difference in _____.
- Put another way, the way we _____ our construct of interest was insufficient

? Previously, we used a vocab term to describe a way to ensure our manipulation had the intended effect - what was that term?

- (●) A) Manipulation check
- ( ) B) Manipulation insurance
- ( ) C) Pilot block
- ( ) D) Pre-test

Explanation:

3.2.2 Insensitive Measures

- We may have the reverse problem: where our manipulation is impactful, but our _____ variable measure is not sensitive enough to detect it.
- Here, we may need to consider using a _____ measure that is detailed enough to capture change in the outcome.

3.2.3 Ceiling and Floor Effect

- A **ceiling effect** happens when most participants have a score close to the _____ end of possible scores on the outcome measure.
- Inversely, a **floor effect** is when most scores are clustered towards the _____ of possible scores.

Discuss: Try to come up of an example of when you might run into a ceiling effect

- These are symptoms of a _____ measure, and will often result in means that are close together, regardless of condition.

3.2.4 Value in Manipulation Checks

- We alluded to **manipulation checks** before, which offer some way to assess whether a manipulation truly caused any sort of change. This is often some additional variable we _____ alongside the outcome.

3.2.5 Reverse Design Confound

- A design confound may confuse the results of an experiment in the _____ direction of the effect of the intervention, thus causing the appearance of null results.

3.3 Too Much Within-group Variation

- It may be that we do have a difference between our groups, but the variance within each condition is so large (i.e., _____ or error) that it becomes difficult to determine.
- This often manifests as large standard errors / wide _____ intervals.

? What validity are standard errors and confidence intervals associated with?

- (•) A) External validity
- ( ) B) Internal validity
- ( ) C) Construct validity
- ( ) D) Statistical validity

Explanation:

3.3.1 Measurement Error

- Measurement error naturally occurs in _____ instrument, but our goal is to limit this as much as possible.
- A Formula:

$$Observed = True + Error$$

- *The solution:*
  - Ideally: Use _____ tools! e.g., recall chapter 5 and our various assessments of measurement reliability and validity
  - Less ideal: Just measure _____ people! The inconsistency will balance out naturally (probably)

3.3.2 Individual Differences

- As previously stated, research is _____, in other words, we capture general trends and mean differences. However, salient-enough individual differences can confuse between groups effects.
- *The solution:*

  - Bigger _____! This dilutes the effects of individuals with odd or unusual characteristics within each group
  - Use a within-subject design, then each person's trait controls for themselves!

3.3.3 Situation Noise

- This is a much more real type of noise, in which the literal _____ of the experiment may be playing some un-intended role in the outcome variable.
- This is why many experiments are done in barren, _____ lab settings.

3.4 Statistical Power

- **Power**, in research, refers to the _____ that a significant effect is found, when that difference is real.
- Ideally, we employ methods that lend themselves to a high amount of power such as:
  - _____-groups designs
  - Larger _____
  - Sensitive measures
  - Low "noise" and high control
- In addition to helping us get significant results, this also aids in the _____ of the study.

3.5 Transparency About Null Effects

- *A misconception:* Non-significant effects are _____ worth reporting.
- Null findings are _____ to the process of self-correcting science

Discuss: Explain what purpose null results serve in the Theory-Hypothesis-Data framework