Week 14 Lecture - Replication and Transparency

Undergraduate Research Methods in Psychology

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1 Learning Objectives

1.1 Textbook Objectives

- Explain why it is essential for a study to be replicated.
- Describe why transparent research practices help ensure credible science.
- Evaluate, in a nuanced way, a study's quality in the context of scientific progress and external validity

1.2 Professor's Objectives

- Appreciate science as an ongoing and continuous process of improvement, guided by replication

2 Chapter Overview

2.1 Chapter Overview

- As we've learned over the course of this class, _____ of scientific work can look a lot of different ways.
- In short, valid studies are those that provide enough _____ that a finding represents a real effect, change, or description - not some fluke.
- One of the best ways to _____ our evidence is to demonstrate that our findings can be produced again under the same or similar conditions.

3 Replication

3.1 Overview

- Replication is a subtype of _____ validity, where we determine whether a finding can be reproduced or if it appears to be a statistical anomaly
- *Recall:* Our findings are often judged against $\alpha = 0.05$, which means we do leave some room for "random _____."

- Often, we evaluate _____ as being of core importance to a study's value - because we want to know if the results tell a consistent story

3.2 Types of Replication

- "Replication" is a fairly loose term, and actually applies to many scientific _____.
- We may separate study replications into a few different types

3.2.1 Direct

- This is the _____ type of replication, where we attempt to largely keep all factors, measures, and circumstances consistent with the original study
- It is, of course, done on a new _____, but from the same theoretical population.
- Design issues are _____ forward in direct replications, as we attempt to stay largely the same (even when that may be a bad thing)
- *Example:* Imagine if I re-did the Harlow Monkey study *exactly* the same way Harlow did it.

3.2.2 Conceptual

- Our central hypothesis stays the same as the _____ study, but we may change minor procedures, designs, and how we operationalize our latent constructs.
- This can be a useful way to _____ some glaring validity issues in an original study and do a more refined investigation
- However, it should be viewed critically as a _____ version of the original, so corrections to the original's effects may not be as cleare
- *Example:* Harlow's Monkey's again, but this time I've changed the food with the wire mother to be more appealing and I have turned up the heating element on the felt mother just a little bit more

3.2.3 Replication and Extension

- In this type, we add _____ conditions or variables to add more nuance and context to findings.

- Such procedures could reveal _____ and mediators, or just present other relevant outcomes for convergence
- Like any replication, this type may _____ the findings of the original study, and also add their own new information at the same time
- *Examples:* Harlow's Monkeys, but instead, I am also going to add baby gorillas in to see if their behavior differs.

3.3 Real Projects

- A replication effort/project can look different ways, but is almost always very time-consuming and _____.
- It is beneficial to have multiple _____ and sets of researchers replicate an effect to reduce the chance that a single experimenter's bias affects results.

3.3.1 One Study, Many Labs

- In this scenario, one research lab "leads" numerous other labs in applying replications to a single central _____ and research design.
- Then, all labs' _____ are looked together at once and examined for their convergence or divergence.
- Because the scope of such an effort tends to be very _____ and focused on just one original study, we are more likely to see direct and, to a lesser extent, conceptual replications.

3.3.2 Many Studies, Many Labs

- This is largely an _____ of the above type, where we now focus on a broader issue or topic and try different studies within that area.
- A project such as this adds value by approaching a hypothesis with a variety of conceptual and extension replications, to see how different outcomes and _____ may contribute to significant findings (or not)

3.3.3 When It Doesn't Work

- Some replications find _____ or even opposite results from the original study!

- One possibility is that the two studies differ in some notable, _____ way, i.e., if you change many things, it is no surprise that the results are different
- Or, either the _____ or original study is flawed or a fluke
- So what next? Replicate some more! - A single-_____ replication is likely to not be sufficient to full dissuade the scientific audience from the original finding.

3.4 Meta-analysis

- Instead of embarking on running many replications ourselves, we may choose to _____ summarize the existing evidence.
- We have previously learned about _____ reviews, where we attempt to synthesize many original studies and replications to describe the state of the science in an area
- _____ -analyses quantitatively averages results across many similar studies to determine an aggregate/composite average.
- The averaging can be done with any _____ of effect size, such as Cohen's d and r.

3.4.1 Strengths and Limitations

- Meta-analyses can be an _____ way to give a summary of certain area with a clear number, informing future researchers of the state of the science at that time.
- However, this _____ lives and dies by its attention to detail and finding all relevant studies.
- Especially, null findings may be subject to the "_____ drawer problem", and may be obscured from being collected and aggregated.

3.5 In Popular Culture

- Rarely, does popular journalism adequately capture the _____ and changing nature of science.
- Journalism is also partially drawn to _____ and new research, but may give less emphasis to historical, but still relevant, studies.

- In general, it is much better to start with a peer-reviewed, scientifically _____ meta-analysis or literature review when orienting to a new area.

4 Transparency and Credibility

4.1 Overview

- Even well-meaning scientists (and malicious actors) can make _____ in truthfully reporting results
- It should always be our goal to make _____-driven predictions and designs - not making changes just for beneficial results.
- We have a variety of questionable practices to _____ and transparent practices to try to stick to which aid in reproducability

4.2 Questionable Practices

4.2.1 Under-report Null Findings

- “Real” research tends to involve more than one outcome variable of interest, and sometimes more than one _____
- But, some authors may downplay many null _____ in favor of focusing on the shiny significant findings.
- This creates a narrative of _____ importance and reproducability of findings, when the majority of evidence in a study actually points to the contrary.

4.2.2 HARKing

- This stands for “Hypothesis After Results are _____”
- Generally, we want to make predictions and hypotheses prior to our data _____ and analyses
- As a general ethical rule, it is bad to say “I knew it all along!” - as it is not theory or literature driven.

4.2.3 P-hacking

- This occurs when multiple analysis methods are used _____ a significant p-value is found, and usually only the final method is reported
- Similar to under-reporting null findings, this tends to _____ contrary evidence and overstate otherwise weak findings
- Early decisions on design, hypotheses, and analyses need to be guided first-and-foremost by _____

4.3 Transparent Practices

- To _____ the previous, questionable techniques - we may use a few strategies to increase public and scientific confidence in our results.
- Often, these "open" methods intentionally make us _____ to wide critique from the broader public - but this is good for science!

4.3.1 Open Data and Open Materials

- Open _____ is when we publicly share anonymized data that can be re-analyzed by anyone to ensure results were correct
- Open materials provide all in-depth procedures, measures, and tools to be used in any _____.
- Both of these may be posted on repositories like https://github.com or https://osf.io

4.3.2 Preregistration

- As previously mentioned, this is the _____ announcement of one's hypothesis and plans prior to completing a study.
- Doing this helps discourage any desire to HARK or p-hack, as any interested party could easily point out that you changed your future analysis.

5 When Do We Need (Really) External Validity

5.1 Overview

- Replication (especially _____) can help us establish just how widespread and generalizable effects are outside just our original sample of individuals.
- As we _____ original studies, we are able to better see just what people and contexts they can apply to
- External validity is one of the most _____ and difficult to establish validities - therefore we must discern how to balance our priorities with it

5.2 Generalization to Other People

- Remember that our sample comes from a _____ population that we chose, not just everyone in general
- Samples are primarily strong by virtue of their _____, not only their size!
- Samples can be easily _____ by convenience - think carefully about the impact that it is likely to have!
- Results may not generalize to _____, but we must consider whether this is vitally important to us.

5.3 Generalization to Other Settings

- Many _____-based studies may benefit from replication in more “real-world” settings
- On the other hand, we may be interested to see if we can isolate a _____ behavior within the confines of the lab
- More broadly, we likely also want to examine how our studies look outside of the geographic and _____ areas they are conducted.

5.4 Do We Always Need to Generalize

5.4.1 Theory-testing Mode

- This is the “first” stage, where we attempt to _____and describe a theory accurately under more controlled conditions
- We work knowing external validity is _____, but taking care to establish other strong validity.
- In this scenario, often _____validity is treated as most important.
- Association and _____claims usually work in a “theory-testing” mode.

5.4.2 Generalization Mode

- _____claims more often aim to be widely applicable and relevant.
- Generalization mode places a special emphasis on making sure theories have strong _____validity, putting less focus on internal, like when theory-testing
- _____psychology is a sub-discipline almost entirely determined to investigate cross-cultural differences and similarities, working in generalization mode.

5.5 Do We Always Need to be in the Real World?

- Valuable research happens in _____setting, both lab-controlled, and completely ecological (i.e., the “real world”)!
- Researchers in these separate setting often _____greatly from the mutual shared knowledge.