Week 1 Lecture - Scientific Thinking

Undergraduate Research Methods in Psychology

Quinton Quagliano, M.S., C.S.P

Department of Psychology

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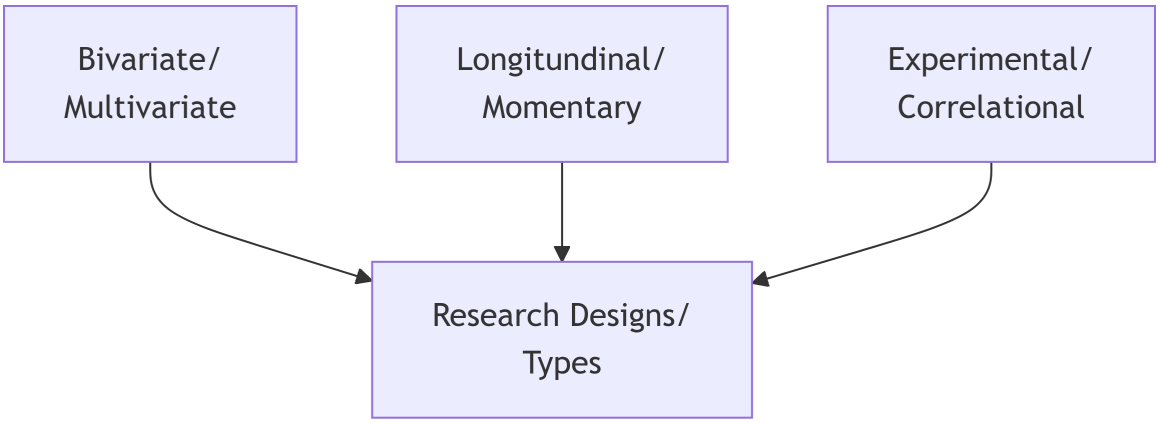
1 Overview

1.1 Psychology is a Science

- The methods of psychological research may be different from those found in chemistry, physics, or biology - but we still follow the same _____ in how we conduct our investigations.
- To be scientific, we must first be **empirical**, that is, to rely upon _____ and controlled observations of a phenomenon. We cannot be purely **intuitive**, which is to make decision off of "gut feeling".
  - But, intuition *can* be part of the scientific _____, more on that later
- Our scientific procedures may be _____ by confounding variables, poor ethical conduct, or limitations in design - we will discuss all of these throughout the semester
  - Scientific studies are often comprised of a balance of numerous practical choices impacting different parts of the _____ of the study.
- *Example:* Just like a chemist detailing each and every step in a successful or failed experiment, we must be equally _____ in our work as social scientists

1.2 Different Methods, Same Answers?

- There are many valid ways of _____ empirical/scientific research, many of which we will explore in this course
  - Different methods may explore the *same* overarching research question, but with different techniques, _____, and weaknesses



- It is vital that you are able to both _____ the methods of other researchers (consumer), and craft your own (producer)

  - In this course - homework and research proposal will help you strengthen both sets of skills, applying the knowledge you get in class.

2 Producers and Consumers

2.1 Research Producers

- **Research Production** is the process of actually _____, designing, conducting, and reporting research - using the methods we discuss in this class
  - Producing research is often a _____ of advance training in psychology (e.g., M.S., Ph.D., etc.) - and also part of your undergraduate training here at GVSU (see PSY-350 and PSY-400)
- Being an author of research establishes your _____ as an expert in a certain area or topic, and advances your analytical and writing skills
  - However, only one study does *not* make you an expert - it is the full body of your scientific and _____ work that defines your ability
- Good research is almost always **peer-reviewed**, meaning it is _____ by other individuals in that discipline.
  - Peer-review is effectively a collaboration of research producers to only publish the most _____ version of a study.
- *Example:* A scientist at a testing company (e.g., The College Board) runs analyses and reports on the metrics for the SAT over the last 5 years.

2.2 Research Consumers

- Applied _____ of psychology in businesses, clinics, and schools **must** understand the state of scientific literature in their respective areas. This makes them **consumers** of research.
  - You will also be expected to be able to _____ research from journals during your training here at GVSU
- It is not enough to just read research, but also to be _____ and mindful of how “good” research is done.
  - Just because research is “peer-reviewed” does not mean it is entirely free from limitations or _____!
  - Unfortunately, some research is not properly vetted all the way
- *Example:* A therapist applies a new, evidence-based technique for a _____

2.3 How Producers and Consumers Compare

- Both producers and consumers play an _____ role in how science is

applied:
  - Producers use _____ research designs to demonstrate real effects and relationships
  - Consumers critically _____ research findings and carefully apply them to "real-world" problems
- *Example:* An educational psychologist (_____) complete a long-running study on the effectiveness of a cutting-edge intervention for disruptive behaviors in class, and a teacher (_____) then implements it into their classroom management strategy.

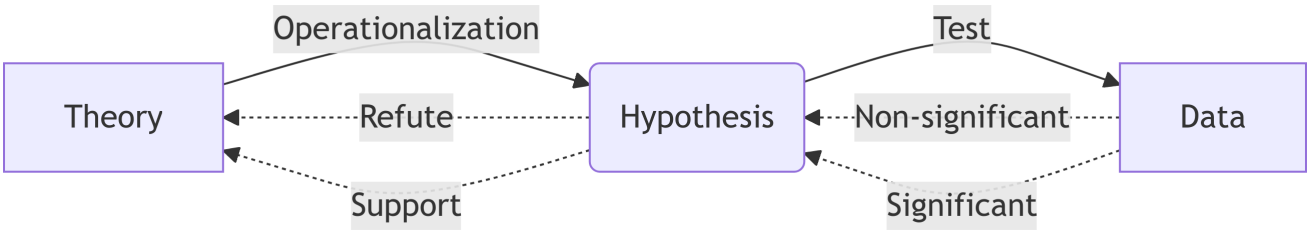
3 How Scientists Work

3.1 Empiricism

- Scientists are empiricists that assess _____ through rigorous and systemic thinking, testing, and writing
- It is not enough to just see a relationship _____; instead we must be able to observe, measure, and elicit it consistently
- We may use evidence from our senses, or from measurement _____ to establish the properties and behaviors of a certain idea
  - Not all procedures for _____ or **operationalizing** are built equal, and some may be more reliable and valid than others (more in week 5!)
- *Example:* Issac Newton does not watch an apple fall from a tree just once, he drops many apples and other objects and _____ observes each.

3.2 The Theory-Hypothesis-Data Cycle

- Part of science is not just establishing theories and ideas, but updating them as new evidence supports or _____ with existing frameworks
  - In order to do so, we must make specific hypotheses to test, and then report on the _____ of said testing
  - Effectively we move from Theory to Hypothesis to Data, which then either refutes or supports the _____ theory



3.3 Theories

- These are general statements or concepts about how a certain phenomenon is believed to _____.
- They are often _____ and expand over time as further information adds to and subtracts from understanding of a certain construct (Remember the Theory-Hypothesis-Data cycle from earlier!)
- These theories, oftentimes, try to describe some _____ of two or more constructs, whether that be a monkey and a figurine; a person and a treatment; a person and another person; etc.
- Most theories try to follow the **rule of parsimony**, that is, trying to fit the simplest-*possible* _____ for a phenomenon or observed behavior.
  - Note: not all things can be fully "simplified", but we seek the most basic and _____ explanation we can

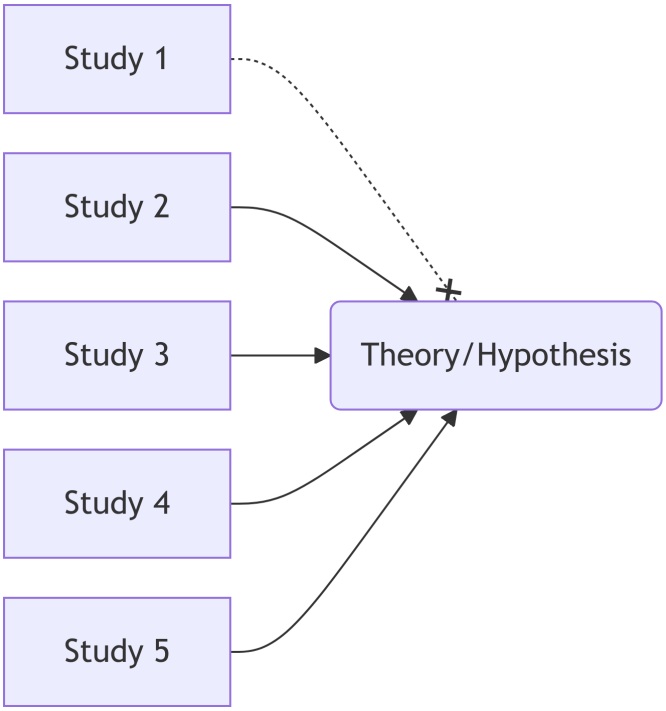
3.4 Hypotheses

- These are much more _____ statements that often serve as the foundation for any particular study. They should be **pre-registered** - and stated _____ to the actual commencement of the planned study.
- Making hypotheses after a study, to fit the data, is unethical (we will later touch on this issue in Week 14).
- These may be made within the context of a broader theory, but are likely to focus more concretely on a predicted outcome with _____ measures (that could be wrong!)
- Several studies, led by several hypotheses, may all contribute to the development of a grander theory

3.5 Data

- Data is the _____ of an experiment or study, and contains the observations and tests that show significance or non-significance for the **hypothesis**, which aids in understanding whether the results support or refute the **theory**, respectively.
- Just like with crafting our hypothesis, we have a lot of input in how our data is treated and tested - different designs and measure will produce _____ outcomes.

3.6 Burden of Proof



- A singular study does not definitively _____ a certain hypothesis or theory, nor can it fully disprove these. Rather, it may add to evidence for or against a certain idea.
- Example in writing: “This paper aids in understanding how CBT-I may be beneficial for individuals with depression. Results indicate a moderate effect of the treatment in reducing depression in the present study. Future research is needed to clarify the effect in different populations and contexts.”
- Put statistically: we never *prove* or *disprove* our null hypothesis (H_0), we just supply evidence for or against our _____ hypothesis (H_1)

- Only once *many* studies have provided support for a theory, can we say the weight of _____ is in favor of it.

3.7 We Can be Wrong

- **Falsifiability:** Good research must allow for our theory and/or hypothesis to be flawed or _____. If this is not accounted for, we engage in confirmation bias, or effectively choosing to only investigate for our views.
  - Recall the Theory-Hypothesis-Data flowchart from earlier. Revision is a valid outcome of new _____ !
- It is critical that our design, statistics, and reporting make clear the _____ that a study is limited in its scope and abilities
- No one study is so _____ designed that it can account for all edge cases in a phenomenon

3.8 Example of Theory-Hypothesis-Data: Harlow's Monkeys

- How do we test a component of primate attachment theory? We must perform an empirical _____!
- *Example:* Harry Harlow was interested in attachment theory (broad idea set - theory) gave a young monkey two options: cling to a "wire mother" with food, or a "cloth mother" with fur and warmth. He _____ that them monkey would prefer the cloth mother (concrete prediction - hypothesis). He found that monkeys generally preferred the clothe mother (concrete outcome - _____)
- This also shows the _____ of good research - we must be willing to be wrong (i.e., we provide the possibility that the experiment can go the "other way")
- *But,* this one study does not singularly define attachment theory, the _____ of evidence requires more studies!

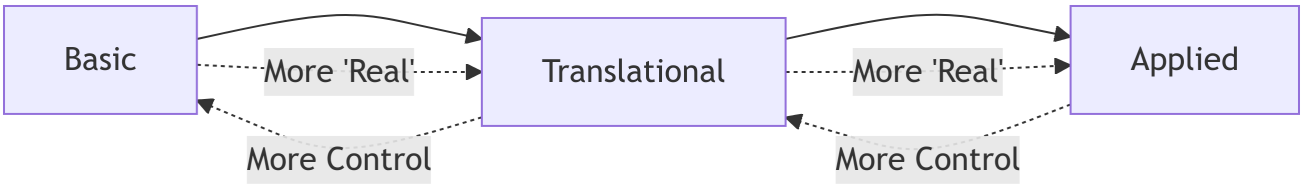
3.9 Norms for Scientific Research

- Robert Merton proposed a set of scientific norms that can and should _____ our actions and behaviors in approaching and conducting research

- **Universalism** states that "science is for _____" and that claims are not based solely upon the expertise or stature of the scientist, but rather, their methodology and rigor
  - *Example:* an undergraduate student can perform research the same as a doctoral student, and it will be measured by its strength, not the person who made is
- **Communality** is the concept that science is done in a community and as a _____, not only a small group of individuals.
  - *Example:* Even the authors of a published paper cite many others in their writing.
- **Disinterestedness** states that we must be guided by a commitment to truth and accurate _____, not by monetary gain or pushing of a particular ideology.
  - *Example:* A prominent medical scientist publishes results about concerning side effects of a drug, despite the fact that they have stock in the pharmaceutical producing the drug.
- **Organized Skepticism** says we must commit ourselves to be critical of everything, even _____ ! We question things, not to simply be contrarian, but because we must understand the faults in existing knowledge.
  - *Example:* I strongly believe the MMPI to be a valid measure of personality, but I read a study that is critical of its accuracy.

3.10 Continuum of Research Contexts

- **Basic Research** is that done for theoretical purpose to expand knowledge or _____ ideas
  - *Example:* EEG Electrodes and brain waves during a certain activity
- **Translational Research** is done in a more controlled environment, but now being applied to _____ people (or animals)
  - *Example:* Experimental study in a research lab of peoples reaction to a certain stimulus
- **Applied Research** happens more so in the "real world" where the findings from basic and translational research are applied to less-controlled _____.
  - *Example:* Retrospective study on patient outcomes after a certain treatment



- ALL forms of research here are useful and important in the _____ of well-rounded and well-supported theories!

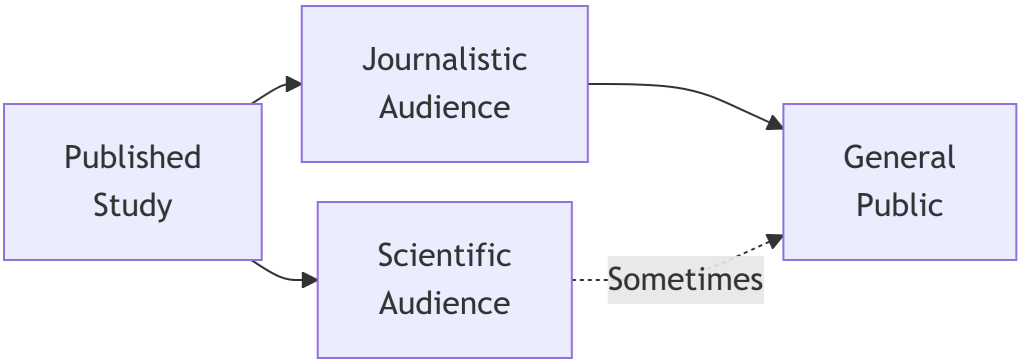
  - As you will learn throughout the semester, certain research _____ will also lend themselves well to one of these types in particular.

3.11 "Publicly" Available Research

- Scientists communicate primarily through publishing findings in _____ journals that use a system of editors and peer reviewers to ensure the rigor and validity of a study
- If a paper is published, it may be _____ by future scientists in support of certain claims and arguments in papers, presentations, and reports. Or, others can also disagree and provide competing evidence in their own work.
  - A theory is not crafted from the work of just one author, but instead the synthesis of _____ different published articles
  - In psychological science we use _____ style (in its 7th edition) to reference previous scientific work
- Journals may range in quality and _____ though! We will discuss some nuances in this later in the semester
- Also, some journals may be difficult to _____, but there are many ways we may use the library resources to access the texts
  - By the end of this semester, you should be very familiar with what a peer-reviewed publication looks like.

3.12 Scientific Journalism

- Specialized journalists often try to bring scientific findings (published in journals) to a _____ that is more acceptable to laypeople.
  - This is important work, as it can help _____ new knowledge.
- However, these writings are *not* peer-reviewed the same as the original research - and may _____, understate, or be reductive towards the "true" findings
  - It is not that journalism is _____ bad, just that we must be cautious
- When in doubt $\rightarrow$ always go to the original publication!!
  - Note: Citing journalism about a study, rather than the study itself, may be improper _____
- There is an old saying in journalistic media: "If it bleeds, it leads" - referring to how more violent and shocking stories tend to be covered more and generate more public interest. The same thing happens in this type of _____ journalism!
  - Journalists may occasionally prioritize writing in a way that sounds "flashy".


Published Study
Journalistic Audience
Scientific Audience
General Public
Sometimes