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# **Week 1 Lecture - Scientific Thinking**

Undergraduate Research Methods in Psychology

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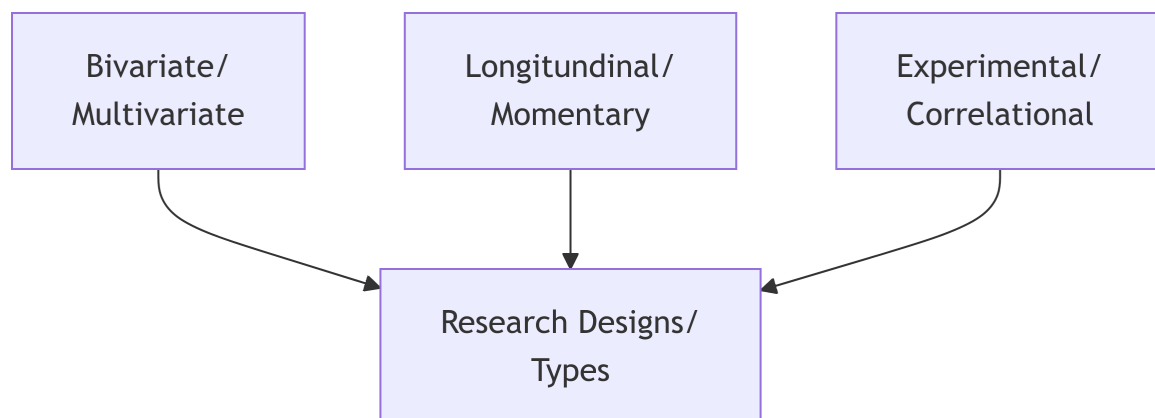
# 1 Overview

## 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
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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.

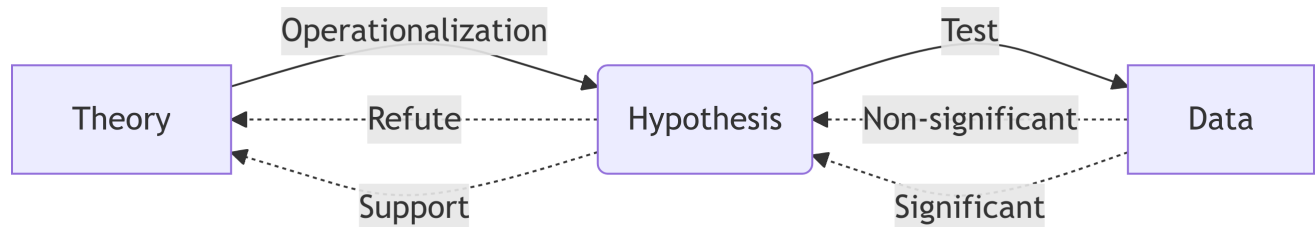
### 3 How Scientists Work

#### 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
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### 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 \_\_\_\_\_

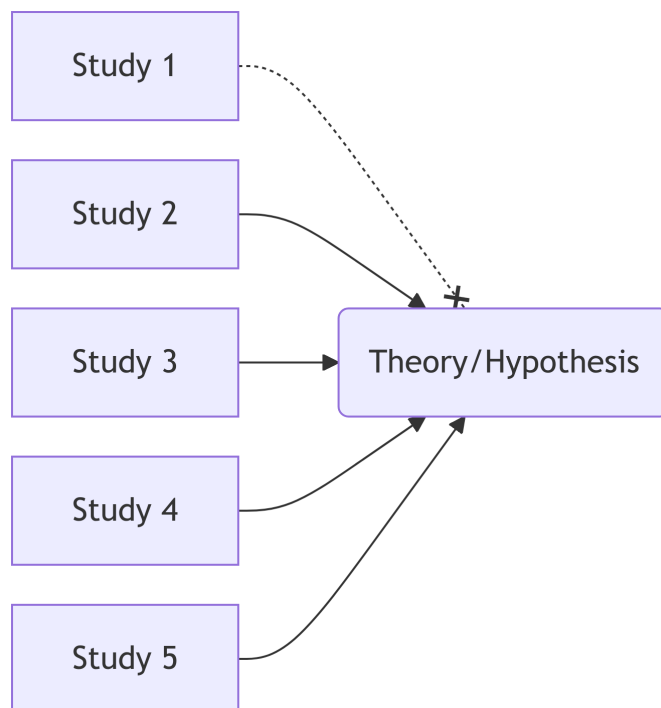
### 3.4 Hypotheses

- 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 ( $H_1$ )
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- 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

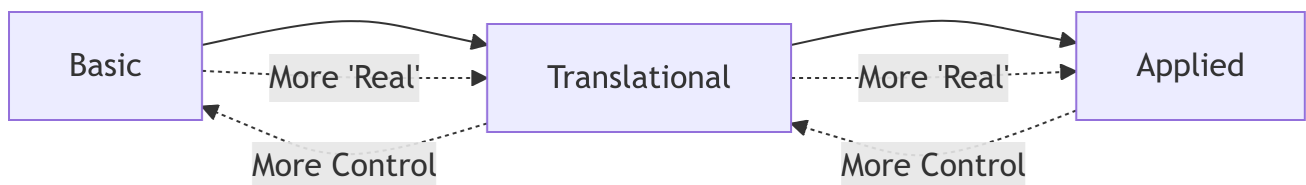
- Robert Merton proposed a set of scientific norms that can and should \_\_\_\_\_ our actions and behaviors in approaching and conducting research
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- **Universalism** states that “science is for \_\_\_\_\_” and that claims are not based solely upon 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 → 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”.
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