

Scientific Method

PSY 4433

Jonathan A. Pedroza, PhD

Cal Poly Pomona

2022-01-24

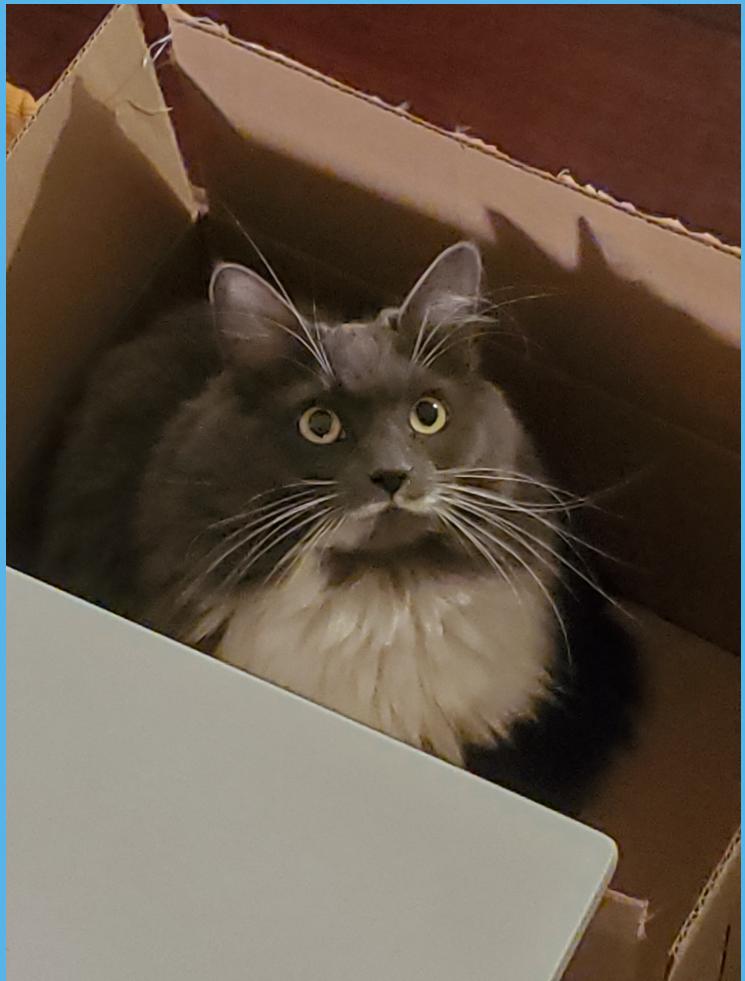
Agenda

- Introductions
- The Scientific Method

About Me



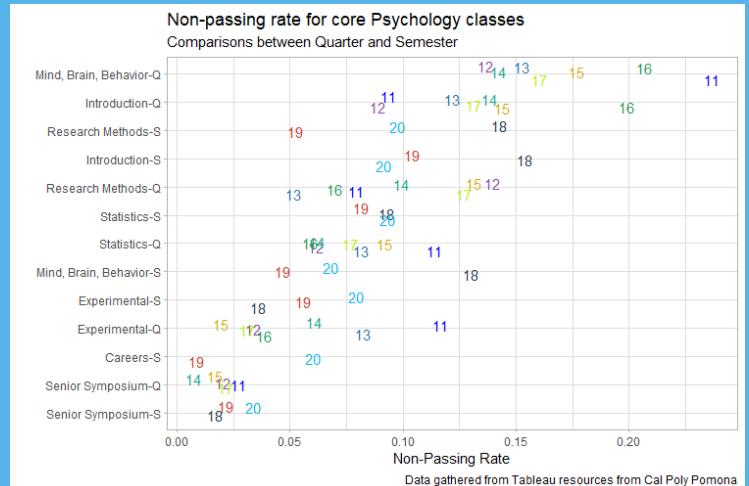
- My name is Jonathan A. Pedroza (he/him)
 - please refer to me as **JP** unless around other instructors/faculty
- First-generation Graduate
 - CPP Alumni (2014)
 - CSUDH (2017)
 - University of Oregon (2021)



- Hobbies include: fishing, hiking, cooking, and coffee

Nerdy Stuff

- Passion/Nerdy Topics:
 - I love creating data visualizations in R
 - health inequities in communities of color
 - examining environmental variables that influence health behaviors



Tell Me About Yourself

- Name, Activity Section, and pronouns
- What do you want to do after you graduate?
- What is your experience with statistics and SPSS?
- What is your experience with conducting research?
- Name a topic/area of interest for you that you would want to

Acquiring Knowledge

- **Methods of acquiring knowledge** are ways in which we know things or discover answers to questions
- The issue becomes what ways of acquiring knowledge are valid and reliable
 - we'll learn about these topics down the line
- *Wikipedia*
- Facebook
- *Reddit*

Would you consider this a "Good Source of Knowledge"?

- Peer-review journal article on effectiveness of vaccinations
- Uncle's Facebook rank on effectiveness of vaccinations
- Publication from drug company on medication's effectiveness
- JP's slides

Method of Tenacity

- **Method of tenacity** is when information is accepted because it has been accepted as fact for a long period of time or due to superstition
- Some examples include:
 - breaking a mirror gets you bad luck
 - Depression is all in your head
 - only boys show signs of ADHD
 - Napolean Bonaparte was short
 - We only use 10% of our brains
 - having a glass of wine is good for your health

Method of Intuition

- **Method of intuition** is when information is accepted because it feels right
 - essentially relying on instinct



Method of Authority

- **Method of authority** is when information is accepted because the source is an expert in the area
 - issue is that people take this information without researching the topic themselves
 - also sometimes we perceive people as *experts* when they are not
- Examples include:
 - JP telling you that this is a method of accepting information
 - JP's mom telling him that chicken soup will make him feel better
 - JP's mother-in-law telling him to take Emergen-C

Method of Faith

- Within the method of authority, **method of faith** is when people accept information from an authority figure without doubt based on their faith
 - based on a form of sacred text and an authority figure within that context (faith/religion/spirituality)



The Rational Method

- The **rational method** or **rationalism** is when someone seeks answers by rational thinking
- You experience this any time you take a multiple choice exam.
 - If you come up with an answer rationally you are using what method:
 - Method of authority
 - Method of Faith
 - The Empirical Method
 - The Rational Method

The Rational Method

- When facts or assumptions are presumed to be true, they are **premise statements**
- An **argument** is a set of premise statements that are logically combined to reach a conclusion
- Example:
 - In fall/winter months, there is more consumption of ham.
 - In fall/winter months, there are more DUI collisions.
 - Eating mass quantities of ham cause DUI collisions.



The Rational Method

- Issues with this method are that people don't consider other possibilities
- For the example on the previous slide, what may be other causes and conclusions?
- Does not include direct observation or actively gathering information/data

The Empirical Method

- The **empirical method** or **empiricism** uses observations or other observable information to obtain knowledge and draw conclusions
- Some examples could be:
 - Does it snow in Pomona?
 - CPP is a diverse campus?
- If you've ever googled something a professor said to see if they are wrong, then you have relied on the empirical method

The Scientific Method

- The **scientific method** is an approach to acquiring knowledge through steps from formulating questions to finalizing conclusions
 - uses several other steps that we previously learned
- Steps to the scientific method
 1. Observation
 2. Form question/hypothesis
 3. Test hypothesis and collect data
 4. Analyze and evaluate data
 5. Draw conclusions

Observations

- Start with a general observation
- Example:
 - When I walk around my neighborhood I realize there are not many parks; these parks also lack amenities. When I go to higher income neighborhoods, there are several parks with great amenities.
- In this example, **inductive reasoning** is used
 - By relying on small number of instances where I noticed a pattern, I created a general statement about a possible larger phenomenon
 - Use a small number of data to reach conclusions about larger implications

Form a tentative question/hypothesis

- From the experiences you have observed, draw a potential conclusion
 - A **research question** is often used here --> **hypothesis**
- This often begins with thinking about what variables should be considered
 - **Variables** are characteristics/conditions that have different values in different individuals (or other units of measurement)
- Example:
 - What may lead to difference in the number and access to parks? (Research Question)
 - Does income differences in neighborhoods lead to differing numbers of parks? (Research Question)
 - Lower incomes are associated with less parks. (Hypothesis)

Test hypothesis and collect data

- Then you would create a scenario/experiment to test your hypothesis
 - Example: Go around different neighborhoods that are considered low and high incomes to see how many parks each neighborhood has
- **Deductive reasoning** uses a general statement as the basis for reaching a conclusion about specific examples
 - Use your hypothesis to reach a conclusion about your small sample/specific example
 - See in the two neighborhoods you are interested in if there are differences in parks

Analyze and evaluate data

- use past research and your own data collection to use for conclusions
- make sure not to bias responses
 - use operational definitions (standardized definitions) to make sure you are measuring the correct construct
 - Parks = grass, water fountain, public restroom, 1 sports field (baseball diamond, basketball court, tennis court)
- Example:
 - The data shows that the average number of parks in high income neighborhoods is 3.4. It also shows that the average number of parks in low income neighborhoods is 1.1

Draw conclusions

- Compare your hypothesis to what your data showed
- Was your hypothesis correct?
- What was the finding?
- Is it still important to know about, even if you were wrong?

Draw Conclusions



Draw Conclusions

- This is the basis of all research
- From your findings (1 research study), you keep adapting and moving forward learning more intricate details about the association/phenomenon you are interested in
- Then you make a career out of that and you never leave your office



Science is...

- Empirical
 - Be systematic
 - Rather than go into something without knowing about that topic, we refer to the literature
 - "Refer to the literature" or "Well, what does the literature say"

Science is...

- Public
 - should be published for "all" to see
 - Not really what happens
 - Should be able to be replicated
 - **Replication** is the repetition of observation
 - Importance of a good Method section

Science is...

- Objective
 - The researcher or participant should not bias the finding results
 - p-hacking
 - constantly running a number of tests until finding something "significant"