EPSY 5195: Intro to Quantitative Methods

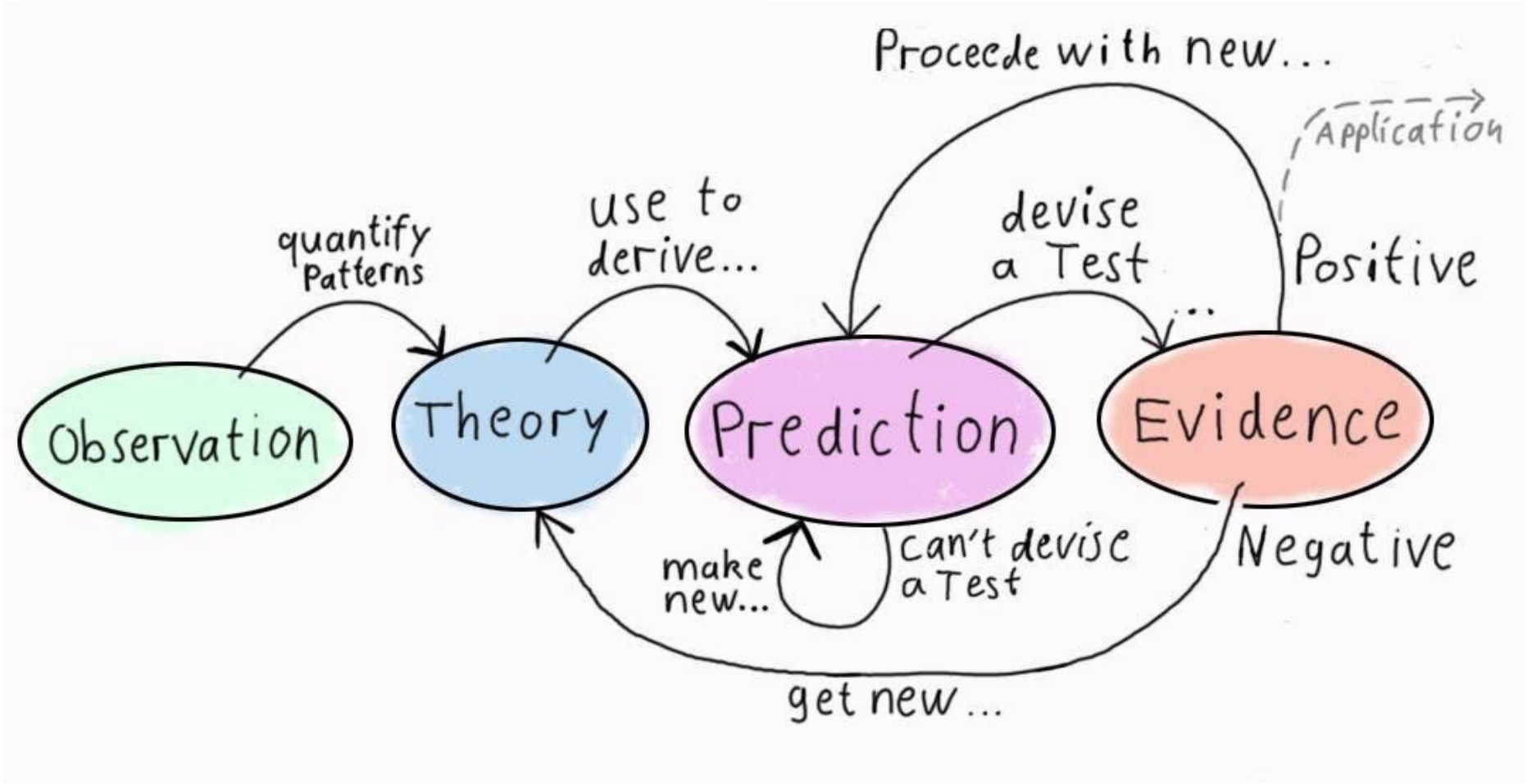
Brittney Hernandez

Housekeeping

- Start recording
- Materials:
- Sign in: https://forms.gle/8LeesWK3XoxHobTD8
- We’re going to be using Poll Everywhere to interact with the presentation to start the session:
  - via web, go to PollEv.com/brittneyhern168
  - via text, text brittneyhern168 to 37607

Briefly tell me about your inquiry project

How do we come to know things?



The Scientific Method Infographic by Jan Graf von der Pahlen

What is research?

- “The formal, systematic application of scholarship, disciplined inquiry, and most often the scientific method to the study of problems.” (Fraenkel, Wallen, & Hyun, 2015, p. G-7)

- “The formal, systematic application of the scientific method to the study of problems.” (Gay, Mills, & Airasian, 2012, p. 630)

- “…the systematic process of collecting and logically analyzing data…for some purpose” (McMillan & Schumacher, 2010, p. 8)

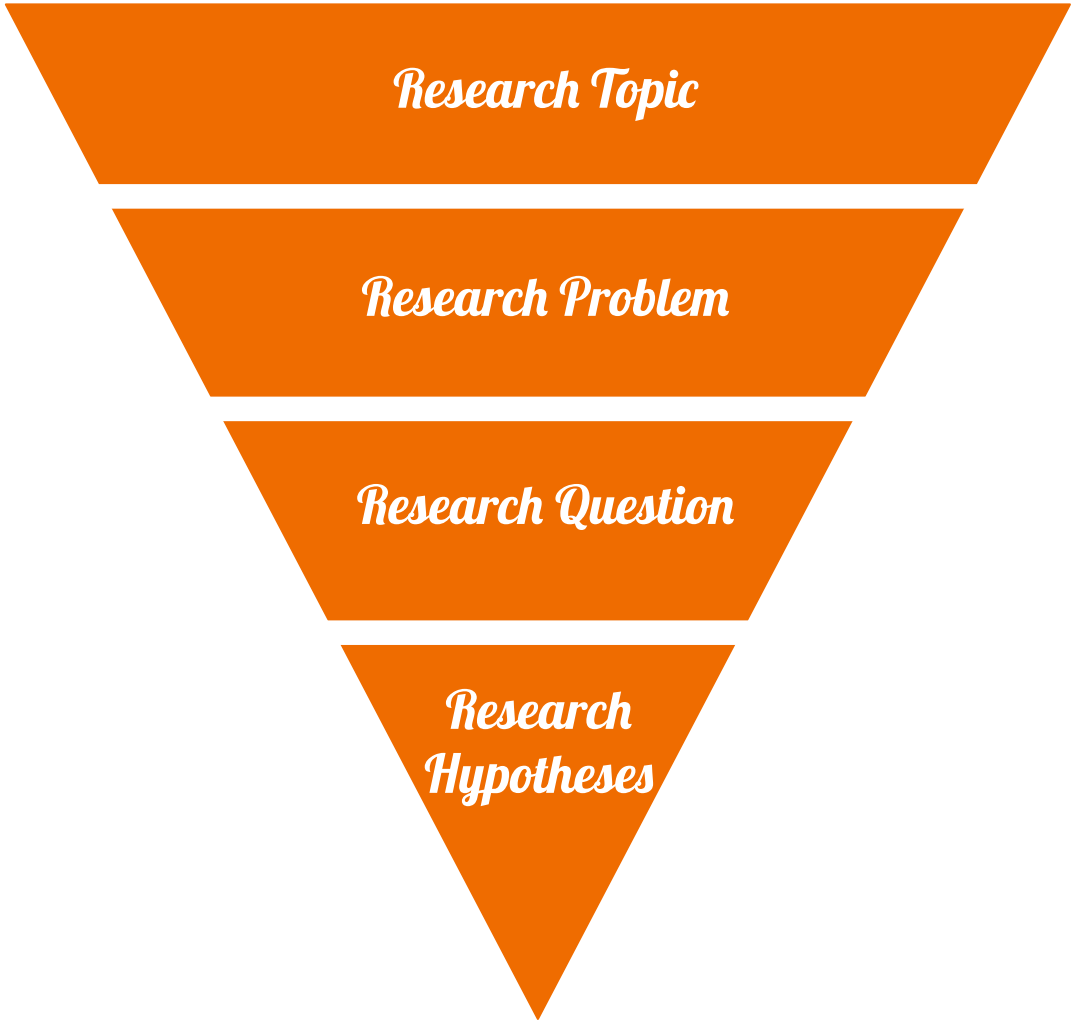
What’s common in these definitions?

Research Methods

Quantitative	**Qualitative**
Numeric Representations	Verbal Representations
Closed-Ended	Open-Ended
Outcome-Oriented	Process-Oriented
Confirms	Describes
Contains variables	Contains concepts and ideas

(Steckler, McLeroy, Goodman, Bird, & McCormick, 1992)


Quantitative Methods
Only one in 30 take the free ice cream. Interesting...
free icecream
Qualitative Methods
What did you feel when you saw the free ice cream?
Excited. A little scared.
And why was that?


Research Topic
Research Problem
Research Question
Research Hypotheses

Research Topic

- General content area for research
- Examples:
  - Adult learning
  - Motivation
  - Social aspects of sport
- A research topic should be...
  - Should be interesting to you
  - Researchable
  - Ethical
  - Make a contribution to research theory/practice
  - Reasonable (consider time, skills, and resources)

What are some research topics?

Research Problem

- Some sort of “issue, controversy, or concern” (McMillan & Schumacher, 2010, p. 47)
- Purpose statement: clearly states how the research will address the problem
- Consider the *context* and how it impacts the problem
- Consider the *significance* and how the research will impact theory and/or practice

Research Problem

How do I identify a research problem?

- Personal experience
- Discuss with professors, advisors, mentors, colleagues
- Literature review
- Theory in practice

What are some research problems related to the topic our group chose?

Research Questions

- A research problem can be investigated in many ways, and research questions tell us HOW we plan to investigate the problem
- Determine the types of variables you will measure
    - Variables are concepts or items that can vary in a study
- How will the variables measured help answer the questions? What evidence will this provide to help address the research problem?

Research Questions

- You must be able to collect data to investigate the question
- When developing question, consider
  - Feasibility
  - Clarity
  - Significance
  - Ethics

What are some research questions we can ask to address the problem?

Research Hypothesis

- Statements you make about what you expect will happen when you investigate your research questions
  - Null hypothesis: expects no effect
  - Alternative hypothesis: expects something will happen
- When developing hypotheses, consider:
  - Clarity
  - Rationale for the expectation (theory, justification, etc.)
  - Is it testable?
  - Direction of the expectation

What are some examples of research hypotheses?

How do we investigate our research questions/hypotheses?

Types of Quantitative Analyses

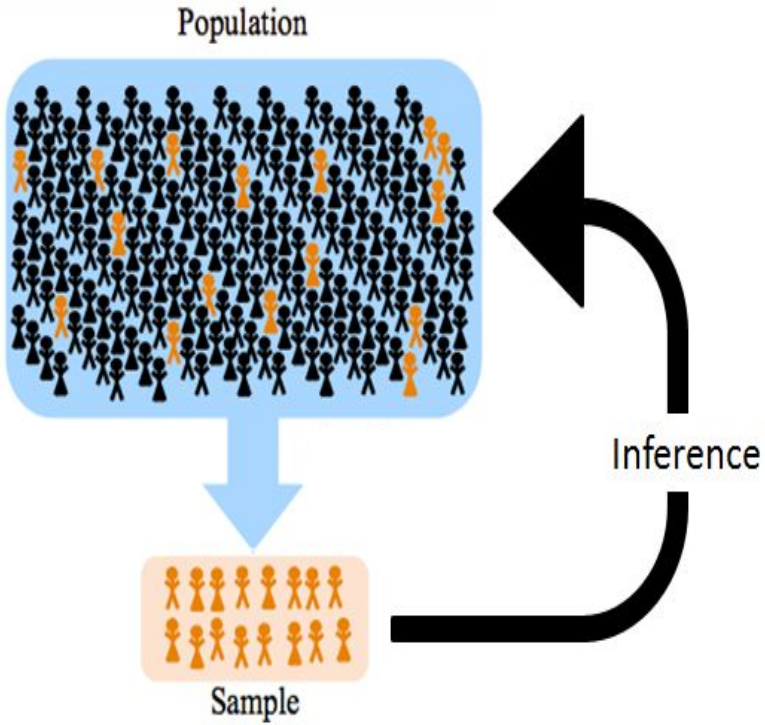
Descriptive Statistics:

- Seek to *describe* or *summarize* observed data
- Examples:
  - Central tendency
  - Variation
  - Frequencies

Types of Quantitative Analyses

Inferential Statistics:

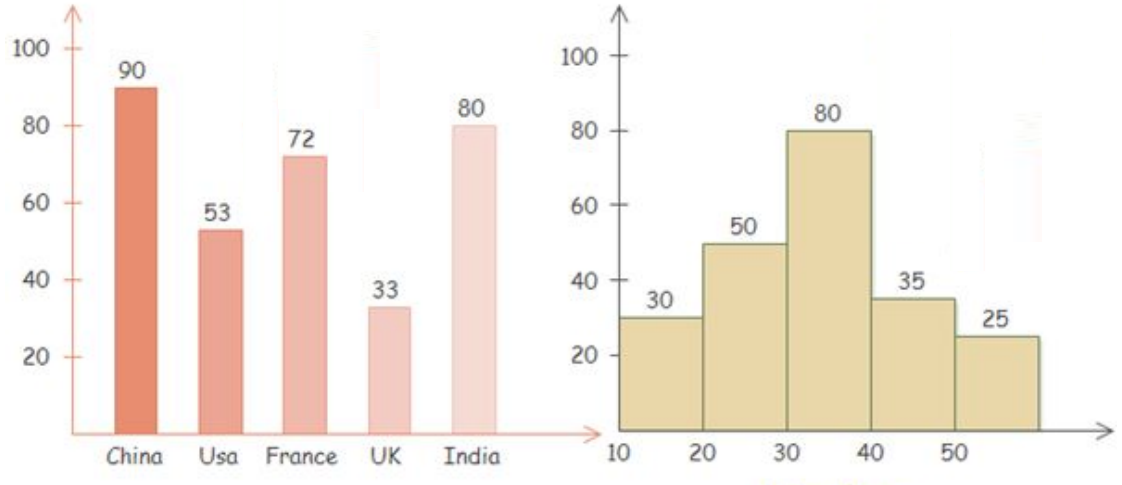
- Seek to make *comparisons* or *associations* in observed data
- Examples:
  - Correlations
  - Chi-Square
  - T-test
  - Anova
  - Regression



We wouldn't need to make inferences if we had data from the entire population

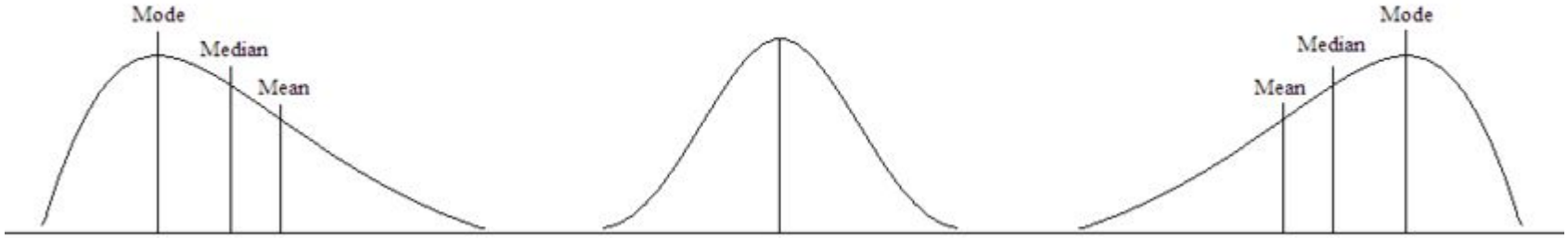
Descriptive Statistics

- Frequencies describe the number of occurrences of a given value
  - Relative vs cumulative frequency
  - Bar chart vs histogram



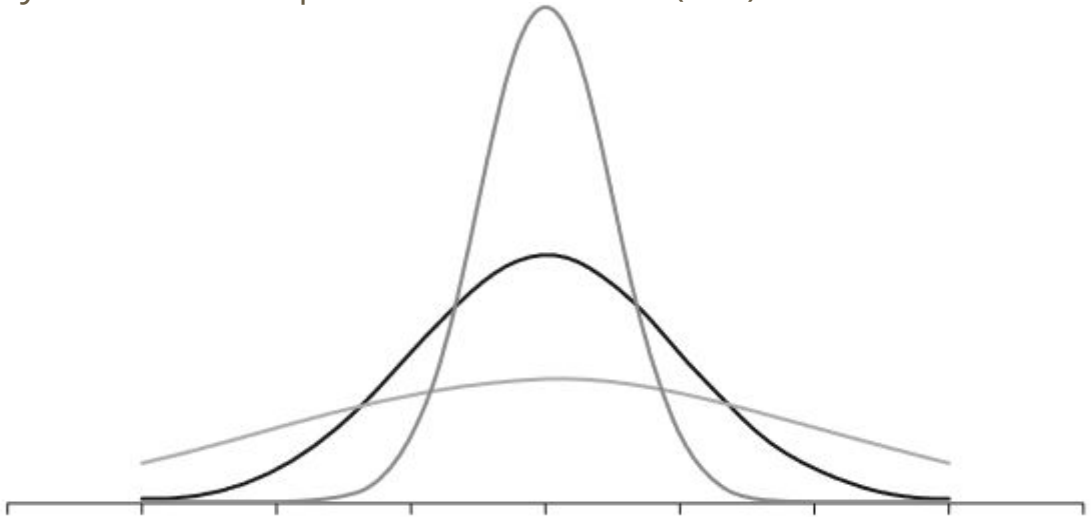
Descriptive Statistics

- Central tendency describes the
  - Mean: Sum of scores divided by number of scores
  - Median: Middle number in an ordered data distribution
  - Mode: Most common value in a distribution



Descriptive Statistics

- Variability
  - Standard deviation: Represents the average (or standardized) distance of the scores from their mean SD =
  - Variability: Tells us how spread out our data is (SD^2)

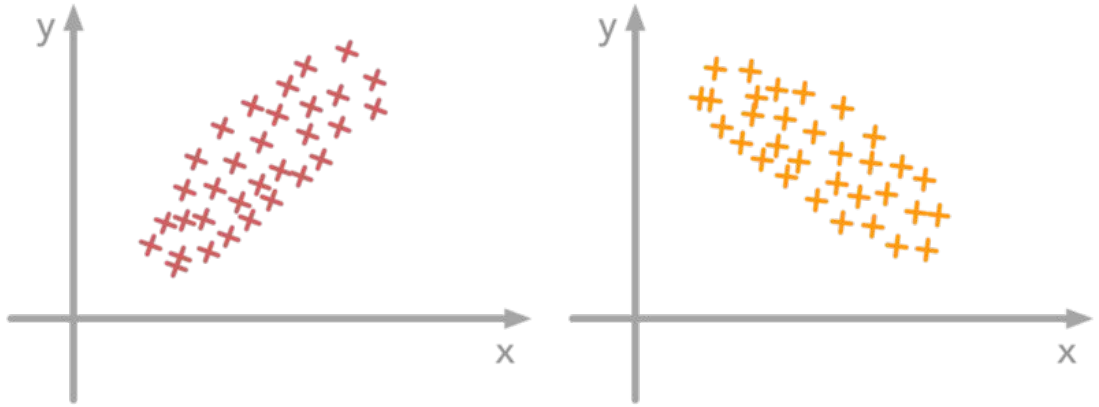


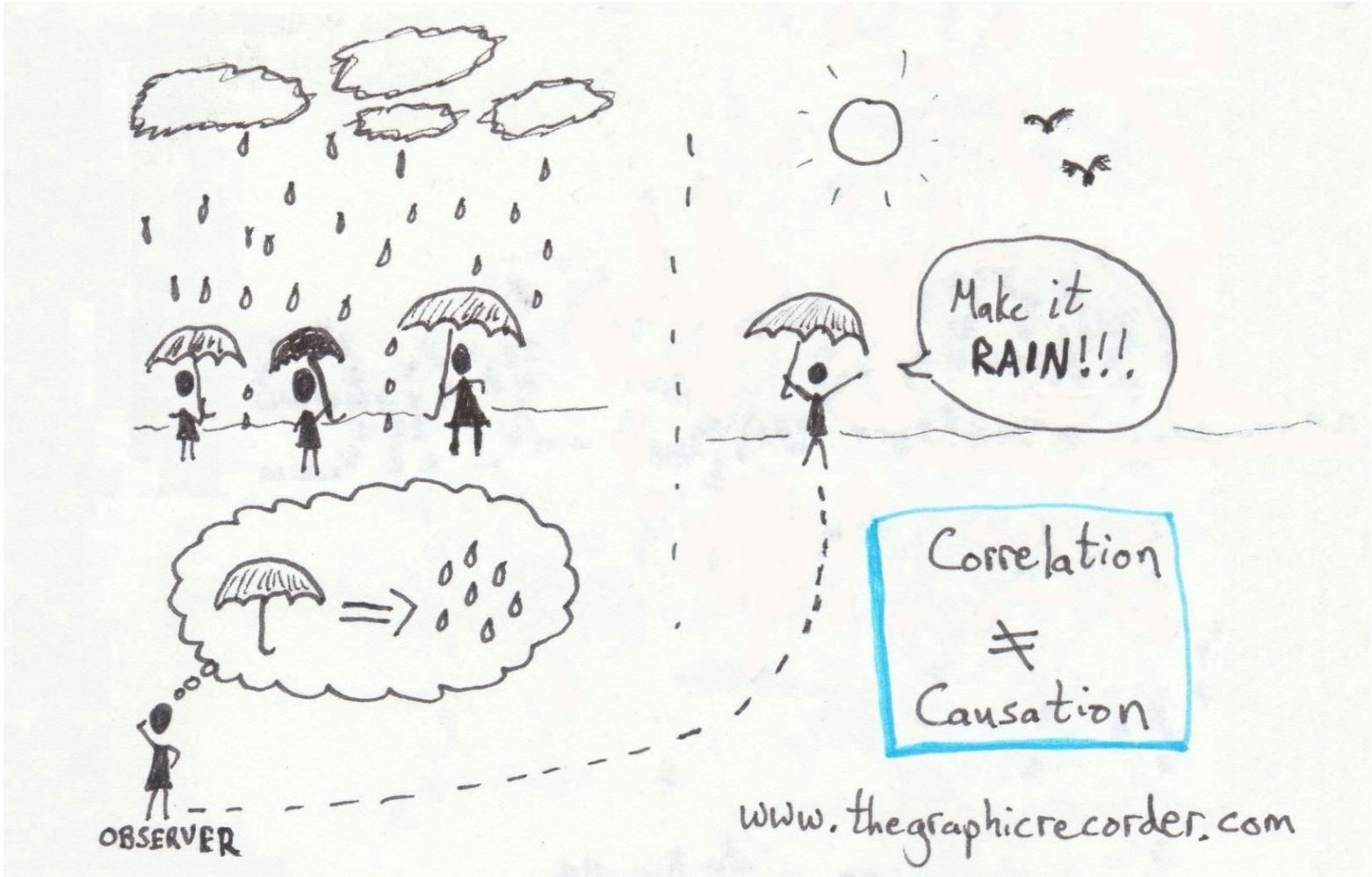
What is the mean of the following sample? 02, 10, 22, 12, 07, 06, 10, 18, 05, 22

What is the standard deviation of the following sample? 02, 10, 22, 12, 07, 06, 10, 18, 05, 22

Inferential Statistics

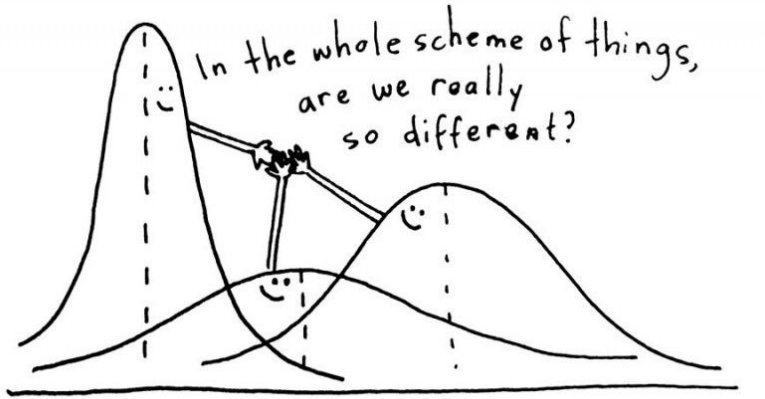
- Correlation: relationship or association between two variables
- “Correlation is not causation”
- Ranges from -1 to 1
- Strength of the correlation (Cohen 1992)
  - Small: +/- 0.1
  - Medium: +/- 0.3
  - Large: +/- 0.5




Make it RAIN!!!
Correlation ≠ Causation
OBSERVER
www.thegraphicrecorder.com

Inferential Statistics

- Chi-square: comparing categorical data
- T-test: comparing two groups
- ANOVA: comparing multiple groups



	Chi-Square	Correlation	Independent Samples T-Test	ANOVA
Predictor (IV)	Categorical	Continuous	Categorical (2 levels)	Categorical (2+ levels)
Outcome (DV)	Categorical	Continuous	Continuous	Continuous
Inference Made	The frequency of membership in a sub group	Strength and direction of the association	The mean difference between two groups across an outcome variable	The mean difference between two or more groups across an outcome variable
Sample Interpretation	There were more people who got high sleep and high test scores than low sleep and high test scores	The more hours of sleep a person gets, the higher their test score	The high sleep group has a higher mean test score than the low sleep group	The high sleep group has a higher mean test score than both the medium and low sleep groups

If I wanted to examine the differences between boys and girls on their coffee intake, which test would I use?

Chi-Square

T-test

ANOVA

Correlation

Inferential Statistics

- Linear regression analyses test multiple variables and how well they predict an outcome
  - Essentially combine t-test, anova, and correlation

$$\text{Math Score} = B_0 + B_1(\text{SES}) + B_2(\text{Hrs Sleep}) + B_3(\text{Pre-Test})$$

Statistical Tests

- P-value: the probability you would observe a difference of the magnitude obtained if there was really no difference
  - The probability we incorrectly find an association when there really isn't one
- If it is less than a certain threshold (alpha) we call the difference statistically significant (less than .05 or .01)
- Statistical significance tells us the difference we found probably isn't just by chance

We find that the difference between boys and girls in their coffee intake is t = 0.8673, p = 0.3868. Is it significant?

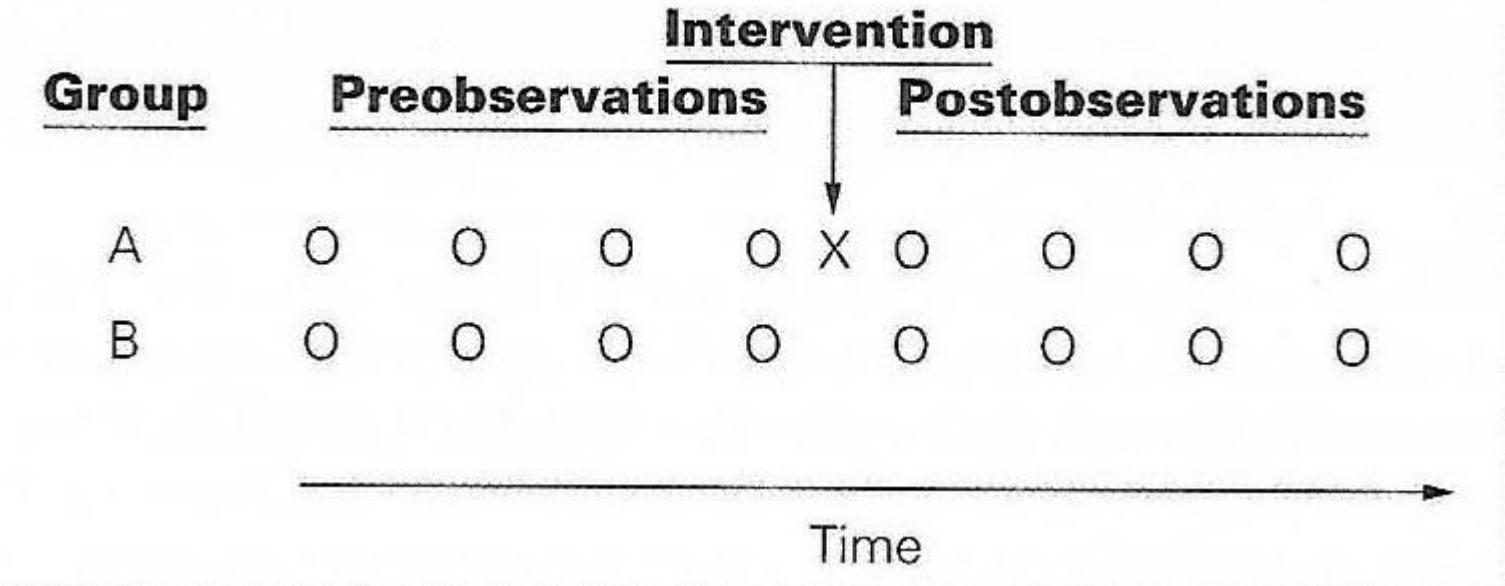
Significant

Not Significant

Research Designs

- Research designs are the strategies used to integrate the different parts of a study to effectively address the research problem
- Fall into different types including…
  - Case-study: in-depth study of a research problem
  - Exploratory: focused on gaining insights when there is limited prior research
  - Nonexperimental: investigates the relationships between variables (i.e., differences between groups or correlations between variables)
  - Quasi-experimental: attempts to make causal claims without random assignment
  - Experimental: can make strong causal claims by controlling confounds through random assignment (e.g., randomized control trials)

Research Designs



Data Collection

- Observations: watch for behaviors
  - Frequency-count recording, continuous observation, etc.
- Interviews: meet individually to discuss questions or topics
  - Structured, semi-structured, unstructured
- Focus groups: interview for groups
  - Structured, semi-structured, unstructured
  - Consider focus group interactions
- Surveys
  - Affective (e.g., personality), cognitive (e.g., math ability)

Measurements

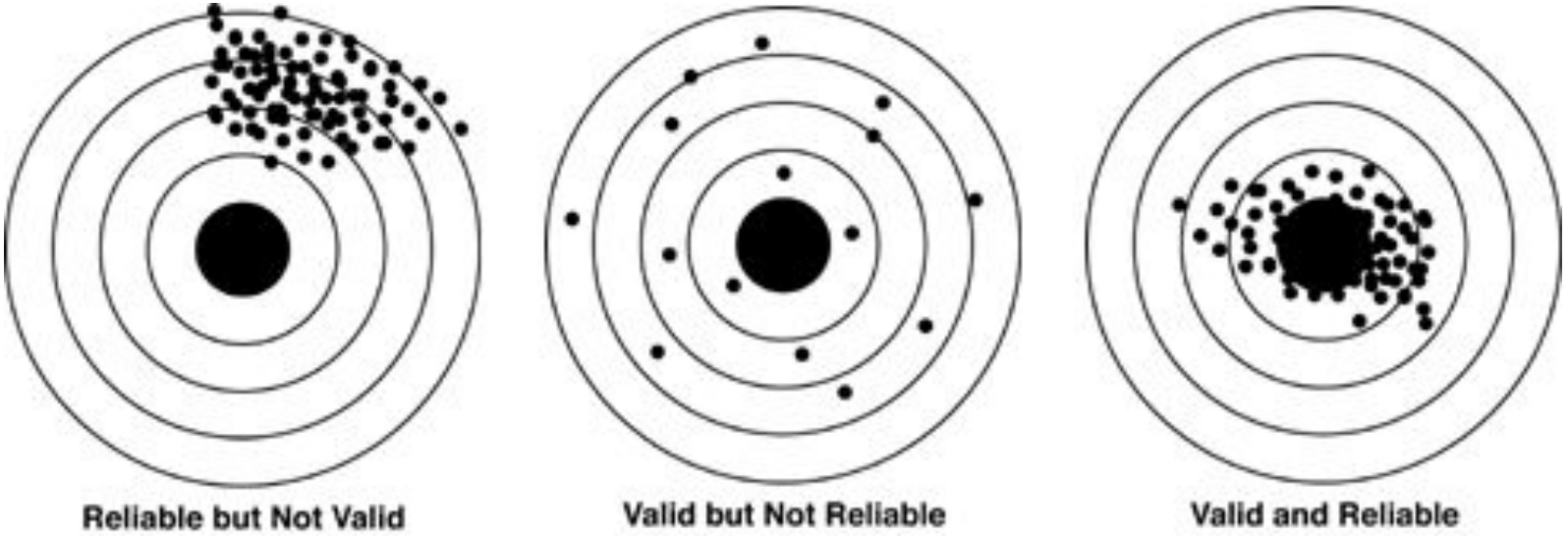
- Measurement: assigning numbers to represent amounts or levels of attributes, attitudes, beliefs, etc.
  - Assessments vs measurements

What can you physically measure about pizza?

What can you NOT physically measure about pizza?

Measurement

- Latent constructs: concepts, ideas, variables that are not physically observed
  - They're informed by "indicators" or variables that can provide inferences about the latent construct
- Validity: Can we make reasonable inferences based on the data obtained with the instrument?
- Reliability: Does the instrument produce the same score when used in similar situations?


Reliable but Not Valid
Valid but Not Reliable
Valid and Reliable

Measurement

- Other considerations:
  - Floors and ceilings (e.g., gifted students)
  - Fairness and objectivity (e.g., snowman in Florida)
  - Feasibility:
    - Time
    - Money
    - Appropriateness
    - Measurability