

Inferential Statistics:

Interpreting data

What you need to know:

- What are inferential statistics?
- Null and research hypotheses
- What is meant by statistical significance?
- What is an alpha level?
- What are Type I and Type II errors?
- Why might we fail to reject the null hypothesis?

- What statistic will you use for your data?
- What is an effect size?

What are inferential statistics?

- They are a tool used to determine whether or not there is a true relationship between variables or difference between groups
- They are grounded in **probability theory**.

Probability Theory

- procedures/rules used to predict events
- We can know what a probability distribution should look like for a particular event if things are 'normal'

Probability Theory

- We have a hypothesis about a difference between groups/relationship between variables
- We make a set of observations
- We then compare those observations to what we would expect if our hypothesis is wrong- if there are no differences between groups/relationship between variables

Inferential Statistics

- True score + random error
 - Random error will be responsible for some difference between groups/scores
- Inferential statistics determine if what we observe we could have observed by chance alone:
 - random error explains any differences or relationship

OR

 - there is a difference/relationship that is unlikely due to chance

Another view: Samples and Populations

- Samples are a subset of a population that we hope represents the population
- Inferential statistics help determine how likely it is we would obtain the same result using numerous samples

Null and Research Hypotheses

- The **null hypothesis** is that any difference/relationship we see is due to random error
 - H_0 : there is no difference between groups
 - H_0 : there is no relationship between variables
- The **research hypothesis** is that any difference/relationship observed is true of the population, is real
 - H_1 : there is a difference between groups
 - H_1 : there is a relationship between variables

What is meant by 'statistical significance'?

- Goal of research is to reject the null hypothesis and accept the research hypothesis
- If results are **statistically significant**, this means that we are rejecting the null hypothesis because there is a low probability that our difference/relationship is due to random error

What is the 'alpha level'?

- As researchers, we decide what probability level we will require in order to reject the null hypothesis. This probability is called the **alpha level** (e.g. .05, .01, .001)
 - If probability is low (.05 or less), reject the null hypothesis
 - If probability is high (over .05), fail to reject the null hypothesis
- The probability of obtaining a particular result is referred to as the p value

An example...

- Bargh, Chen, and Burrows (1996) puzzle study
 - Group 1: 15 students worked on puzzles containing stereotypes for elderly people
 - Group 2: 15 students worked on puzzles containing neutral words
 - DV: Mean walking time to get to elevator
- Results:
 - Group 1 $M = 8.28$ seconds
 - Group 2 $M = 7.30$ seconds
- A t-test gave the following result: $t(28) = 2.86, p = 0.0079$

What are Type I and Type II errors?

- Depending on whether we reject or accept the null, we may be making one of the following errors:
 - Type I: Made when the null hypothesis is rejected but the null hypothesis is actually true
 - Type II: Made when the null hypothesis is accepted although in the population the research hypothesis is true

		True state	
		Null is true	Null is false
Decision	Reject null	Type I error	Correct decision
	Accept null	Correct decision	Type II error

What does it mean if we fail to reject the null hypothesis?

What test will you use?

1. Correlations (Pearson r)
2. Comparing group means (t-tests: t , ANOVA: F)
3. Comparing percentages (Chi Square: χ^2)

What is an effect size?

- An effect size tells you, if you find a significant relationship or difference:
 - How strong is that relationship?
 - How big is that difference?
- All associations/differences are not equal

What is your effect size?

- Correlations- the r value is your effect size.
- Comparing means: Cohen's d

$$d = \frac{M_1 - M_2}{SD_{\text{(pooled)}}}$$
- Interpreting Cohen's d
 - 0.20: Weak/small
 - 0.50: Moderate/medium
 - 0.80: Strong/large