Factorial Design

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Introduction to Factorial Designs

- Most studies we've talked about are focused on the differences between two or more groups on a single outcome
  - Ex: Depression (Therapy vs Control) and Exercise Levels

Introduction to Factorial Designs

- Factorial designs are when you are interested in these variables and an additional variable where this relationship differs
  - can be quasi-experimental, experimental, or nonexperimental designs
  - written out as each variable included in the design with the number of conditions each variable has
    - Ex: Depression and Age Group (Adolescent vs Young Adult) and Exercise Levels
    - 2 x 2 factorial design

Introduction to Factorial Designs

- terminology for factorial designs include
  - IVs are commonly referred to as **factors**
  - study with two or more factors is a **factorial design**
    - **two-factor design** includes two factors
    - **single-factor design** includes one factor

Introduction to Factorial Designs

- **levels** or conditions are the number of groups for each IV/factor
  - Ex: Depression, Sex, Age Group (Adolescent vs Young Adult) and Exercise Levels
  - How many factors?
  - How many levels per factor? How would we describe the design with numbers? What would be call the design?

Main Effects & Interactions

- in your factorial design, you'll have at least two main effects and one interaction
- a **main effect** is the difference between the levels of one factor on your outcome
  - Ex: Depression and Age Group (Adolescent vs Young Adult) and Exercise Levels
  - What is a main effect from this example?
  - What is the second main effect?
  - What is the third main effect?

Interactions

- there is also an **interaction,** or when a relationship between one factor and the outcome depends on the second factor
- The inclusion of an interaction will change the value of the main effect because we are including more variables in the model
- However, you will still have your two main effects

Interactions

- Some instances, you can have a significant main effect or both
  - the inclusion of the interaction can cancel those out
- You can also have a significant interaction without any significant main effects

Interactions

- Ex: Depression and Age Group (Adolescent vs Young Adult) and Exercise Levels
  - An example of an interaction is:
    - Compared to those that did not receive therapy, participants that received therapy exercised significantly longer depending on whether they were adolescents or young adults
- We will talk about this in more detail since there are multiple ways that researchers conduct and interpret interaction findings

Alternative View of Interactions

- if both factors are independent of one another (they each have their own unique relationship with the outcome) then there will be no interaction
- The statistical tests we use can incorporate continuous and categorical variables
  - our analyses for our studies/experiments will only incorporate two categorical factors/IVs

Alternative View of Interactions

- to examine interactions visually (you should always look at your interactions), you will create either a line graph or bar graph with one factor on the x-axis and your outcome on the y-axis, while having different colors for your second factor
- don't let the visuals fool you
  - visuals can sometimes show an interaction, but the statistics are always right...most of the time
- Book: When two factors are graphed, the existence of nonparallel lines (lines that cross or converge) is an *indication* of an interaction between the two factors

Interpreting Main Effects & Interactions

- Be careful to only state what your significant findings tell you
  - An interaction can be significant, while main effects are not
  - If only looking at main effects, those may have been significant *until* the incorporation of the second factor and interaction

Interpreting Main Effects & Interactions

- Book: IV1: Amount of TV watched by children
  - IV2: Educational or Noneducational TV
  - Outcome: HS GPA

Independence of Main Effects & Interactions

- A two-factor study provides three different mean differences
  - Ex: Depression and Age Group (Adolescent vs Young Adult) and Exercise Levels
  - Average exercise for those that got therapy vs control
  - Average exercise for adolescents and young adults
  - The average of therapy group and control groups when they are adolescents and young adults

Types of Factorial Designs

- We have predominately focused on between-subjects designs
  - factorial designs can be created with various designs
- Factorial designs also do not need to have both factors be experimental variables
  - For your study, you'll have one manipulated factor and an additional factor of your choosing
  - It could be a between- or within-subjects factor or a combination, which would create a mixed factorial design

Types of Factorial Designs

- This allows researchers to create various designs
  - maybe you want a pretest-posttest but you also want to have different levels

Between-Subjects & Within-Subjects Designs

- a between subjects design allows for you to test multiple different treatment combinations
  - this can then require a lot of participants per condition
  - 2 x 3 design has 6 conditions and would need participants for each condition
  - removes influence of order effects

Between-Subjects & Within-Subjects Designs

- within-subjects designs can be factorial
  - this requires participants to go through 6 different conditions
    - issues of fatigue, boredom, and practice effects
- uses less participants since they get all the conditions

Mixed Designs

- includes a between-subjects and within-subjects factor into the design
  - common form of mixed factorial design

Mixed Designs

- Book: Examining the effect of acetaminophen on pain and pleasure
  - participants shown pictures of positive images and negative images
  - participants either got acetaminophen or a placebo
    - both sets of images were rated less extremely than the placebo
  - What is the within-subjects factor?
  - What is the between-subjects factor?

Experimental and Nonexperimental or Quasi-Experimental Research Strategies

- you can have both factors be experimental variables/manipulations
- for this class, you'll have one experimental variable and one nonexperimental variable
  - you can control for this however you'd like by fixing it in qualtrics or by hoping you get the number of participants you want for the nonexperimental variable (e.g., Sex)

Experimental and Nonexperimental or Quasi-Experimental Research Strategies

- a combination of experimental and nonexperimental variables is a **combined strategy**
  - can also have an experimental and quasi-experimental OR
  - quasi-experimental and nonexperimental