PSY 250

Chapter 8: Between Subjects Designs

Experimental Design: The Basic Building Blocks

- Experimental design
  - The general plan for selecting participants, assigning participants to experimental conditions, controlling extraneous variables, and gathering data.

Simple between subjects design

- One independent variable (single factor design)
- # of groups = # of levels of IV = # treatment conditions
- Different participants in different groups
- Each participant exposed to only one level of IV
- Allows only 1 score per individual (even if average)
- Look for differences BETWEEN groups

The Two-Group Design

- How many groups?
  - Although an experiment can have only one IV, it must have at least two groups (levels)
    - The simplest way to find out whether our IV caused a change in behavior is to compare some research participants who *have* received our IV to some others who have *not* received the IV
    - Thus, the *presence* of the IV is contrasted with the *absence* of the IV
    - If those two groups differ, and we are assured that we controlled potential **extraneous variables**, then we conclude that the IV caused the participants to differ.

The Two-Group Design

- Experimental group
  - the group of participants that receives the IV.
- Control group
  - the group of participants that does not receive the IV
- E.g.
  - DV: Aggression in child's behavior with doll
  - IV: Exposure to :
    - Group A: Violent Images on TV
    - Group B: No TV images

The Two-Group Design

- Or Compare Two (or more) Experimental Groups
  - Different levels of violence in images (high or low) or (neutral vs. violent)
  - Could have 3 groups: No TV, Neutral TV, Violent TV

The Two-Group Design

- Equivalent Groups
  - Random Assignment
    - each participant has an equal chance of being in any group (created equally)
    - Composed of equivalent individuals
    - *not* the same as random selection
    - Restricted random assignment – groups must be equal in size
  - Treated Equally

The Two-Group Design

- Independent groups
  - The participants in one group have *absolutely no* ties or links to the participants in the other group.
- Between-subjects comparison
  - Refers to a contrast between groups of participants who were randomly assigned to groups.

The Two-Group Design

- Confounded experiment
  - An experiment in which an extraneous variable varies systematically with the IV.
  - Confounding makes drawing a cause-and-effect relation impossible.
  - Confounding may occur if participants are *not* equal before the start of the experiment.

The Two-Group Design

- Nonrandom Assignment to Groups.
  - Random assignment tends to create equal groups in the long run.
  - As groups get larger (at least 20), we can place more confidence in random assignment achieving what we want it to.
  - If we are faced with a situation in which we have few potential research participants (5 or less) and we are worried that random assignment may not create equal groups, what can we do?

The Two-Group Design

- Holding Variables Constant
  - Use participants of all one gender or exact same IQ
- Restricting Range of Variability
  - Restrict participants to IQ range of 100 and 110
- But limits…what??

Advantages of Between Designs

- Each score is independent
- Not susceptible to:
  - Practice or experience gained in other treatments
  - Fatigue or boredom
  - Contrast effects

Disadvantages

- Large # of participants
  - Esp. problematic with special populations
- Environmental Confounds
  - Characteristics of environment that might vary between groups
- Individual Differences
  - Can become confounding variables
    - Assignment bias
  - Can produce high variability in scores

Comparing Two-Group Designs

- Error variability
  - Variability in DV scores that is due to factors other than the IV – individual differences, measurement error, and extraneous variation (also known as *within-groups variability*).
  - It is important to reduce error variability because all statistical tests reduce to the following formula:

$$\text{statistic} = \frac{\text{between-groups variability}}{\text{error variability}}$$

  - **The possibility of a result occurring by chance decreases as the value of your statistic increases**: *increase* the between-groups variability or *decrease* the error variability.
  - **The larger your test statistic the more likely a significant result**

Variability

- Statistical value that measures the size of the differences from one score to another
- All similar scores = small variance
- Big differences = large variance
- Group A

  90 100 100 110 110 100
- Group B

  70 100 130 70 100 130
  - 10 pt diff. more substantial for group A
  - More variance in group B

Variance cont.

- Differences BETWEEN groups are desired
- So… increase diff. between group conditions
- Variance = background noise
- Difficult to see real treatment effect with large variance
- Individual differences – large variance
- So… big differences WITHIN group are bad
- Variance must be equal between groups

Minimizing Within Treatment Variance

- Standardize procedures and treatment setting
- Limit individual differences
  - Hold participant variable constant or restrict its range
- Increase sample size
  - But not as effective
- Also beware of limits on:
  external validity

Additional Confounds in Between Subjects Designs

- Differential Attrition
  - May lead to diff. characteristics within groups
- Diffusion or Imitation of Treatment
- Compensatory Equalization
- Compensatory Rivalry/John Henry effect
- Resentful Demoralization

Statistics

- With two groups
  - Can maximize differences between treatments
  - Easy to interpret significant effects
  - But little information – may get wrong picture
- More than two groups
  - May blur distinction between groups

Two or More Groups?