

# Between-subjects Designs

PSY 4433

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# Between-subjects Design

- **Between-subjects** designs are when you obtain scores from different groups of participants
  - control and (multiple) treatment groups
  - only receive one condition (either treatment or control/placebo)
- **Between-subjects experimental designs** are when the researcher manipulates an independent variable

# Independent Scores

- each individual has their own score
  - each condition/group should have roughly the same amount of participants
  - different participants in each condition
- How many participants do you have in each condition if you have 80 total participants?
- For certain variables (demographics), you'll have single scores for each participant
  - construct measures will have several questions about the construct, which will need to be created into composite scores

# Advantages of Between-subjects Designs

- biggest pro is that each individual provides their own scores
- only measuring participants once
  - because of this, often called **independent-measures experimental designs**
- other factors that could influence **within-subjects designs** are
  - practice effect
  - fatigue/boredom
  - contrast effects (order of treatments can dictate the manipulation)
- robust because it can be used in several different scenarios

# Disadvantages of Between-subjects Designs

- you need more participants for these designs
- if conducting a power analysis, you may be under-powered to conduct your experiment
  - need approximately 20 participants per variable in your analyses
- not useful for special populations
  - Ex: wanting participants that are left-handed as your sample
- What other populations may be difficult to collect enough data from for each group?
  - Think about the participants you are interested for your project?
  - Do you have any inclusion/exclusion criteria
- issues with individual differences in conditions

# Individual Differences

- **individual differences** are the differences between participants
    - not a concern until differences are found between groups
  - individual differences can become a confounding variable
    - educational content (phone app, brochure) --> eating habits
    - if one group is significantly different in your outcome (eating healthier) than the other group, great!
    - cultural components, higher proportion vegetarian, age and technology
1. groups can be different
  2. individual differences within groups can have more variability
- Participants can read questions differently
    - Ex: Do you eat healthy?

# Confounding Variables from Individual Differences

- Want to make sure your groups are as even as possible
  - age, sex, etc.
- confounding can occur from
  - individual differences
  - environmental variables
  - when the environment changes (rooms, temperature, lighting, distractions, etc.)

# Equivalent Groups

- you'll want your groups to be as equivalent as possible
  - in both sample size and in other extraneous variables
- Groups should be
  - created equally (obtaining participants)
  - treated equally (except for treatment, everything should be equal)
  - composed of equivalent individuals (participants in each condition should be similar)



# Limiting Confounding Variables by Individual Differences

- Random assignment
  - any random way to assign participants to one group/condition
  - must be equal chance of being control or treatment
- minimizes chance of individual differences
- **restricted random assignment** is when the assignment process is limited to ensure that groups are equal size
  - should get equal groups that due to randomization, are equal in other individual characteristics

# Matching Groups

- there may be times when some variables can influence participants' scores
- **matching**, or the process of assigning participants to groups based on a confounding variable, so that the final groups are balanced and equivalent
  - used when believed a variable could throw off the true difference between groups
- Ex: worried that age could be a factor when separated into groups, you can make sure that participants are matched in both groups by age
  - Think about your own project and something that could influence your groups
  - you may need to match based on a variable

# Restricting Range of Variability

- incorporating some type of inclusion/exclusion criteria to hold a potential confounding variable constant
  - we talked about constant in regard to design (environment), now we can think about other variables
- Ex: only want to see the relationship between IV and DV in Psychology only students (maybe Statistics test)
- you can also think about restricting the variation/variability around a variable of interest
  - maybe I only want to see those that have never taken statistics or those that took it a year or greater ago

# Recommendations

- random assignment will handle most issues
- read past literature to know if a similar study had some issues
  - descriptive statistics of the groups
  - Means, standard deviations, range, etc.
- maybe age is a potential confounding variable that was seen in a past study, therefore, you should maybe only use a certain age group (restricting range) or match groups based on age

# Individual Differences & Variability

- **variance** or variability is the statistical value for the average distance of values around the mean
  - low variance = scores roughly around the mean
  - high variance = scores separated all over the place
- Group 1:  $M = 24$ ,  $SD = 30$
- Group 2:  $M = 24$ ,  $SD = 1.5$
- variance within groups is the amount of variability that is from individual differences
  - group 1 shows that while the average age of the group is 24, there is a lot of variability around that age

# Differences Between Treatments & Variance Within Treatments

- for your study, you want to find differences between treatments
  - some proof that your treatment is better *or worse* than the control group
- **variance within groups** or **variance within treatments** is not desirable
  - 
  - means that individuals in those groups are not similar to one another
  - don't want them exactly the same but similar enough

# Minimizing Within Treatment variance

- standardize procedures and treatment settings
  - scripts
  - groups are treated equally
  - reflect on experiment procedures
- limit individual differences
- random assignment and matching
  - useful, although not perfect, theoretically groups could still be different
- sample size
  - larger samples reduce high variance
  - not the most useful technique for reducing variation in groups
- useful to have preliminary tests/results

# Threats to Internal Validity

- internal validity is essentially how your experiment controls for everything and is only looking at a true cause and effect relationship
- two threats
  - confounding to individual differences between groups
  - confounding from environmental variables



# Differential Attrition

- **attrition** is when participants withdraw from the study before its completed
  - if consistent between groups, then you are still okay
- **differential attrition** is when attrition levels differ from your conditions/groups
  - direct threat to internal validity
- one time point will not result in high attrition
  - mainly an issue for pre-post designs, longitudinal designs, or interventions
- attrition can be handled with statistically but that is not perfect

# Attrition

- if you have a study that is multiple time points, you
  - may have participants that are motivated to continue
  - have those that want to get the benefits of an intervention
  - lose participants that are no longer interested
- this separates your groups and you no longer know whether your intervention is the cause to whatever outcome you are studying
- What can you do to get people from leaving too early?
  - send out reminders for study (phone calls, emails, social media)
  - SOME will state that you remind them they don't get compensation (may organize your compensation to get a bonus for staying)

# Communication Between Groups



- Don't let your participants talk to one another!
- When debriefing, inform them not to talk to other participants until the end of the experiment's duration (End of spring semester)

# Communication Between Groups

- **diffusion** refers to the spread of a experimental treatment to the control group
  - reduces the potential effect on the outcome
- **compensatory equalization** is when participants in the control hear about the benefits from the treatment group and they want the same treatment
  - this alone can be the end of your experiment
  - if treatment is something interesting, participants may want the interesting treatment rather than doing nothing
  - double-blind experiments stop this because no one knows what participants are receiving

# Communication Between Groups

- groups can also change behavior when learning of another
  - groups may state responses more aligned with other groups because the other group is getting special treatment
  - **compensatory rivalry**
- groups may also just stop caring about the study when they learn others get special treatment
  - **resentful demoralization**