Methods

Methods: What we’ll cover
- Research designs: Observational, experimental
- Characteristics of experimental designs:
  - There is some kind of manipulation
  - Can be between participants or within participants
  - Variables: Independent, dependent, confounding
    - Variables have to be operationally defined
  - There are types of validity: Internal, external, construct
  - Given variability in data, we need inferential statistics

Research designs
- Observational designs
  - Researcher studies the world as it is (more or less)
  - Examples include case studies, correlational studies, and quasi-experiments
- Experimental designs
  - Researcher manipulates the world, somehow
  - Then measures the effects of the manipulation

What is an experiment?
- An experiment involves a manipulation
  - If you can identify a manipulation, the design is an experiment. If you can’t, it isn’t.
- Researcher manipulates the independent variable, creating different conditions
  - Ideally, the conditions should match on all variables other than the manipulated one
  - Then measures the effects on the dependent variable, by comparing conditions

Elements of an experiment
- A variable: Something whose value can change
  - Light exposure, rape survivor decisions, family environment, amount of practice, ...
- Independent variable: What you manipulate
  - Each value is a level, helps define a condition
  - If there are two independent variables, each with two levels, how many conditions?
    - $2 \times 2 = 4$
- Dependent variable: What you measure
  - “Depends” on the independent variable

Elements of an experiment
- Confounding variable: A variable that doesn’t match across groups
  - ... and isn’t an independent variable
  - A good design has as few confounds as possible
Example 1

- Independent variable(s)?
  - Hormone (levels: ghrelin vs. control)
  - Picture type (levels: food vs. non-food)
  - Conditions:
    * ghrelin-food, ghrelin-nonfood, control-food, control-nonfood
- Dependent variable(s)?
  - Brain activation while looking at pictures
  - Memory for the pictures after seeing them

Example 1

- Possible confounding variables?
  - Suppose only the ghrelin group got an injection
    * The injection itself could affect appetite
    * So give a sham dose to control group
  - Suppose the groups were run at different times
    * Control group @ 10am
    * Ghrelin group @ 11am
    * Ghrelin group may be growly before lunch
    * Have to control for time of day

Internal validity

- An experiment has good internal validity if there are no obvious confounding variables
  - So the conditions are as closely matched as possible at the start of the experiment
  - Lets you conclude that the manipulated variable caused any condition differences

Two types of manipulations

- Between participants
  - Each participant participates in only one level
  - Participants are randomly assigned to levels
- Within participants
  - Each participant participates in all levels
  - Each design matches levels in different ways
    * And has different strengths and weaknesses

Between-participants manipulation

- Participants are randomly assigned to levels
  * For each participant, flip a coin
- Random assignment helps cancel differences
  * Suppose someone shows up at the experiment very hungry
  * With random assignment, each condition should have roughly equal numbers of hungry people
  * If the sample is large enough

Within-participants manipulation

- Each participant participates in all levels
  * So in one sense, the levels are perfectly matched
- But participating in one level may change you for the other levels
  * E.g., they’ve already seen the pictures once
    * So need different sets of stimuli
  * E.g., your first visit to the lab may change your attitude toward the second
    * So counterbalance: Different participants experience the levels in different orders
Example 1

- They may have used a mixed design
  - Hormone manipulated between participants
  - Picture type manipulated within participants

Example 2

- Independent variable(s)?
  - Virtual scene type (alcohol vs. neutral)
- Dependent variable(s)?
  - Level of craving

External validity

- A study has good external validity if it reflects the world as it is
  - In terms of participants, materials, and procedure
  - Lets you conclude that the results apply to situations we care about
- Example 2:
  - Claim was that external validity was high because they used virtual reality and smells

Example 3

- Question: Which are more aggressive, boys or girls?
- Can we answer this with an experiment?
  - No: Can’t manipulate a child’s sex
  - The design has to be a quasi-experiment
    - Like a between participants design, but groups are intact
    - Have to be especially concerned about confounds

Defining a variable

- Definition should be operational
  - There are specific rules for measuring it
  - E.g., Rules for measuring aggression
- Definition should have construct validity
  - The variable should measure the construct you’re interested in
  - E.g., Do we count playful acts that only simulate aggression?