Methods

Methods: What we’ll cover

- Research designs: Experimental, observational
  - Experimental designs:
    - Defining characteristic: A manipulation
    - Variables: Independent, dependent, confounding
    - Manipulations: between- vs. within-participants
    - Validity: Internal, external, construct
    - Defining a variable: operational definitions
    - Variability in data and inferential statistics
  - Observational designs:
    - Quasi-experiments, correlational studies

Research designs

- Two broad classes
  - Observational
    - Researcher studies the world as it is (more or less)
    - Quasi-experiments, correlational studies, case studies
  - Experimental
    - Researcher manipulates the world, somehow
    - Then measures the effects of the manipulation

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
  - Measures effects of the manipulation 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
  - Conditions are as closely matched as possible at the start of the experiment
  - So you can 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 Alice shows up at the experiment 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 that person for the other levels
  - E.g., they’ve already seen the pictures once
    - So need different sets of stimuli
  - E.g., an injection 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 between participants
  – Picture type 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
  – Let us 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