Announcement

• Class is canceled Tuesday 9/20
  – Syllabus on course webpage is updated

Methods

Defining a variable

• A definition should be operational
  – Give specific rules for measuring it
  – E.g., rules for measuring aggression
• A 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?

Operationalizing aggression

• Could have an observer count aggressive acts
  – Possible problem: Observer bias
    • Observers may expect boys to be more aggressive
• Could have kids report their aggression level
  – Possible problem: Demand characteristics
    • When participants perceive the situation as “demanding” a particular kind of response
    • Boys may think it’s good to be aggressive

Hypothetical results

• From 32 boys and 32 girls:
  – Boys’ aggression score = 17.6
  – Girls’ aggression score = 13.5
• Can you conclude, based on this difference alone, that boys are more aggressive?
  – No: also need to factor in the variability in aggression scores within each group

Variability

In which sample is the difference in means less likely to have occurred by chance?
Inferential statistics

- The larger the difference in means, relative to the variability within conditions, the lower the probability $p$ that the difference occurred by random chance
- A difference in means is statistically significant if $p$ is below a threshold
  - By convention, threshold is .05 (or 5%)
  - E.g., “the difference in mean aggression scores was significant, $F(1,30)=6.5, p<.05$.”

Was this an experiment?

Correlational studies

- Correlation: two variables changing together
- Causation is more difficult to establish than with experiments
- Often, causal arrow could point either way
  - E.g., less independence $\rightarrow$ more loneliness
  - People with larger parietal cortex have higher IQ

- Often, the cause could be a third variable:
  - Smart people could have high GPAs and know they should exercise
  - E.g., drowning deaths and ice-cream consumption

- To establish causation, it helps to identify a mechanism
  - Smoking and cancer, greenhouse gasses and global warming

Memory and studying
Testing effect

(Karpicke & Roediger, 2008, Science)

- Questions:
  - Can testing help you retain material?
  - How accurately can we predict our own test performance?

Method

- Materials: 40 Swahili-English word pairs
  - E.g., mashua → boat
  - Paired associates ("items")
- Procedure:
  1. Learning phase, all in one day
  2. Immediately after learning: Judgments of learning
  3. One week later: Final test

Learning phase

- 8 periods: S T S T S T T
  - S=study period, T=test period
  - 30 sec of distracting activity after each S

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Conditions

Four between-subjects conditions

ST:
- Studied all 40 items in every S
- Tested all 40 items in every T

SnTn:
- If you recalled an item in a T, it was dropped from all later Ss and Ts
  - [n = non-recalled only]

Judgments of learning

- Right after learning phase, each participant was asked to predict how many items he or she would recall in a week
  - Average predicted number (out of 40):
    - ST: 20.8
    - SnTn: 20.3
    - SnT: 20.4
    - STn: 22.0
  - i.e., predicted recall was about .5 (proportion)
  - No significant differences between conditions
Recall after a week

Results

- Testing helps retention
  - A lot – at least with these materials
  - And studying more doesn’t
- In a way participants couldn’t predict for themselves very well

External validity

- Replicates with more complex materials and more realistic tests
  - Typing out a summary of a scientific text is better than doing a concept map (Karpicke & Blunt, 2011)
- Testing some material enhances memory for related material (Chan, McDermott, & Roediger, 2006)
  - Important, because we usually don’t know exactly what will be on the test
- Self-testing while studying is probably a good strategy

Evidence-based study tips

- Self-test while you’re studying
- Space out your studying over time
  - Learning lasts longer than when you cram