Methods
Memory and Studying

Defining a variable
• A definition should be operational
  – Should give specific rules for measuring it
  – E.g., rules for measuring aggression
• A definition should have construct validity
  – The variable should measure what you think you’re measuring (the “construct”)
  – E.g., do we count playful acts that only simulate aggression?

Operationalizing aggression
• 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
• Could have an observer count aggressive acts
  – Possible problem: Observer bias
    • Observers may expect boys to be more aggressive

Hypothetical results
• Hypothetical aggression scores for 32 boys and 32 girls (higher is more aggressive):
  – Boys = 17.6
  – Girls = 13.5
• Can you conclude, based on this difference alone, that boys are more aggressive?
  – No: need to factor in the variability in aggression scores within each group

Variability

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”.
Correlational studies

- Correlation: two variables changing together
- **Correlation is not causation**
  - Direction of causation
  - Third-variable problem
- Direction of causation
  - More loneliness → less independence, or
  - Less independence → more loneliness? (or both?)
  - Another example: *Larger parietal cortex, higher IQ*

Methods: What we covered

- 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

Memory and studying
Testing effect
(Harjuoke & Koeck, 2006, 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
  – Called paired associates (or just "items")
• Procedure:
  1. Learning phase, all in one day
  2. Immediately after learning: Judgment of learning
  3. One week later: Final test

Learning phase
• 8 periods: S T S T S T S
  – S=study period, T=test period
  – 30 sec of distracting activity after each S

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Variables
• Independent variables:
  – Items studied (all vs. nonrecalled)
  – Items tested (all vs. nonrecalled)
  – Manipulated between participants
• Dependent variable:
  – Judgment of learning
  – Proportion recalled on final test

Conditions
Four between-subjects conditions
ST:
  Studied all 40 items in every S
  Tested on 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]

Conditions
SnT:
  If you recalled an item in a T,
  it was dropped from all later Ss
STn:
  If you recalled an item in a T,
  it was dropped from all later Ts
Judgments of learning
• After the 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 helped retention
  – A lot (with these materials, and this sample)
  – And studying more doesn’t
• Participants couldn’t predict this effect
  – Not reflected in judgments of learning

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 material enhances memory for related material (Chan, McDermott, & Roediger, 2006)
  – Important, because we usually don’t know exactly what will be on the test

Evidence-based study tips
• Self-test while you’re studying
• Space out your studying over time
  – Another effect: the spacing effect
  – A given amount of time spent studying helps more for long-term learning if you spread it out in time