Describing your experiment

Experimental Research

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Last week

- Walked through different aspects of estimators (functions to estimate population quantities)
  - Unbiasedness
  - Consistency
  - Efficiency
- Proved that the sample mean is an unbiased estimator of the population mean
- Relation between sample mean and computation of average treatment effects within samples
- Introduced sampling theory
  - Sampling distributions
  - Central limit theorem
  - Standard errors, confidence intervals, and margins of error

Last week

- Standard deviation vs. standard error
- How do we improve precision?
  - Sample size
  - Reducing variation in our outcome
- What is the purpose of covariates?
  - Assessing experimental balance
  - Improving precision
  - Assessing conditional average treatment effects

Research question

- In your non-human subjects experiment, you likely started off with a research question
  - How long does it take for water to boil with and without salt?
  - How many techno songs are recommended if I search for deep house vs. drum and bass?
  - Am I happier if I walk in the morning or at night?
- Political science research questions
  - How do people's beliefs affect their retention of new information?
  - How do different political institutions contribute to corruption?

Hypothesis

- Your best guess or expectation based on previous evidence or theory
  - How long does it take for water to boil with and without salt?
    - I expect salt to raise the boiling point, therefore pots with salt and water will boil faster than those without.
  - How many techno songs are recommended if I search for deep house vs. drum and bass?
    - I expect a larger share of techno songs to be recommended if I search for drum and bass vs. deep house because D&B has more in common with techno than deep house.
  - Am I happier if I walk in the morning or at night?
    - I expect my self-assessed happiness to be higher in the morning than at night because I generally dislike waking up but enjoy walking around the neighborhood.

Hypothesis

- Political science research questions
  - How do people's beliefs affect their retention of new information?
    - Previous research suggests that people who have strong priors about politics may be less responsive to new information, whereas those with weaker priors may be more responsive.
  - How do different political institutions contribute to corruption?
    - Previous research suggests that unitary governments exhibit higher levels of corruption than federal governments. Therefore, in my data set, we should expect countries with …

Data and Methods

- Treatment
  - Salt, political institutions, information
- Outcome
  - Time, corruption, beliefs
- Measures
  - Seconds, expert-assessed corruption scores (0-10), Likert item
- (Experimental) Unit
  - Pots, countries, people
- Setting
  - Columbia apartment, sample of K countries, online survey

Analysis

- Compute the average treatment effect
  - ATE = Mean among treated units - mean among untreated units
    - Mean boiling time (with salt) - Mean boiling time (without salt)
    - Mean belief support (with new information) - mean belief support (without)
    - Mean corruption score (with unitary) - mean corruption score (with federal)
- Compute the standard error
  - Obtain the standard deviation for treated and untreated units
  - $$SE(\hat{A}TE) = \sqrt{\frac{Var(Y_1)}{N_1} + \frac{Var(Y_0)}{N_0}}$$
  - Variance in boiling time (with salt), variance in boiling time (without salt), treated sample size (number of pots with salt), untreated sample size (number of pots without salt)

Analysis

- Suppose you estimate an ATE of -4.5 seconds for the salt vs. no salt experiment and obtain a SE of 1.2 seconds
- What is the 95% confidence interval?
- Is the number zero between the lower and upper interval?
- Example write-up:
  - Adding salt to a pot reduces the boiling time by 4.5 seconds (ATE = -4.5s; SE = 1.2s; 95% CIs = [-6.85, -2.15]).

Designs