Research Design

17.871
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General Comments

• The road map of political science
• Different ways of doing political science research
• Major components of research designs
• Designing research to ferret out *causal* relationships
• Social science vs. natural science/engineering
The Road Map

- Theoretical
  - Philosophy
  - Normative
  - Positive

- Empirical
  - Causal (Experimental)
  - Correlational (Observational)
  - Descriptive
Major Components of Research Designs

• Research question
• Theory
• Data
Research Question

• Important
  – Not too general
  – Not too specific
  – Just right

• Contribute to literature
  – How to tell: Social Sciences Citation Index
  – E.g.: effect of redistricting on congressional election results
    • Search for Cox & Katz, “The Reapportionment Revolution and Bias in U.S. Congressional Elections,” AJPS 1999
Theory

• Definition: A general statement of a proposition that argues *why* events occur as they do and/or predicts future outcomes as a function of prior conditions

• General/concrete trade-off

• Desirable qualities of theories
  – Falsification (Karl Popper)
  – Parsimony (Occam’s razor)
Data

• More on this later, but first some basic terms:
  – Cases
  – Observations
  – Variables
    • Dependent variables
    • Independent variables
    • Confounding (lurking) variables
  – Units of analysis
Causality

• Definition of causality
• Problems in causal research
• Campbell and Stanley
Definitions of Causality

• Logical
  – A causes B if the “presence” of A is a sufficient condition for B.

• Experimental
  – A causes B if B occurs following the “exogenous” introduction of A
  – When does exogeneity occur?
    • Classic experiments
      – Ansolabehere & Iyengar on negative campaign ads
    • “Natural” experiments
      – Voting machines in Georgia & Massachusetts
      – Village councils in India
  – When does it not occur?
    • Typical research in previous examples
    • Anything strategic (prices, deterrence, campaign spending)
The Biggest Problems in Causal Research

• Establishing the exogeneity of “causes” in observational/correlational studies
  – Selection into “treatment” and “control” cases rarely random
    • Medical examples
    • Schooling examples (private vs. public)
    • Freshman special programs example

• Jointly determined relationships
  – Prices/quantities in markets
  – Spending/(expected) votes in elections
  – Armaments/level of violence in international systems
How to Establish Causality

• Donald Campbell and Julian Stanley, *Experimental and Quasi-Experimental Designs for Research* (1963)
Design types

- Pre-test/post-test with control group
- Solomon four-group design
- One-shot case study
- One-group pre-test/post-test
- Static group comparison
- Post-test only experiment

[Running examples: voting machine effects]
Pre-test/Post-test Control Group

• Summary:
  \[
  \begin{array}{c|c|c|c}
  R & O^1_T & X & O^2_T \\
  \hline
  R & O^1_C & & O^2_C \\
  \end{array}
  \]

• Effect of treatment:
  \[ [O^2_T - O^1_T] - [O^2_C - O^1_C] \]

• This is the classic randomized experiment

• Problem: “Hawthorne effect”
  – Placebo helps mitigate
Solomon Four-Group Design

• Summary:

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• Allows you to control for the effect of the experiment itself
One-shot Case Study

• Summary:
  X O
  or
  O X
• Journalism
• Common sense
• “of no scientific value”
One-group Pre-test/Post-test

• Summary:
  O  X  O  O

• “Historical control”
• Better than nothing
• Standard way of doing most research
• Big problems
  – No comparison group
  – No random assignment
    • Encourages “samples of convenience”
Static group comparison

• Summary:

\[
\begin{array}{ccc}
X & O^2_T \\
\hline
O^2_C \\
\end{array}
\]

• This is most cross-sectional & correlational analysis

• Problems
  – Selection into the two groups
  – No pre-“treatment” measurement

Imaginary Article adding Cambridge, Somerville, plus cities that don’t have Sunday liquor openings
Post-test only experiment

• Summary:

  R   X   O
  R
  R   O

• No prior observation (assume $O^1_T = O^1_C$)

• Classical scientific and agricultural experimentalism
Where do standard political science studies fall among the Stanley/Campbell designs?

• One-shot case study
  – Little scientific value, but may be descriptively useful
• One-group pre-test/post-test
  – Often used in policy analysis
  – Only justified as a “best design” if there are ethical or other constraints
• Static group comparison
  – Correlational studies by far the most common “scientific” social science research
• Pre-test/post-test with control group
  – “Real” experiments uncommon, but growing in frequency
  – “Quasi-experiments” growing more rapidly
• Solomon four-group design
  – Don’t recall ever seeing this
• Post-test only experiment
  – Leads to weaker statistical tests
What are the Implications for My Research?

• Classical experimentation unlikely, but always preferred (never had one)

• Strive for “natural” or quasi-experiments
  – Alternating years of standardized testing
  – Ruling death penalty unconstitutional
  – Imposition of new voting machines
  – 9/11 terrorist attacks

• Gather as much cross-time data as possible (panel studies)

• If you have a pure cross-section, be humble