Lecture 13:
Quasi-Experimental Designs

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Non-random Assignments

- Random assignment not always possible
- Alternative approaches serve as approximations
- Quasi – same except for randomization
- Basic presumption: groups are non-equivalent
  - Result: internal validity threatened by a full range of threats
- Three classes of designs
  - Non-equivalent group designs
  - Interrupted time-series designs
  - Correlational designs

Non-equivalent Group Designs

- Most widely used in quasi experiments
- Pre/post measures on treatment/control
- Problem: expect subjects in different groups to differ because assignment not controlled
  - Must make assumptions about variables
- Alternatives
  - Randomization after assignment into treatment and control if sample mandated
  - Match groups as closely as possible
  - Non-volunteers as wait-list; compare against volunteers
  - Compare different amount of treatments

Interrupted Time Series

- Effects of treatments are inferred
  - Compare outcome measures at different time intervals
    - A single data point for each point in time
  - Before and after treatment is introduced
    - A clear dividing line at the beginning of treatment
  - Four considerations
    - Need a sufficient number of data points
    - Same units thru-out equally spaced
    - Sensitive to the particular effects being studied
    - Measurements should not fluctuate

Box-Jenkins Procedure

- Auto-regressive integrated moving average
- Aim: identify underlying model of serial effects
  - Abrupt change at point of treatment
  - Gradual constant changes in levels
  - Abrupt change but lasting only a short while – a pulse
- Assumptions
  - The series of observations must be stationary
    - Fluctuate around the mean rather than drift
    - Secular trend handled by differencing
      - ✓2 3 4 5 6 -> 1 1 1 1 1
  - *Autocorrelation*
    - Dependence or independence of observations o each other
    - Regular: adjacent observations on one another
    - Seasonal: observations separated by a period

Single Case, Small N

- N=1, single case
  - Widely used to evaluate effects of behavioral control treatments
  - Widely use in SWE
  - Problematic to call these experimental – randomization not a consideration at all
- Argument
  - Subjects serve as own controls
    - Behavior monitored as treatment effects replicated over time
    - Changes in patterns of performance are basis for inferences about treatment

Single Case, Small N

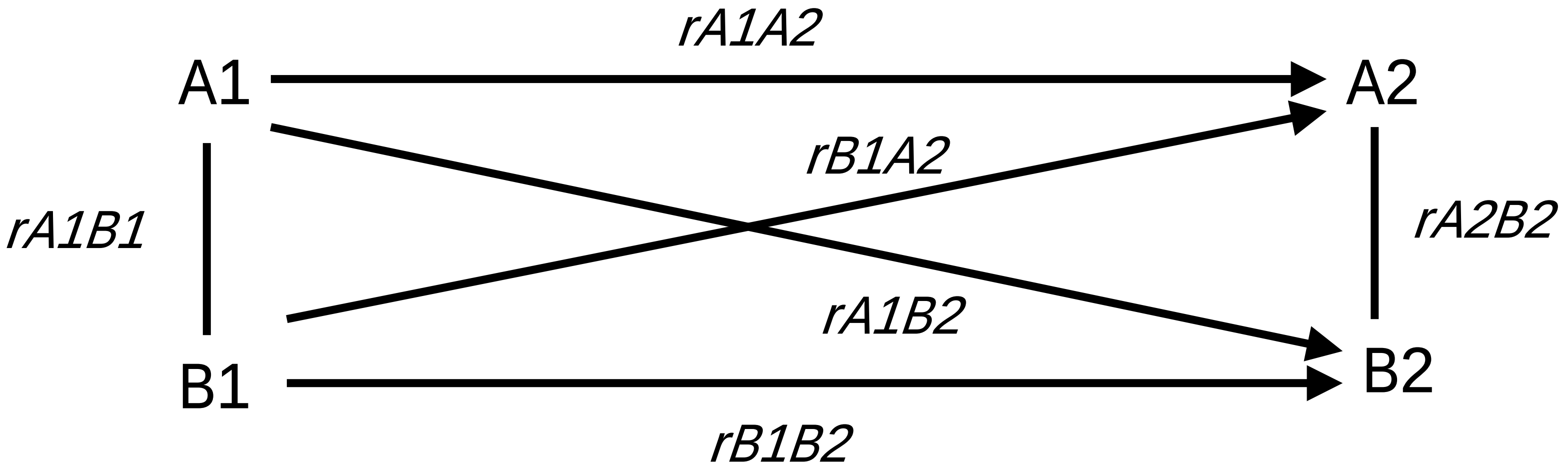
- Start by establishing a behavioral baseline:
  - the continuous, continuing performance of a single individual
- Found niche for effects of clinical, counseling and educational interventions
- Prototype procedure: A B A (variant of AB)
  - A is pretreatment phase
  - B denotes introduction of independent variable
  - A treatment is withdrawn at the end and behavior measured
- Variants – non unambiguous wrt internal validity
  - A B BC B
    - to tease out effects of BC and B alone
  - A B A B
    - To emphasize positive effects of treatment variable
- Seldom report elaborate statistical analyses, but use good graphical representations

Cross-Lagged Panels

- Frequent in past, now employed with *skeptical advocacy*
- Cross-lagged:
  - a time series design
  - some data treated as temporarily lagged values of the outcome variable
- Panel: another name for longitudinal
  - Two motivations
    - Increase precision by measuring each subject in all conditions
    - Examine individuals change response over time

Cross-Lagged Panels

- **Assumption:** ***longitudinal measurements of same two variables (A,B) would provide information about causal relationship between them***
- **Hence: a method for choosing between competing causal hypotheses**



Cross-Lagged Panels

- 3 sets of paired correlations
  - Test-retest: *rA1A2, rB1B2*
    - Indicates reliability of *A* and *B* over time
  - Synchronous: *rA1B1, rA2B2*
    - Reliability of relationship between *A* and *B* over time
  - Cross-lagged: *rA1B2, rB1A2*
    - Relationship between two sets of data points
    - Is *A* a stronger cause of *B* than *B* of *A*
    - *Yes if rA1B2 is higher than rB1A2*
      - ✓ Eg, *rA1B2=.585* and *rB1A2=.405*

Cross-Lagged Panels

- Interpretability considered maximum when *r* values remain the same at each period
- However, seldom stationary
  - Temporal erosion
  - *Attenuation* leaves us with a *residual* effect
- Seldom reliable and clear cut
  - seldom a clear inference

Path Analysis

- Eg, violence in TV and aggression
  - Boys
  - Time periods 1960 and 1970
  - *A1* and *A2* – preference for violent TV
  - *B1* and *B2* – peer-rated aggression
  - *rA1A2*=.05, *rB1B2*=.38
  - *rA1B1*=.21, *rA2B2*=-.05
  - *rA1B2*=.31, *rB1A2*=.01
  - Measures of aggression: who starts fights, takes others' things
  - Predictors of aggression: three favorite TV shows
  - Data indicates some not very reliable relationships
    - *AB* positive in 1960, negative in 1970
    - Test-retest only .05 for TV, .38 for aggression
    - Statistically a significant relationship between violent TV in 1960 and aggressive behavior in 1970 (.31)
    - Alternative causal pattern quite negligible (.01)

Cross-Lagged Panels

- Plausible inferences
  - Not possible to demonstrate a particular hypothesis is true
  - Possible to reject untenable hypotheses and narrow down rival explanations
- *A1 -> B2* – 5 plausible hypotheses
  - 1: *A1 -> B1, A1 -> B2*
    - Preferring to watch violent TV is a direct cause of aggressive behavior
    - *rA1B1*=.21, *rA1B2*=.31 is consistent with this
    - Low test-retest might be explained by different overtly violent activities in teens
  - 2: *A1 ->B1, B1 -> B2*
    - Preference for violent TV stimulates children to be aggressive and carries over into teen years
    - Ruled out: correlation between A1B2 much higher than *rA1B1 x rB1B2*

Cross-Lagged Panels

- 3: *B1 -> A1, A1 -> B2*
  - Aggressive children prefer violent TV
  - Ruled out for reasons similar to above
  - *rB1B2* much higher than product
- 4: *B1 -> A1, B1 -> B2*
  - Aggressive children are more likely to watch violent TV and to become aggressive teenagers
  - Not so easily rejected
  - Did a partial correlation
    - ✓Removed other influences:
      - *A1* and *B2* controlling for *B1*
    - ✓very close to original - .25 vs .31
  - Hence, implausible as complete causal explanation

Cross-Lagged Panels

- 5: *B1 -> A2, B1 -> B2*
  - Early aggression causes both a weaker preference for violent TV as a teenager and a penchant to continue to be aggressive
  - Rejected: needed cross correlation for this basis of rejection
    - ✓ *rB1A2* = .01 was very close to comparison base

→ **Thus ruled out 2-5, leaving 1**

- Watching violent TV was a direct causal link to aggressive behavior in some viewers

Cohort Designs - Utility

- A wider set of longitudinal
  - Pure: one cohort followed over time
  - Mixed – several cohorts followed
- Age, time and cohort effects
  - Eg, believed that IQ increase to a maximum at age 30 and then declined
  - Confounded age and cohort effects
    - Cohort: different life experiences etc
  - Diachronic designs: changes in successive periods of time
  - Useful in uncovering relationships that remain shrouded in synchronic designs

Cohort Designs - Limitations

- Example of age and no religious affiliation of women in The Netherlands
  - Clearly cross-sectional conclusions cannot be correct
  - With full cohort data can do other analyses
    - Avoid *fallacy of period centrism*
      - One time period generalizable to another
    - Age effect: due to natural aging process
    - Time of measurement effect: impact of events on time that occur at points of measurement
    - Cohort effect: represents past history

Cohort Designs - Limitations

- Comparison where age, time and cohort effects are the major variables
  - Simple cross-sectional
    - Limitation: confounds age of subject with age of cohort
  - Simple longitudinal
    - Limitation: does not control for effects of history
      - ✓ Different results might be obtained using a different period of time
  - Cohort sequential
    - Takes into account age and cohort. But not the time of measurement fully
  - Time sequential
    - Does not take into account cohort
  - Cross-sectional
    - Does not take age fully into account
- Each has limitations
  - Hence best to employ a variety of methods