Quasi experimental and Nonexperimental Designs

Quasi-experimental Design

- Often, we cannot manipulate a variable of interest
- Quasi-independent variables:
  - Participant variable = individual characteristic used to select participants to groups
  - Natural treatment = exposure in the "real world" defines how participants are selected

Nonexperimental vs. Quasi-Experimental Strategies

- Resemble experiments but contain some threat such as a confounding variable that can not be completely eliminated so can not infer causation
- Researcher has even less control over the independent variable, and seldom can specific levels of the independent variable be precisely established or quantified
  - Serious limitations in terms of internal validity
- QE – make some attempt to minimize threats to Int. V.
- NE – do not

Types of Quasi-experimental Design

- Between
  - Nonequivalent-control-group designs
    - Experimental and comparison groups that are designated before the treatment occurs and are not created by random assignment
- Within
  - Before-and-after designs
  - Pretest and posttest but no comparison group
    - Cannot rule out time related confounding variables

Nonequivalent-Control-Group Designs

- Random assignment cannot be used to create groups
- Confounds related to equivalency of groups cannot be eliminated
- Often high in external validity
  - Particularly ecological validity

Posttest-Only Non-equivalent Control Group Design

- Also called static group comparison
- Applied settings when pre-testing not possible
- Measure effectiveness of treatment with pre-existing participants
- Similar but nonequivalent participants used as control condition

Control	No Treatment	Post-test
Experimental	Treatment	Post-test

Pretest – Posttest Non-equivalent Control Group Design

- Stronger version of posttest only design
- Both control (C) and experimental (E) groups measured prior to treatment and again after E group receives treatment
- Shows if groups are similar on the DV before manipulation of IV
- Also controls for time related changes in DV indep. of IV
- Reduces threat of both assignment bias and time related threats

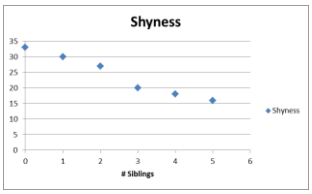
O	IV	O	Exp. Grp.
O		O	Control

But…

- Doesn't eliminate all threats to Int. V.
- E.g., differential history effects
  - History differs between groups
- Differential instrumentation, differential testing, differential maturation or differential regression

Differential Research Design

- Also called ex post facto research
- Experimental and comparison groups that are not created by random assignment
  - Individuals may decide whether to enter the treatment or control group
  - Selection bias is a significant issue
- E.g., shyness scores from single child vs. child with siblings
- Existence and description of relationships
- Similar to correlational design but different data and analysis



Correlational

Differential

Siblings		
0	1-2	>3
33	28.5	18

Within-Subjects NE and QE Pre-Post Designs

- One group of participants measured before and after an event or treatment
- Impossible to counterbalance order of treatments
- Useful for studies of interventions that are experienced by virtually every case in some population
- No comparison group
- Time Related Threats to Int. V.
  - History, instrumentation, testing effects, maturation, & statistical regression

Preexperimental Designs

- One-shot case study
  - X-O (X=exposure to event, O=observation)
  - No comparison to those not exposed to event
  - No way to know person's response before intervention
- One-group pre-post design
  - O-X-O
  - Cannot rule out uncontrolled events between X and O

One-Group Pretest – Posttest Design

- One pre and one post-test measurement
- E.g., voter's confidence in electoral candidate before and after televised debate
- O X O

Time Series Design

Goal is to have sufficient numbers of observations so that researcher can rule out the possibility that observed changes following treatment are not due to naturally occurring cycles or trends

Time Series Design

- Treatment *is* manipulated by researcher
- Series of observations for each participant before and after treatment or event
- E.g., Measures of stress weekly for 2 months preceding and following introduction of aromatherapy in workplace
- O O O X O O O

Interrupted Time Series Design

- Treatment is *NOT* manipulated by researcher
- E.g., Depression measured monthly for 3 months before and after Christmas
- Works with predictable event like decriminalizing marijuana
- For unpredictable events like Katrina, rely on archival data
- Can see trends in data before treatment
- Can observe long-term changes following treatment
- But other changes can coincide with treatment
  - E.g., cold weather/snowfall and Christmas

Texting while Driving

Imagine a Study…

- "U Drive. U Text. U Pay."
- The state received $2.3 million in federal distracted-driving-prevention funds from the National Highway Traffic Safety Administration (NHTSA).
- North Haven Police received a grant for $10,125, Orange Police received $11,100, Branford received $11,325, and Derby also received a grant to carry out this enforcement mobilization.
- These funds, and similar disbursements to other towns, will go toward overtime staffing
- The DOT will also purchase advertising to inform the public of the enforcement campaign.

Interventions Include…

Public Awareness

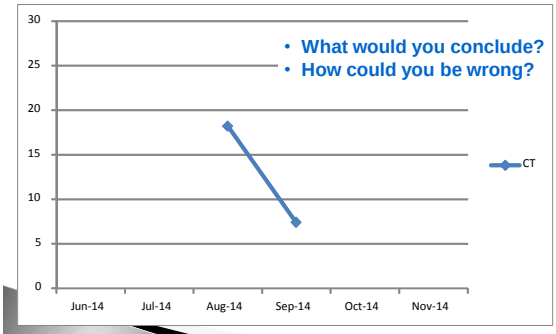
Laws

Pledge Campaigns

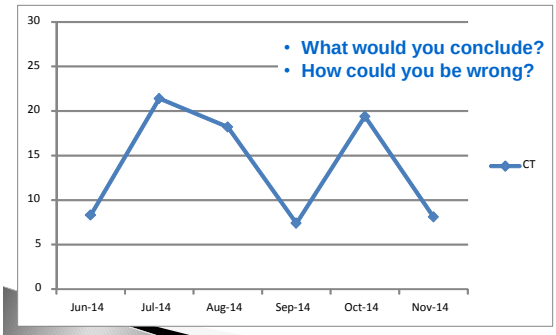
Education – humor (sometimes morbid)

Technology

Imagine the Results…



Imagine the Results…2



Equivalent Time – Samples Design

- Treatment is repeatedly administered and removed during series of observations
- E.g., introducing music in the workplace – turning it on and off and measuring worker concentration at regular intervals weekly
- O O O X O N O X O
- Best used when treatment effect is expected to be temporary
- Hard to determine causality if treatment effect is permanent

TABLE 9.1 A Comparison of the Classical Experimental Design

DESIGN	RANDOM ASSIGNMENT	PRETEST	POSTTEST	CONTROL GROUP	EXPERIMENTAL GROUP
Classical	Yes	Yes	Yes	Yes	Yes
One-shot case study	No	No	Yes	No	Yes
One-group pretest/postest	No	Yes	Yes	No	Yes
Static group comparison	No	No	Yes	Yes	Yes
Two-group posttest only	Yes	No	Yes	Yes	Yes
Time-series designs	No	Yes	Yes	No	Yes

Patched-Up Quasi Experiments

- Used when pretesting is not possible
- Control group is added to test for possible confounds
  - "Patches over" holes in internal validity
  - E.g., does study abroad program increase maturity level of college students? No pre-test
    - Compare maturity level of returning students to those at same level that did not study abroad
    - Include as controls, individuals that applied for program but did not participate
    - Include second control from another university to minimize likelihood of one type of factor differentiating groups based on recruitment/selection

Patched-Up Quasi Experiments

Allows test of effectiveness of intervention after it has been designed and implemented

- Could compare results of treatment group in online class to a control group of participants who couldn't enroll in an online class due to space limitations
- If treatment group shows better completion rates than additional control group, case is stronger that effect was due to treatment

Focal Local Controls

A control group in a nonequivalent comparison group experiment that is similar to treatment group in

- locale
- characteristics, especially those most highly correlated with
  - selection into conditions
  - outcome of the investigation

Memories of 9/11

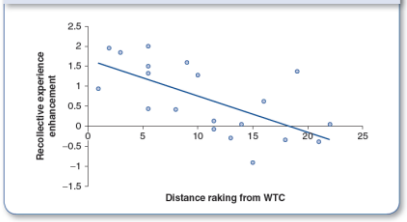
- Sharot, Martorella, Delgado, and Phelps (2007)
- Participants viewed word cues while in fMRI scanner
  - Words belonged to one of two categories: Sept. 2001 and summer 2001
- Participants also rated the word cues on a number of dimensions

Memories of 9/11 (cont.)

- Participants were divided into groups (near the World Trade Center or far from the WTC) *ex post facto*
- Negative correlation between distance and memory rating (near yielded higher memory ratings)
- Researchers also found a different pattern of brain activity between the near and far groups

Scatter Diagram

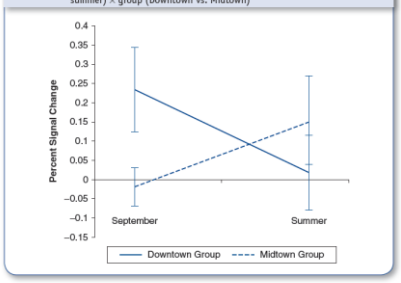
Exhibit 8.7 Correlation scatter plot across all groups for enhancement in recollective experience, defined as the average differential scores on all subjective scales for 9/11 memories vs. summer memories, with participants' distance from the WTC defined by ranking participants from the individual closest to the WTC to the individual farthest from the WTC.



Source: From Sharot et al. 2007.

Pattern of fMRI activity

Exhibit 8.8 Mean percentage signal change from the peak active voxel in the left amygdala, revealing a two-way interaction of trial type (9/11 vs. summer) × group (Downtown vs. Midtown)



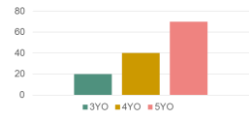
Source: From Sharot et al. 2007.

Memories of 9/11: Quasi-experimental Characteristics

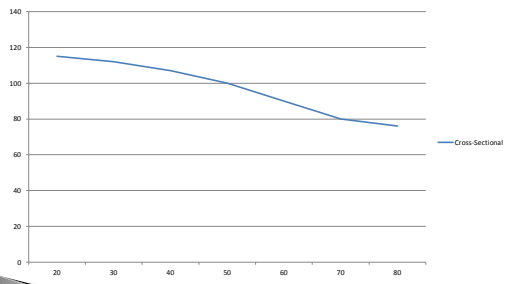
- Summer condition served as a control condition
  - Baseline for comparison
- 9/11 is a natural treatment
  - Researchers could not manipulate
  - Random assignment was not possible
- Location not controlled by experimenter

Cross-sectional Design

- Selects groups of people of different ages and then compares these age groups on psychological processes
- Confounded by:
  - Cohort effects
  - Period effects



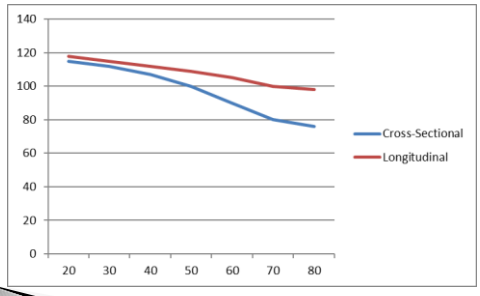
Cohort Effects



Longitudinal Design

- Same research participants are followed over time
- Problems:
  - Attrition
  - Secular trends

Cohort Effects



Cross-sequential Design

- Time-lag design = a researcher aims to determine the effects of time of testing while holding age constant
- Cross-sequential design = tests two or more age groups at two or more time periods
  - Avoids problems of both cross-sectional and longitudinal designs

Cross-sequential Design (cont.)

Exhibit 8.11 Cross-sequential Design Combining Longitudinal, Cross-sequential, and Time-lag Methods

Year of Birth	Year of Test: 2004	2005	2006	2007	
1984	20	21	22	23	← Longitudinal
1985	19	20	21	22	
1986	18	19	20	21	
1987	17	18	19	20	← Time Lag

Source: Adapted from Elmes et al., 2006.

Confidence in Results of Non-Equivalent Control Group Design

Increased by

- use of ANCOVA or other methods to examine preexisting group differences
- patched-up designs to rule out alternative explanations
- replication in different circumstances
- randomly assigning naturally occurring groups to condition
  - Use of nested analysis of variance design
    - Allows separation of the variance in the dependent variable due to IV and to the factor in which the IV is nested
- research showing that results of quasi-experiments are generally similar to results of true experiments