

9.63 Laboratory in Cognitive Science

Fall 2005

Lecture 12

Quasi-experiment
designs

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Experimental designs

- The purpose of an experimental design is to minimize uncontrolled variables, increasing the likelihood that an experiment will produce consistent results.
- In a quasi-experiments, the experimenter does not manipulate directly variables:
 - particular subjects variables (age, sex, weights, type of diseases, etc)

Quasi-experiment

- A typical quasi-experiments has a subject variable as an independent variable: we have to select rather than vary the independent variables
- Inherent subject variables: Age, sex, race, ethnic group
- Socially cause subject attribute: social class, region of residence
- Disease and illness related attributes: limb loss, mental illness, brain damage, effects of disasters.
- The main concern of quasi-experiment: when the experimental has to take what is given, what is given may include **several important confounding variables**

Quasi-Experimental Designs

- Quasi-Experiments: Designs that lack all of the control features of true experiments
 - “A research design in which an experimental procedure is applied but all extraneous variables are not controlled.”
 - Definitions vary from person to person
- Inability to randomly assign participants to conditions is the most common reason for the use of quasi-experiments
- Quasi-experiments do not allow same confidence in causal inferences as true experiments (lower internal validity)

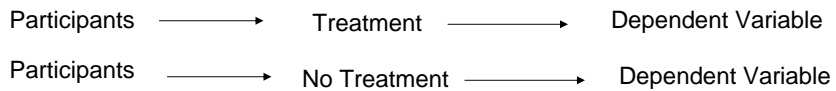
Problems with Quasi-Exp

- Question: does handing out “learning evaluations” (short non-credit quizzes) at the end of each lecture improve performances on the major tests?
- Independent variable with two levels:
 - (1) learning evaluations
 - (2) no learning evaluations
- Controls variables:
 - teach the same course, the same teacher, the same discourse and slides
- What we cannot do:
 - - have the same students
 - - force a student to take a particular class

Problems with Quasi-Exp

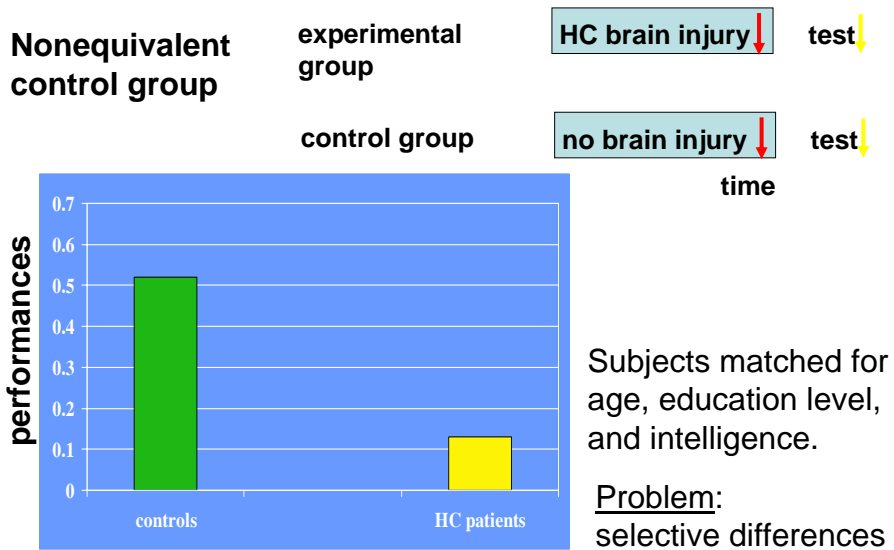
- We could use two classes that already exist:
 - (1) a morning class vs. afternoon class.
On which (uncontrolled) dimensions morning vs. afternoon students may vary?
 - (2) One class meets 3 times a week, the other class meets 2 times a week, both mornings.
On which (uncontrolled) dimensions the two classes may vary?

Nonequivalent Control Group Design



- Brain Damage Patients Require Nonequivalent Controls
- E.g., damage to the medial temporal lobes (hippocampus) appears to selectively impair the declarative memory system
- Anterograde amnesia: Loss of ability to form new long-term memories after brain injury
- Retrograde amnesia: Loss of long-term memories that occurred before the brain injury

Experimental Design Problems in Testing Brain-Damaged Patients

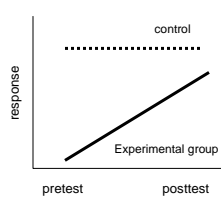


Non-equivalent group control

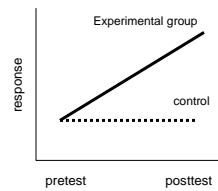
- A group is exposed to a treatment
- A control group is not exposed to a treatment
- Each group is given a pre-test and a post-test

	Pre-test	Treatment	Post-test
G1	Yes	Yes	Yes
Control	Yes	No	Yes

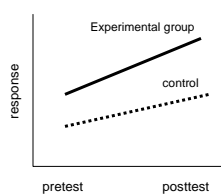
Non-equivalent group control



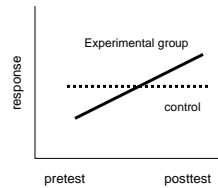
-A-



-B-



-C-



-D-

Posttest-only design with nonequivalent control groups

- A quasi-experiments because the subjects are not randomly assigned to each group

	Treatment	Test
G1	Yes	Yes
Control	No	Yes

- The basic problem with a posttest-only design with non equivalents group is that any observed difference could be due either to the treatment or to selection differences between the groups
- One way of strengthening the conclusion in the absence of a formal pretest is to have informal pretest information by which the two groups can be compared.

The effect of Video Games

- Question: Does the pressure to act rapidly on several visual items, which is inherent to most action games, alters the ability to process items over time, particularly the ability to avoid “bottlenecks” of attention that often occurs in temporal processing
- Participants: All males, between 18 to 23 years old
- Experimental Group: the VGPs had played action video games on at least 4 days per week for a minimum of 1h per day for the previous 6 months.
- Control group: the NVGPs had little and preferentially no video games usage in the past 6 months

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•**The effect of video games on visual attention:**
Green, C.S. & Bavelier, D. (2003). Action video game modifies visual attention. Nature, 423, 534-537.

<http://www.bcs.rochester.edu/people/daphne/webdemos.html>

The effect of Video Games

- Results: Video game players (VGPs) were found to outperform non-video game players (NVGPs) on three tasks of selective attention:
- (1) the localization of an eccentric target among distractors
- (2) the number of visual items they could apprehend at once
- (3) the fast temporal processing of visual information
- -> Attentional blink paradigm

<http://www.bcs.rochester.edu/people/daphne/webdemos.html>

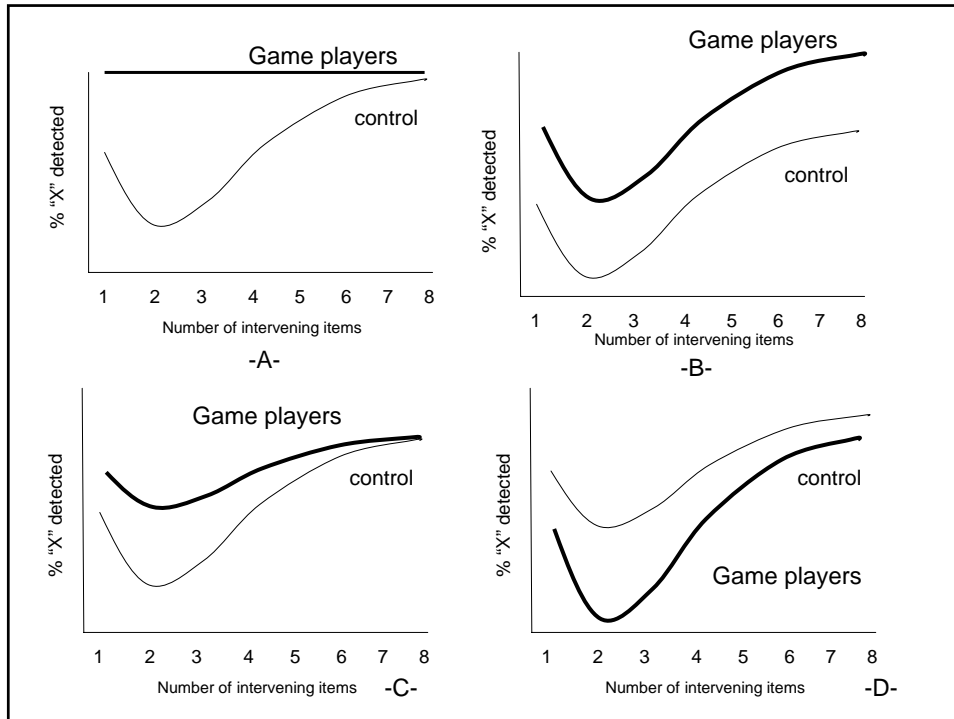
The effect of Video Games

- Measure of attention over time: black letters were rapidly presented at fixation in a standard rapid, serial, visual presentation manner. At a random time in the stream, a white letter was presented (first target). After this first target, an "X" (second target) was presented among the following letters 50% of the time. After the trial, the subject gave the identity of the first target and then indicated whether the X was present.

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Please see:

Green, C. S., and Bavelier, D. Figure 4a in
"Action video game modifies visual attention."
Nature 423 (2003): 534-537.

- Of interest is the performances of subjects on the X detection task (T2) given that they have correctly identify the white letter (why?)



Interrupted time-series design

- An extension of the general observation-treatment -observation design
- In a simple time series design, we have 1 experimental group with multiple observation before and after the treatment.
- We consider the trend of the data before and after experimental manipulation
- Factors to consider:
 - Maturation: during the course of the study, individuals get more experience
 - Events: some uncontrolled events might happened between two observations or X and O
- Examples: developmental research, effect of a treatment on memory recovering for a type of amnesics, effects of introduction of a new learning method on performances in schools (over many years). Often, it concerns a naturally occurring treatment (with available records of data)

O1 O2 O3 O4 O5 X O6 O7 O8 O9 O10

Interrupted time-series design

Black Uniform Study
Frank & Gilovich, 1988

hypothesized that people perceive others wearing black clothing as more aggressive/violent and/or wearing black clothing makes people behave more aggressively

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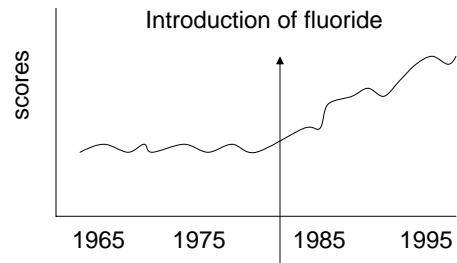
Frank, M. G., and T. Gilovich. Figure 1 in "The dark side of self- and social perception: black uniforms and aggression in professional sports." *J Pers Soc Psychol* 54 (1988): 74-85.

Time-series design

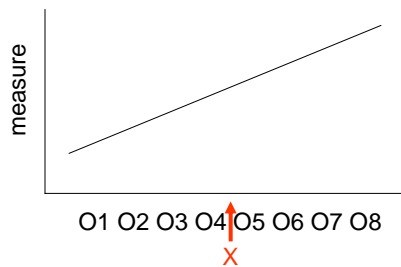
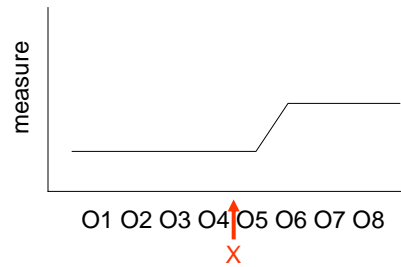
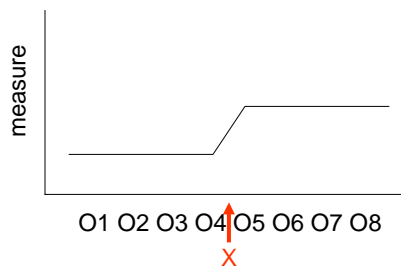
- Suppose we had records of public-schools achievement for a city that added fluoride to its water one year.
- We can plot achievement against time and look for changes in achievement subsequent to fluoridation.
- What we look for in a time-series analysis are changes following the introduction of the treatment

Time-series design

- Can we assess that fluoride causes better achievements?

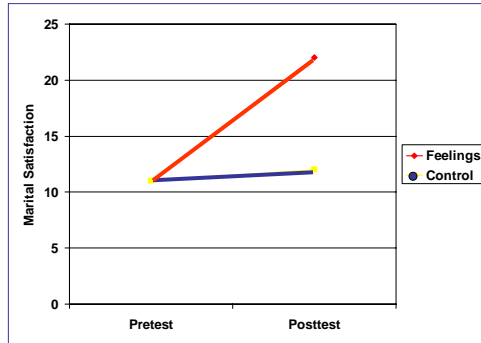


Possible results of a time-series design



Nonequivalent Control Group Pretest-Posttest

Pretest Marital Satisfaction → Share feeling program → Posttest
 Pretest Marital Satisfaction → No program → Posttest

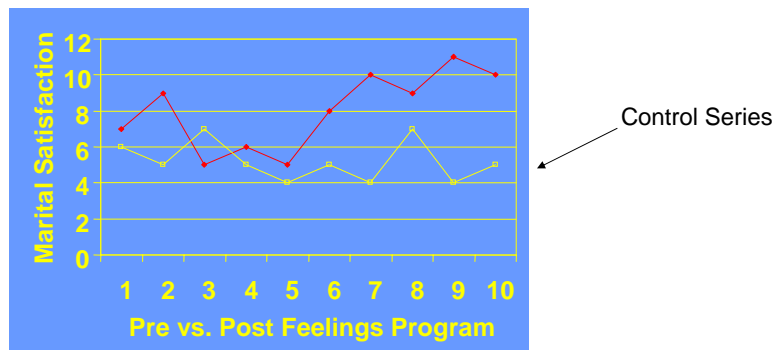


Selection-Maturation Effect?

Time Series Designs

- Similar to pretest-posttest designs, but take multiple measures before and after treatment

Pretest measures Treatment Posttest measures
 Y1, Y2, Y3, Y4, Y5 ↓ Y6, Y7, Y8, Y9, Y10



Procedure for Time-series designs

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