PSYC 334
Research Methods

Session 6 –TYPES OF RESEARCH -
EXPERIMENTAL PSYCHOLOGY III

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Session Overview

- In this Session we will cover three more designs and these are complex designs, quasi designs, and single N designs.
- In Complex designs, the researcher studies the effect of at least two independent variables simultaneously and examines the main (independent) and interaction (varying effect of one over the other) on the dependent variable.
- In Quasi design, you will learn about experiments in which there cannot be random assignment.
- In Single N designs, you will learn about use of single participants or single groups in experiments

Session Outline

The key topics to be covered in the session are as follows:

- Topic One: Complex Experimental Designs
- Topic Two: Quasi Experimental Designs
- Topic Three: Single N Designs

Reading List

- Cozby, P. C. (2004). *Methods in behavioral research* (8th Ed.). Mayfield Pub. Co. CA.
- http://open.lib.umn.edu/psychologyresearchmethods/ (Chapter 6, pages 134–140; Chapter 8, pages 150-158; Chapter 10, pages 184-197). Please refer to Sakai for the PDF version of this textbook.

Topic One

COMPLEX EXPERIMENTAL DESIGNS

Complex/Factorial Designs

- More than one IV
- More efficient than single IV experiments
- Gives more information
  - Allows analysis of main effects and interactions.
  - Simplest Factorial Design

    2 x 2 factorial design

    Has two independent variables

Complex Designs - Terminology

- An IV is called a factor
  - *number* of numbers = how many IVs there are
  - *values* of numbers = how many levels each IV has
- Examples:
  - "2 X 2 design" (two IVs, each with 2 levels)
  - "2 X 3 design" (first IV has 2 levels, second IV has 3 levels)
  - "2 X 8 design" (first IV has 2 levels, second IV has 8 levels)
  - "2 X 2 X 4 design" (first IV has 2 levels, second IV has 2 levels, third IV has 4 levels).

Main Effects

- There is one potential main effect for each IV
  - A 2 X 2 design has two possible main effects
  - A 2 X 2 X 4 has three possible main effects

- A main effect is present if an IV had a significant effect on the experiment's outcome (regardless of the effects of the other IVs).

Factorial Designs

- Example:
  - Examining sex and mode of presentation (visual or auditory) on recall (memory)
  - Independent variable 1: ??
  - Independent variable 2: ??

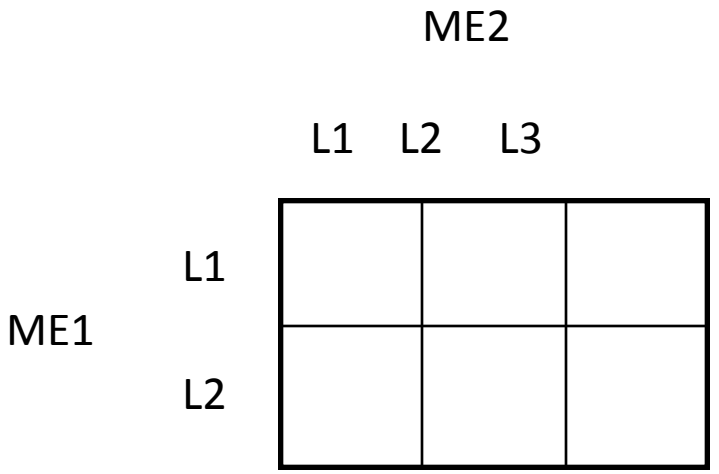
Mean Score on a Verbal Test

Factor 2 / Factor 1	auditory	visual
female		
male		

Two-Way Factorial Design

- Studies multiple independent variables
  - Main effects (ME)
  - Each with a number of levels (L)
- Permits study of interactions

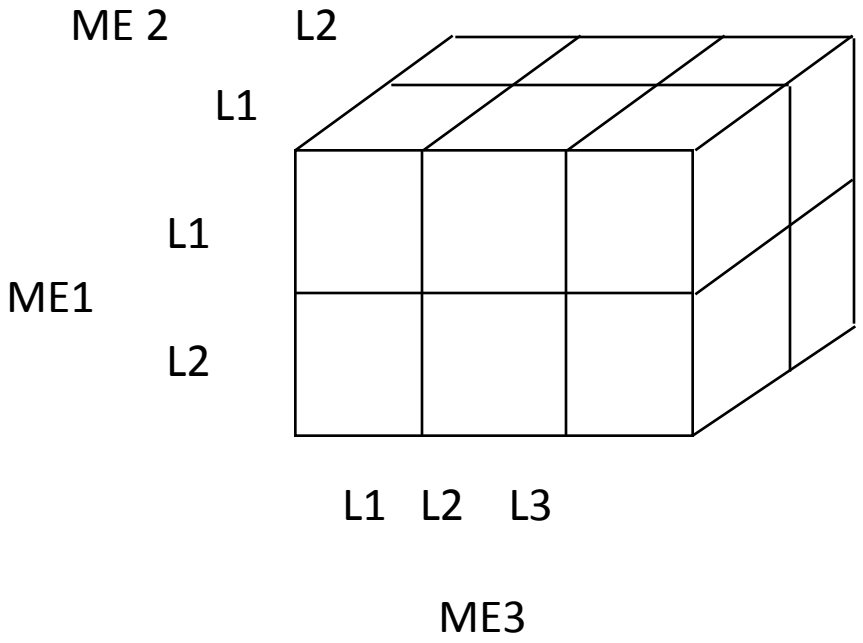
Example: 2 x 3



Three-Way Factorial Design

- Studies multiple independent variables
  - Main effects (ME)
  - Multiple levels (L)
  - Interactions effects

Example 2 x 2 x 3



Factorial Designs

- Interactions and Moderator Variables
- Outcomes of a 2 x 2 Factorial Design
  1. There may or may not be a significant main effect for independent variable A
  2. There may or may not be a significant main effect for independent variable B
  3. There may or may not be a significant interaction between the independent variables
- Example of studying effects of different levels of caffeine and gender differences on anxiety
  - Simple main effect of levels of caffeine
  - Simple main effect of gender
  - Interaction between levels of caffeine and gender

Advantages of factorial Designs

- A greater precision can be obtained in estimating the overall main factor effects.
- Interaction between different factors can be explored.
- Additional factors can help to extend validity of conclusions derived.
- Uses fewer subjects than in separate experiments
- Avoids between experiment comparisons
  - selection confound/bias
  - cohort effects

Disadvantages of factorial Designs

- Complex/large designs require a large number of participants
- Between subjects design lack statistical power
- Researchers must address selection issue (e.g., random assignment to treatments)

Topic Two

QUASI EXPERIMENTAL DESIGNS

Quasi-Experimental Design

- Similar to a *true experiment* but lack some of the characteristics of a true experiment
- Lacks randomization
- It is necessary when randomization is not possible
- There is threat to internal validity

Quasi-Experimental Designs

- Groups or subjects *not* randomly assigned
  - e.g., sample of convenience

- May not have a comparison group
- Typical of clinical research
  - e.g., within subjects repeated measures

Type of quasi-experimental

- Non-equivalent control group designs
  - There are experimental and control groups
  - Usually the participants are not randomly assigned into the groups.
  - Other features of a good experimental design may be maintained

Non-equivalent control group designs

- Threats to internal validity
  - Selection maturation
    - Occurs when the groups selected are maturing at different rates with respect to the DV
  - Local history
    - One selected group has unique experiences that are not experienced by the other group.

Non-equivalent control group designs

- The post-test only non-equivalent groups design

- Pre-test Post-test non-equivalent groups design

Topic Three

SINGLE N EXPERIMENTAL DESIGNS

Single-subject designs

- Single-subject designs or single-case designs are research designs that use the results from single participant or subject to establish the existence of cause-and-effect relationships

- Whereas case studies belong to the group of descriptive research strategies, single-case studies are experimental

Introduction to single-subject designs

- Evaluating the results from a single-subject study
  - the presentation and interpretation of results from a single-subject experiment are based on a simple graph of the data
  - because the results of a single-subject study do not involve any traditional statistical methods, researchers must rely on the visual inspection of a graph to convey the meaning of their results

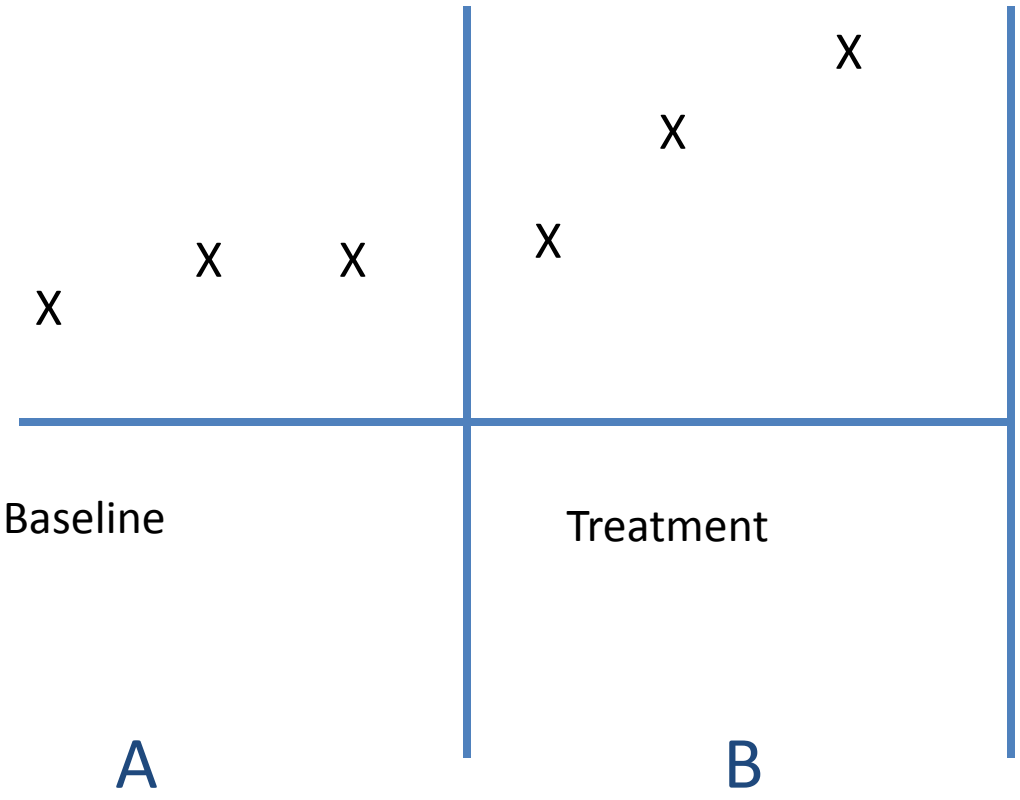
Single Case Experimental Designs

- Single-Case Research
- Single-case research is *idiographic* rather than *nomothetic*.
- These designs are often used in clinical psychology and neuropsychology.
- The two major types of single-case research designs are:
  - case study, and
  - single-subject experimental designs

Phases and Phase changes

- A phase is a series of observations of the same individual under the same conditions
- baseline observations (observation phase)
  - when no treatment is being administered, the observations are called a series of baseline
  - and is identified by the letter A
- treatment observations (treatment phase)
  - when a treatment is being administered
  - and is identified by the letter B.

Single-Case Design



Phases and phase changes

- a consistent level occurs when series of measurements are all approximately the same magnitude;
- in a graph, the series of data points cluster around a horizontal line
- a consistent trend occurs when the differences from one measurement to the next are consistently in the same direction

Phases and phase changes

- the stability of a set of observations refers to the degree to which the observations show a pattern of consistent level or consistent trend;

- stable data may show minor variations from a perfectly consistent pattern, but the variations should be relatively small and the linear pattern relatively clear

The ABAB reversal design

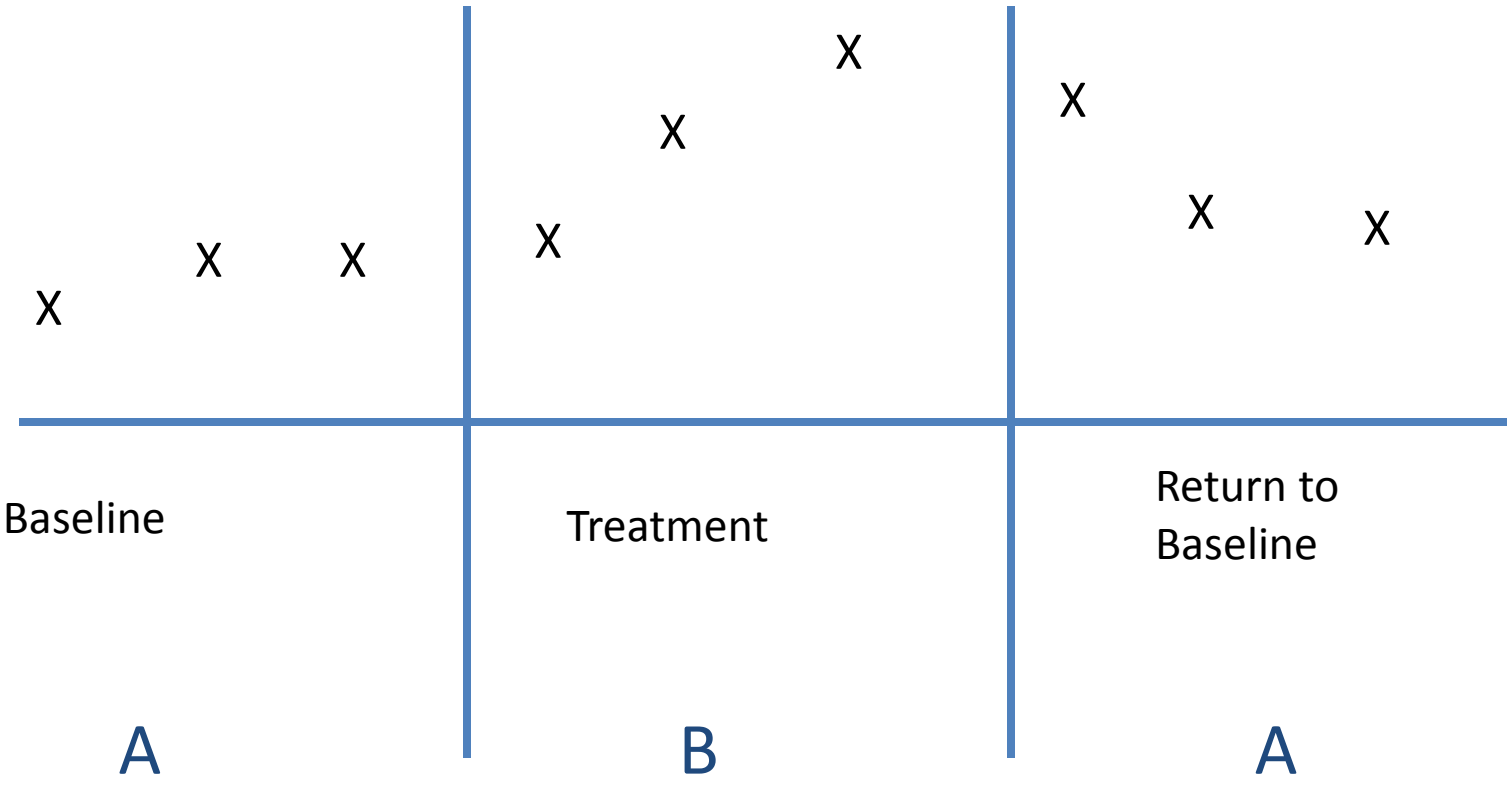
- An ABAB design, also known as a reversal design, is a single-subject phase-change design consisting of four phases: a baseline phase, a treatment phase, a return to baseline phase, and a second treatment phase

- The goal of the design is to demonstrate that the treatment causes changes in the participant's behavior

The ABAB reversal design

- Limitations of the ABAB design
  - It is not appropriate for evaluating treatments that are expected to have a permanent or long-lasting effect
  - There is also the ethical question of withdrawing a successful treatment

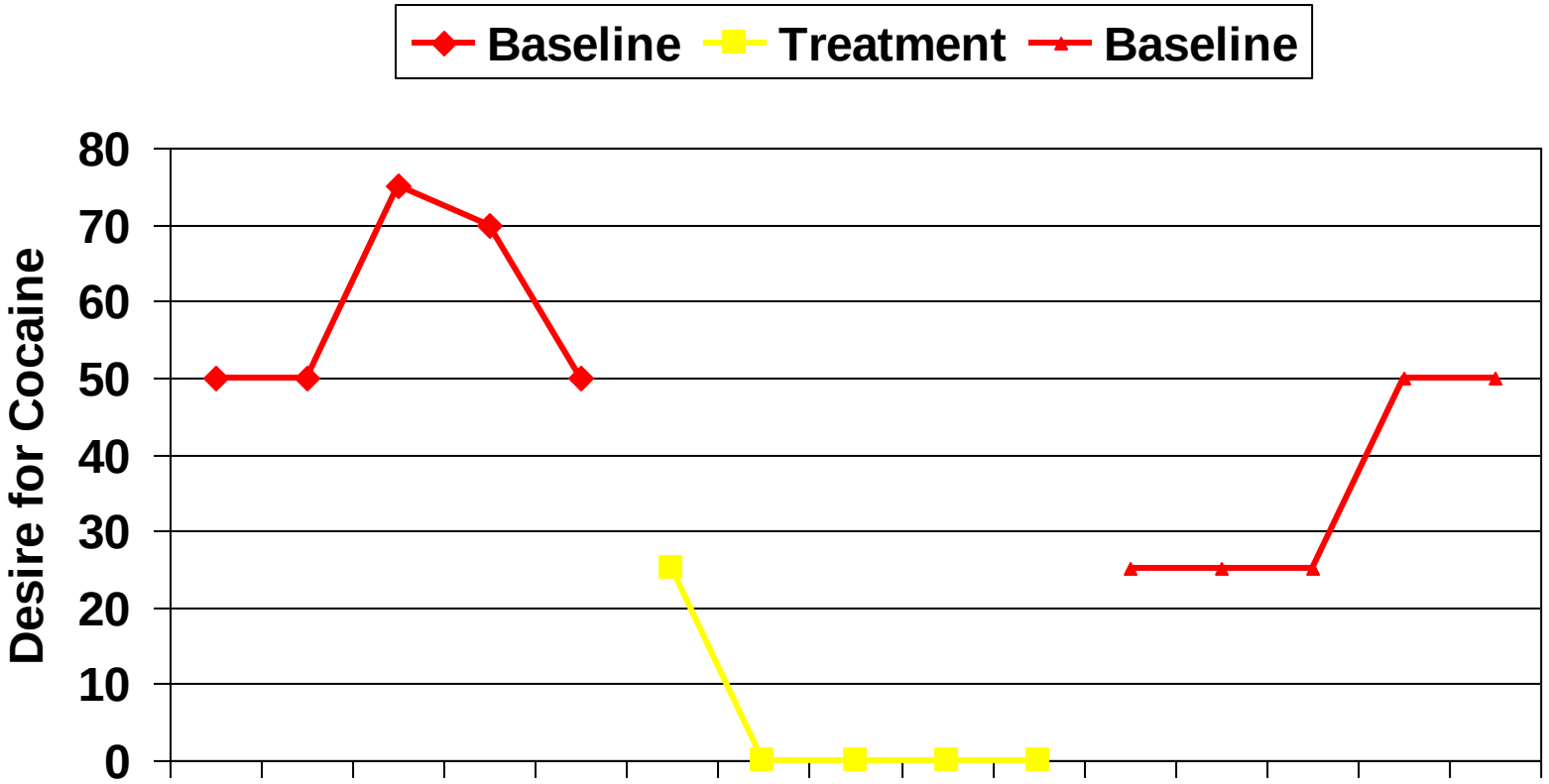
Single-Case Design



Cocaine Abstinence (A-B-A Design)

- Study by Silverman, Wong, et al., (1998)
  - Aim to keep people in a methadone treatment program for using cocaine
  - Used escalating reinforcement for cocaine free urine samples ($2.50 for 1st, add $2.96 for each additional) (could get up to $1950 over course of the study)
  - Baseline, reinforcement, then withdrew reinforcement

Cocaine Abstinence Results - One Participant



Advantage of Small-N Design

- Avoiding problems with the group mean
- Can examine participants from hard to find populations
- Can deal explicitly with individual (not group) behaviour.
- Results are easy to interpret (often no stats)
- Avoids small, unimportant effects
- Flexibility
- Can focus on helping one (few) participant(s)

Disadvantages of Small-N Designs

- Hard to demonstrate causality
- No controls in most cases
- Lack of statistics
- Can’t really look at interaction effects
- Counterbalancing is a problem
- Dependent variable usually limited to response rates
- Problem of external validity

Single Case Experimental Designs

- Case Study Method
- Case study: An intensive description and analysis of a single individual.
- Data: clinical observations, self-report, archival data (e.g., medical records)
- Case studies typically report the results of a treatment.
- Major problem: Lack scientific control, simultaneous treatments, extraneous variables

References

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Thank You