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***Social Science
Research Methods***

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Overview

- Quasi-Experimental Designs
- Time Designs
- Single Subject Designs
- Nonexperimental Research
- Laboratory and Field Work
- Principles of Analysis
- Analysis of Frequencies
- Nonparametric Statistics
- Statistics
- Hypothesis Testing
- Analysis of Variance

Quasi-Experimental Designs

- “. . . one of the major goals of science is to find causal relations” (K&L p. 535)
- “The true experiment is the strongest approach used to meet this goal.” (ibid.)
- “. . . it can provide the researcher with a *cause-and effect* statement . . . ” *WHY?*
- “This is generally considered the highest form of experimentation.” (ibid.)

Quasi-Experimental Designs

- The true experiment requires
 - ★ Manipulation of at least one independent variable
 - ★ Random assignment of participants to groups
 - ★ Random assignment of treatments to groups
- If any of these is missing, we have a *compromise* design or *quasi-experimental* design
- According to Cook and Campbell, two main types of these can be interpreted
 - ★ Nonequivalent control group designs
 - ★ Interrupted time series designs

Quasi-Experimental Designs

- Nonequivalent control group designs
 - ★ No-treatment control group designs
 - ★ Nonequivalent dependent variable designs
 - ★ Removed treatment group designs
 - ★ Repeated treatment group designs
 - ★ Reversed treatment nonequivalent control group designs
 - ★ Cohort designs
 - ★ Posttest only designs
 - ★ Regression continuity designs

Quasi-Experimental Designs

■ Design 22.1: No-Treatment Control Group

★ Y_b X Y_a (Experimental)
 Y_b $\sim X$ Y_a (Control)

- ★ No randomized assignment, and no matching (cf. Design 20.3)
- ★ So how do we know groups are equivalent?
- ★ Check 'control' variables for similarity
- ★ Check means, standard deviations, distributions of pretests

Quasi-Experimental Designs

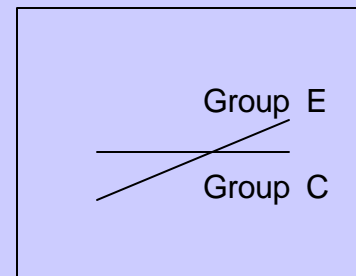
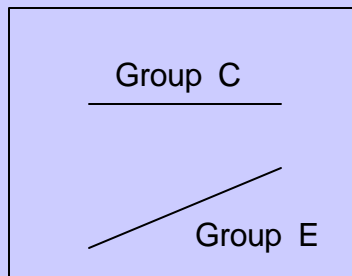
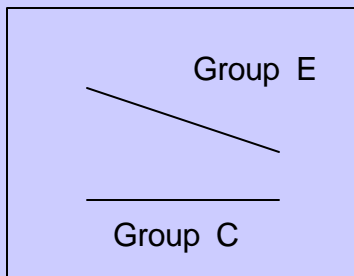
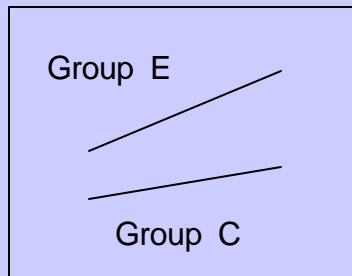
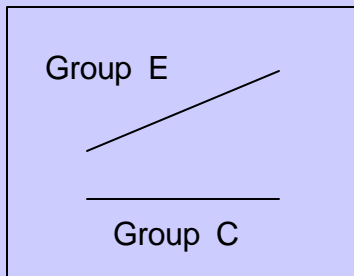
- Many difficulties remain, of which the most important is *selection*
- Need to consider all threats to internal validity and account for them
- We need to eliminate alternative hypotheses

Quasi-Experimental Designs

- Most likely threat is *selection-maturation* interaction
 - ★ Groups initially different
 - ★ Mature at different rates
- Also possible
 - ★ Instrumentation
 - ★ Statistical regression
 - ★ Selection-history interaction

Quasi-Experimental Designs

■ Five possible outcomes



Time Designs

■ Design 22.2: A Longitudinal Time Design

★ Y_1 Y_2 Y_3 Y_4 X Y_5 Y_6 Y_7

- ★ Maturation is a problem
- ★ Plot data over time
- ★ ARIMA

Time Designs

■ Design 22.3: A Multiple Time Series Design

★	Y_1	Y_2	Y_3	X	Y_4	Y_5	Y_6	(E)
	Y_1	Y_2	Y_3		Y_4	Y_5	Y_6	(C)

Single Subject Designs

- One (or a few) subjects
- Repeated trials
- Randomization hardly ever used
- Baseline observations
- Popular in psychological work
- Averages can be misleading . . .
- External validity problems

Single Subject Designs

- Establishing a stable baseline is important
- Designs using withdrawal of treatment
 - ★ **ABA Design**
 - ◆ But is intervention reversible?
 - ★ **ABAB Design**
 - ★ **ABCB Design**
 - ★ **etc.**

Single Subject Designs

- Multiple Baselines
 - ★ Across behaviors
 - ★ Across participants
 - ★ Across environments

Nonexperimental Research

- “*Post hoc, ergo propter hoc*”
- Nonexperimental research is systematic empirical inquiry in which the scientist does not have direct control of independent variables because their manifestations have already occurred or because they are inherently not manipulable. Inferences about relations among variables are made, without direct intervention, from concomitant variation of independent and dependent variables.
- The essential difference from true experiments is the lack of direct control of independent variables

Nonexperimental Research

- Self-selection is a problem
 - ★ Self-selection into samples
 - ★ Self-selection into comparison groups

- ★ Suppose we suspect poor examination performance is caused by smoking. We test a number of candidates, and discover that most high performers do not smoke, while most poor performers do
 - ◆ What if smoking and poor performance are both caused by nervousness?
 - ◆ We can find the statistical association – but not the cause

Nonexperimental Research

- Testing Alternative Hypotheses
 - ★ Eliminating alternative explanations improves internal validity
 - ★ Particularly important in nonexperimental studies
 - ◆ One of the only ways to control the independent variables

Nonexperimental Research

■ Limitations

- ★ Inability to manipulate independent variables
- ★ Lack of power to randomize
- ★ Risk of improper interpretation

- ★ “Nonexperimental research that is conducted without hypotheses, without predictions, research in which data are just collected and then interpreted, is even more dangerous in its power to mislead” (K&L p. 568)

Nonexperimental Research

■ Value

- ★ Much nonexperimental research must be done because many research problems do not lend themselves to experimental inquiry
- ★ “Replication is always desirable, even necessary.” (K&L p. 570)

Laboratory and Field Work

■ Laboratory Experiments

- ★ Research studies in which the variance of all, or nearly all, of the possible influential independent variables not pertinent to the immediate problem of the investigation is kept at a minimum. This is accomplished by isolating the research in a physical situation apart from the routine of ordinary living, and by manipulating one or more independent variables under rigorously specified, operationalized, and controlled conditions.

Laboratory and Field Work

■ Laboratory Experiments

★ Strengths

- ◆ Relatively complete control
- ◆ Random assignment
- ◆ Manipulation of independent variables
- ◆ Precision
 - Accurate, definite and unambiguous

★ Weaknesses

- ◆ Lack of strength of independent variables
- ◆ Artificiality
- ◆ Lack of external validity

Laboratory and Field Work

■ Laboratory Experiments

★ Purposes

- ◆ Studying relations under 'pure' uncontaminated conditions
- ◆ Testing predictions derived from theory
- ◆ Refining theories and hypotheses

Laboratory and Field Work

■ Field Experiments

- ★ Research studies conducted in a realistic situation in which one or more independent variables are manipulated by the experimenter under conditions as carefully controlled as the situation will permit.

Laboratory and Field Work

■ Field Experiments

★ Strengths

- ◆ Practical
- ◆ Variables typically have a stronger effect
- ◆ Appropriate for complex situations
- ◆ Suit testing of hypotheses and to finding answers to practical problems

★ Weaknesses

- ◆ Control rarely as tight as in the laboratory
 - Manipulation may be difficult
 - Randomization may be opposed
- ◆ Attitude of the researcher is an issue
- ◆ Lack of precision

Laboratory and Field Work

■ Field Studies

- ★ Nonexperimental scientific inquiries aimed at discovering the relations and interactions among sociological, psychological, and educational variables in real social structures. Scientific studies that systematically pursue relations and test hypotheses, that are nonexperimental, and that are done in life situations will be considered field studies.
 - ◆ Exploratory
 - ◆ Hypothesis testing

Laboratory and Field Work

■ Field Studies

★ Strengths

- ◆ Realism
- ◆ Significance
- ◆ Strength of variables
- ◆ Theory orientation
- ◆ Heuristic quality

★ Weaknesses

- ◆ Nonexperimental character
- ◆ Lack of precision
- ◆ Practical problems

Laboratory and Field Work

■ Qualitative Research

- ★ Type of field study
- ★ Uses direct observation and semistructured interviewing in real-world settings
- ★ Naturalistic
- ★ Participatory
- ★ Interpretive
- ★ Flexible
- ★ Ethical issues particularly important

Laboratory and Field Work

■ Quantitative Research

- ★ Emanates from post-positivistic tradition; major constituents are physical objects and processes
- ★ Assumes knowledge comes from observation of the physical world
- ★ Investigator makes inferences based on direct observations or their derivatives
- ★ Goal is to describe cause and effect

Laboratory and Field Work

■ Qualitative Research

- ★ Emanates from phenomenological perspective; emphasizes internal, mental events as the basic unit of existence
- ★ Knowledge is actively constructed and comes from examining the internal constructs of people
- ★ Investigator relies on outside observational schemes and tries to keep intact the participants' perspective
- ★ Attempts to describe the ways that people assign meaning to behavior

Laboratory and Field Work

■ Multimethod Research

- ★ Qualitative → Quantitative
- ★ Quantitative → Qualitative
- ★ Both simultaneously
 - ◆ If one is dominant, 'nested'

■ Holistic Experimental Paradigm

- ★ Charles W. Simon

Principles of Analysis

- K&L has chapters on means, variance, covariance, probability, sampling, randomness, (Chapters 6 – 8) that I have not assigned because I assume you are studying / have studied these elsewhere

Principles of Analysis

- Note, in particular, that I reserve the use of the term *multivariate* for techniques with multiple *dependent* variables – K&L reflect the fact that different authors have different usages in this area
- I take the view that multiple independent variables are now commonplace and unremarkable (e.g., multiple regression)

Principles of Analysis

- Frequencies v. continuous measures
- Rules of categorization
 - ★ Based on research problem
 - ★ Exhaustive
 - ★ Mutually exclusive and independent
 - ★ Derived from one principle
 - ★ On one level of discourse
- Graphing

Principles of Analysis

- Measures of central tendency and variability
- Measures of relations
 - ★ (Product-moment) Correlation (r)
 - ★ Spearman Rank correlation (ρ)
 - ★ Phi coefficient
 - ★ Point-biserial correlation
 - ★ Coefficient of multiple correlation (R)
 - ★ Distance (D)

Principles of Analysis

- Indices
 - ★ Composite of two or more numbers
- Negative or inconclusive results are harder to interpret
- Exploratory data analysis
 - ★ Stem-and-leaf
 - ★ Many others . . .

Analysis of Frequencies

- Crosstabs
 - ★ E.g. 2 x 2 tables
- Frequencies v. percentages
- Contingency tables
- χ^2 test
- Levels of significance
- Yates' correction when N small
- Fisher exact test for small N
- Cramer's V (measures strength of association)