

Overview of Design: Choosing a Design

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Research Design

- ☞ Plan for the research process
- ☞ Structure the process of data collection
- ☞ Organize the presentation of findings
- ☞ Guide statistical analysis of the data
 - ◆ *Relation between knowledge of statistical procedures for data analysis and good design*

Types of Design & Research Questions

- ☞ Correlational Designs
 - ◆ *Descriptive research (Naturalistic Observations)*
 - ◆ *Development of Predictive Models*
 - *Multiple regression and other correlational methods*
- ☞ Naturally Occurring Manipulations
 - ◆ *Ex post facto designs*
 - ◆ *Quasi-experimental designs*
- ☞ Experimental Research
 - ◆ *Identify causal relations between variables*

Characteristics of Correlational Research

- ☞ Data consist entirely of observations or measurements
- ☞ No direct manipulation of variables
- ☞ No clear “independent” and “dependent” variables
 - ◆ *Criterion (Target) Variable*
 - ◆ *Predictor Variables*
- ☞ Problems in the interpretation of findings
 - ◆ *Missed relations: the third variable problem*
 - ◆ *Directionality problem (ambiguous interpretation of relations)*

Characteristics of Experimental Research

- ☞ Clear identification of independent variables (IVs) as potential causal agents
- ☞ Direct manipulation of independent variables
- ☞ Control of extraneous variables to eliminate rival explanations
 - ◆ *Hold the extraneous variable constant*
 - ◆ *Manipulate the variable as another IV*
 - ◆ *Randomize the effects of the variable across conditions*
- ☞ How important is the random selection of participants?
- ☞ Random selection versus Random assignment

Validity of Research

- ☞ **Internal Validity**
 - ◆ *Does this design provide an unambiguous answer to the research question?*
 - ◆ *Elimination of alternative (rival) explanations*
- ☞ **External Validity**
 - ◆ *Generalizability of conclusions based on the research*
 - ◆ *Are these findings likely to be replicated?*
 - ◆ *Will these variables have the same effect in other situations?*

Criteria for Credible Arguments (Abelson, 1995)

- ☞ **Magnitude**
 - ♦ *Size of the effects produced*
- ☞ **Articulation of Findings**
 - ♦ *Level of detail and specificity used in describing the effects*
- ☞ **Generality**
 - ♦ *Breadth and applicability of the conclusions*
- ☞ **Interestingness**
 - ♦ *Theoretical interest: potential to change belief*
 - ♦ *Importance of the issues addressed*
- ☞ **Credibility**
 - ♦ *Sound methodology – Internal validity*
 - ♦ *Theoretical coherence*

Why Research Claims Might not be Persuasive

Failure to meet two or more of Abelson's criteria:

- ☞ **Poorly run procedures (or too small samples) fail to produce significant effect sizes**
- ☞ **Inadequately detailed analysis of findings**
- ☞ **Methodological problems – problems with internal validity**
- ☞ **Lack of credibility for research procedures as manipulations or measures of theoretical variables**
- ☞ **Claims run counter to strongly-held theory or common sense**
 - ♦ *Claim based on an artifact produced by confounding or other design flaws?*
 - ♦ *Burden of proof is on the investigator*

Third Variable Problem

- ☞ **Primarily a problem in correlational research**
- ☞ **Failure to make observations on a critical variable associated with the system under study**
- ☞ **Converging operations – coping with the third variable problem**
 - ♦ *Multiple procedures for examining the relation all point to the same interpretation*
 - ♦ *Web of evidence in support of the relation develops explanatory coherence*
 - ♦ *Catalog of potential third variables becomes so extensive and arbitrary that it loses its power as a counterargument*

Relation between Smoking & Lung Cancer

☞ Multiple sources of converging evidence in support of this relationship

- ♦ *Effects of duration of exposure*
- ♦ *Dose effects*
- ♦ *Reduction of risk with smoking cessation*
- ♦ *Pattern of the location & types of cancer*
- ♦ *Association with other respiratory diseases (common mechanism – similar effect)*
- ♦ *Effects of different types of exposure (cigars, pipes, second-hand smoke, etc.)*

Impurities in Procedures

☞ Correlational studies

- ♦ *Mediating variables (another variant of the third variable)*
- ♦ *e.g., correlation between picnics and red welts (mediating variable – mosquito bites)*
- ♦ *Note how an experiment can solve this problem*

☞ Experimental studies

- ♦ *Confounded variables*
- ♦ *Requires a new study in which the confounded variable is adequately controlled*
- ♦ *False confounds can be dealt with logically*
 - *“smoking doesn’t cause cancer, tar does”*
 - *“guns don’t kill people, bullets (people with guns) do”*

☞ Procedural biases

- ♦ *Experimenter effects*
- ♦ *Demand characteristics*

Threats to Internal Validity

(Campbell & Stanley, 1963)

☞ History

☞ Maturation

☞ Testing (effects of a pretest)

☞ Instrumentation (calibration issues)

☞ Statistical Regression

☞ Selection Bias

☞ Differential Mortality

Statistical Regression

- ⌘ Artifact associated with the effects of random error on means of small samples
- ⌘ Designs are vulnerable to regression artifacts whenever groups are created based on scores on a pretest

$$\text{Test score} = \text{True Score} + \text{Error}$$

- ⌘ Groups created on the basis of extreme scores on a pretest will tend to obtain similar scores on the post-test (even in the absence of a treatment)

Threats to External Validity

- ⌘ Reactive Effects of Testing
 - ♦ *pretest reactivity*
- ⌘ Reactive Effects to Experimental Arrangements
 - ♦ *Psychosocial effects of the experimenter*
 - ♦ *Experimenter expectations*
 - ♦ *Demand characteristics*
 - ♦ *Bias associated with stimulus materials or procedures*
- ⌘ Interaction between selection bias and effects of the IV
 - ♦ *Effects are limited to the individuals in the sample*
- ⌘ Multiple treatment interference
 - ♦ *Exposure to one treatment condition alters response to later conditions (carry over effects)*

Research Settings

- ⌘ Laboratory Experiments
 - ⌘ Simulated Environments
 - ⌘ Field Experiments
 - ⌘ Naturalistic Observations
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- ⌘ Realism (Aronson & Carlsmith, 1968)
 - ♦ *Mundane realism*
 - ♦ *Experimental realism*
