

Overview of Design: Choosing a Design

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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)*

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*

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

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*

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*

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.)*

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*

Impurities in Procedures

- ☞ **Correlational studies**
 - ♦ *Mediating variables (another variant of the third variable)*
 - ♦ *e.g., correlation between picnics and red wels (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*

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*

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

- ☞ Realism (Aronson & Carlsmith, 1968)
 - ♦ *Mundane realism*
 - ♦ *Experimental realism*