Strengths and Weaknesses of the Correlational Research Design

**Strengths**
- Describes relationships between variables
- Nonintrusive-natural behaviors
- High external validity

**Weaknesses**
- Cannot assess causality
- Third variable problem
- Directionality problem
- Low internal validity

Goal of experimental strategy

- To establish the existence of a cause and effect relationship between two variables.

Why Psychologists Conduct Experiments

- Test hypotheses derived from theories
- Test the effectiveness of a treatment or program
- Experiments differ from other research designs (e.g., observational, survey research) because they allow researchers to examine the causes of behavior.
Experimental Research

• An experiment must include:
  – an independent variable (IV) and
  – dependent variable(s) (DVs).

• An **Independent Variable**
  – is manipulated (controlled) by the experimenter, and
  – has at least two different conditions or levels
    (e.g., “treatment” and “control” conditions
    "sleep deprived" and "normal sleep").

Experimental Research

• **Dependent Variables** are
  – measured by the experimenter, and
  – are used to determine the effect of the Independent Variable.
  – In most experiments researchers measure several dependent variables to learn the effect of the independent variable.

Marital Distress Intervention

• Markman & al., 1993

• Program teaches couples a set of communication and conflict resolution skills. Emphasis on problem solving skills in handling negative affect.
Selecting a sample

• 114 couples part of a larger study on relationships.
• Matched on:
  1. Engaged vs. planning marriage
  2. Relationship satisfaction
  3. Own ratings of impact of their communication on one other
  4. Confidence in getting married

Group assignment

• Matched on previous variables and randomly assigned to
  – Premarital Relationship Enhancement Program (PREP)- 25 couples- 3 sessions over 3-4 months
  – Control Group: 47 control couples
  – Decline Group: 42 couples

Sample characteristics

• Time 1. pre-marriage
  – Knew each other M=2.5 yrs (range 4-84 mos)
  – Mean age women = 23 years
  – Mean age men = 24 years
  – Mean education = 15.5 years
  – Mean income level = $10, 500
  – 80% sexually active
  – 39% living together
Measures

• Self-report
  – Marital adjustment
  – Relationship Problem Inventory
  – Conflict Tactics Scale
• Communication measures
  – Interaction task:
    • Positive: communication skills, support validation, problem solving, positive affect
    • Negative: withdrawal, denial, conflict, dominance, and negative affect

Depression and sleep deprivation

• Does depression cause sleep problems?
• Does insomnia cause sleep problems?
Writing About Emotional Experiences

– Does writing about emotional experiences cause people to experience better outcomes?
  [Note: Better than what? We need a comparison. That’s why we have control groups.]

– Are cognitive changes that occur with writing about emotional experiences related to these outcomes?

Manipulating an independent variable

• type of writing, using two levels (or conditions):
  – emotional writing
  – superficial writing

Measuring dependent variables

• Health Outcome: # physician visits
• Academic Outcome: GPA
• Cognitive Change: language frequency words (e.g., number of “insight” and “understand” words
Hypotheses

– Students in the emotional writing condition will have better health and academic outcomes than students in the superficial writing condition.
– Students in the emotional writing condition, compared to the superficial writing condition, will demonstrate cognitive change.

Have to think about
Experimental Control and Internal Validity

• Internal validity
An experiment has internal validity when we are able to state confidently that the independent variable caused differences between groups on the dependent variable (i.e., a causal inference).
• How do we know the emotional writing caused them to be healthier and academically successful

Three conditions must be met before we can make a causal inference

1. **Covariation**: We must observe a relationship between the independent and dependent variables.
Three conditions must be met before we can make a causal inference

2. **Time-order relationship**: The presumed cause precedes the effect.

Three conditions must be met before we can make a causal inference

3. **Need to ruling out alternative hypotheses**

   - Using *control techniques*, we rule out other possible causes for the outcome.

Elimination of plausible alternative causes
Elimination of plausible alternative causes

- **Look for Confounds**: When the independent variable of interest and a different, potential independent variable are allowed to covary (go together), a *confounding* is present.

Control Techniques

- To eliminate alternative explanations, researchers use two main control techniques:
  - holding conditions constant, and
  - balancing.

**Holding Conditions Constant**

- the only thing we allow to vary across our groups is the independent variable; *everything else should be the same for the groups in the experiment.*
- no confounds
Pennebaker and Francis

– made sure that participants in their “treatment” condition (emotional writing) and participants in their “control” condition (superficial writing) both wrote something.
– They held constant that participants wrote in both conditions.

Control techniques: *Balancing*

• *Balancing*
  – Some variables cannot be held constant--most notably, characteristics of participants in each condition.
  – We simply cannot make individuals in the different conditions exactly the same.
  – To control these different characteristics of participants in the experimental conditions, researchers use balancing.

*Balancing*

– The goal of balancing is to make sure that, on average, the participants in each condition are essentially the same before the experiment begins.

– Through balancing, all of the participants’ characteristics are equivalent, on average.
How to balance

- How do we balance participants' characteristics across the conditions of the experiment?
- Random assignment to conditions

Independent Groups Designs

- In an independent groups design, different individuals participate in each condition.
- There are three different types of independent groups designs:
  - random groups designs,
  - matched groups designs, and
  - natural groups designs.

Random Groups Designs

- Individuals are randomly assigned to the different conditions of the independent variable.
Random Groups Designs

– What individual differences variables might affect health and academic success in college?
  • Prior success and health, motivation, distance from home, types of courses, etc.

Block Randomization

• **Block Randomization** is often used to assign participants randomly to conditions.
  
  • ABC
  • BAC
  • CAB

Block Randomization

• Advantages of block randomization:
  – Creates groups of equal size for each condition
  – Controls for time-related events that occur during the course of an experiment:
  – As with all random assignment, block randomization balances subject characteristics across the conditions of the experiment.
Alternative Independent Groups Designs

• Random assignment requires large samples
• When only small samples are available, a researcher may choose the matched groups design.

Matched Groups Design: Example

• Suppose you had a treatment for high blood pressure, and compared the treatment to a control group (placebo).

  – Independent Variable: Treatment vs. Placebo
  – Dependent Variable: Blood pressure

What would you match on?

Matched Groups Design

before starting the independent variable manipulation (treatment vs. placebo).

  – participants should be matched on the dependent variable

(or a variable very similar to the dependent variable)
Matching Participants

<table>
<thead>
<tr>
<th>Name</th>
<th>Beginning Blood Pressure</th>
<th>Random Assignment to conditions:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Susan</td>
<td>160 / 110</td>
<td>Treatment: Philip, Control: Susan</td>
</tr>
<tr>
<td>Janet</td>
<td>150 / 120</td>
<td>Treatment: Janet, Control: Catherine</td>
</tr>
<tr>
<td>Philip</td>
<td>160 / 110</td>
<td>Treatment: Barbara, Control: John</td>
</tr>
<tr>
<td>Barbara</td>
<td>160 / 130</td>
<td>Treatment: William, Control: Benjamin</td>
</tr>
<tr>
<td>John</td>
<td>180 / 130</td>
<td>Average Blood Pressure:</td>
</tr>
<tr>
<td>Benjamin</td>
<td>170 / 120</td>
<td>Treatment: 165 / 120, Control: 165 / 120</td>
</tr>
<tr>
<td>Catherine</td>
<td>150 / 120</td>
<td></td>
</tr>
<tr>
<td>William</td>
<td>170 / 120</td>
<td></td>
</tr>
</tbody>
</table>

Random Assignment to conditions:
- Philip and Susan
- Janet and Catherine
- Barbara and John
- William and Benjamin

Average Blood Pressure:
- Treatment: 165 / 120
- Control: 165 / 120

Matched Groups Design

• Important points about matching:
  – participants are matched only on the matching variable (task); the groups may differ on other important variables.
  – These differences may be alternative explanations for the study’s results.
  – The more characteristics you try to match, the harder it will be to match participants.

Natural Groups Designs

• independent variable in which the groups (conditions) are formed naturally.

• individual differences variables (subject variables) refer to characteristics or traits that vary across individuals.
  – Physical Characteristics: sex, race
  – Social (Demographic) Characteristics: ethnicity, religious affiliation, marital status
  – Personality Characteristics: extraversion, emotional stability, intelligence
  – Mental Health Characteristics: depression, anxiety, substance abuse, disordered thinking
Natural Groups Designs

Example

Suppose we want to compare occupational functioning of schizophrenics and normal controls (non-schizophrenics).

What is the independent variable?

Natural groups variable: schizophrenic vs. non-schizophrenic, normal participants

What is the dependent variable?

Occupational functioning

Natural Groups Designs

Causal inferences

Can’t make a causal inference when a natural groups design is used.

For example, suppose schizophrenics have poorer occupational functioning than the normal participants.

Can we say that schizophrenia caused this poorer occupational functioning?

Natural Groups Designs

Example

No. The two groups may differ in other ways, in addition to schizophrenia vs. no schizophrenia. For example:

- education level, drugs, nutritional status, tardive dyskinesia, etc.

Any of these variables may cause differences in occupational functioning; that is, they are alternative explanations for the relationship between schizophrenia and occupational functioning.
Natural Groups Designs

- Natural groups designs are a form of [correlational research](#).
- These designs allow researchers to
  - describe and predict relationships among variables, but
  - they do not allow researchers to make causal inferences.

Internal Validity

- The internal validity of an experiment (the ability to make a causal inference about the effect of an independent variable on a dependent variable) is challenged when:

  - intact groups are used,
  - extraneous variables are not controlled,
  - selective subject loss occurs, and
  - demand characteristics and experimenter effects are not controlled.
**Threat: Intact groups**

- Intact groups are formed prior to the start of an experiment.
- Individuals are not randomly assigned to intact groups. As a result, individual differences among groups threaten the validity of the experiment.
- When groups, rather than individuals, are randomly assigned to conditions, subject characteristics are not balanced.

**Threats: Extraneous Variables**

- Practical considerations when conducting an experiment may confound an experiment—these are referred to as extraneous variables (or nuisance variables).
- Extraneous variables are controlled using balancing or holding conditions constant.

**Threat: Subject Loss**

- Subject Loss (Attrition)
  - Subject loss occurs when participants fail to complete an experiment.
  - This challenges the internal validity of an experiment if the equivalent groups formed at the beginning of an experiment are no longer equivalent at the end of the experiment because of attrition.
Threat: Mechanical subject loss

– occurs when equipment failure or experimenter error results in a participant's inability to complete the experiment.

Threat: Selective subject loss

(1) Participants are lost differentially across the conditions of the experiment (e.g., more participants are lost in the treatment condition compared to the control condition),
(2) When some characteristic of the participant is responsible for the loss (e.g., subject characteristics such as personality, intelligence, physical characteristics), and
(3) The subject characteristic is related to the dependent variable in the experiment.

Placebo Control and Double-Blind Experiments

Demand characteristics are the cues and other information that participants use to guide their behavior in a psychological study.
Placebo control group

- A **placebo control group** is used to assess whether participants’ expectancies contribute to the outcome of an experiment.

Threats: Experimenter effects

- **Experimenter effects** refer to potential biases that occur when experimenters’ expectancies regarding the outcome of the experiment influence their behavior toward participants in different conditions.
- Keep experimenter “blind.”

Double-Blind Experiment

- Both the participants and the experimenters/observers are unaware of which condition is being administered.
- Double-blind experiments control for both demand characteristics and experimenter effects.
The External Validity Question

Can we generalize to other persons, places, times?

How Do We Generalize?

generalize back

How Do We Generalize?

settings

The Study

people

places

times
How Do We Generalize?

How similar

Threats to External Validity

Interaction of Selection and Treatment
maybe it is just these people

Interaction of Setting and Treatment
maybe it is just these places

Interaction of History and Treatment
maybe it is just these times

How Can We Improve External Validity?

random sampling
replicate, replicate, replicate
use theory