

Research Methods Psy 365

Experimental Design



What We Will Cover in This Section

- Overview.
- Basic requirements.
- Between subjects designs.
- Within subjects designs.
- Factorial designs.
- Pre-experimental designs.



Basic Requirements

- Two or more groups.
- Participants randomly assigned to treatment conditions.
- One or more treatment conditions.

Basic Design

Treatment Groups	Independent Variable	Dependent Variable
Group 1	Treatment (s) controlled by the experimenter	Measurement(s) made after the treatments are applied.
Group 2		

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Treatment Groups

Experimental Group

Group that gets some level of the treatment being studied.

Control Group

Group in the study that does not get the experimental treatment.

Comparison Group

Group in the study that gets some alternative level of the experimental treatment.

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Characteristics of Good Treatments

- Construct valid.
 - Right construct.
- Strength
 - Right levels.
 - Right strength.
 - Salient.
- Reliable.
- Multiple levels.
- Multiple stimuli.

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Field Research Example

- In 1984 Pittsburgh National Bank had a problem with their tuition reimbursement program.
- They were paying tuition and fees for employees seeking bachelors degrees.
- Approximately 45% of the people did not want to work in the field in which they majored.
- The bank was prepared to scrap the program.

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Evaluation Design

	Independent Variable	Dependent Variable
Experimental Group	342 people who attended workshop	Job posting Applications 70% Promotions: 12% Salary/grade change: 91%
Control Group	450 people who did not attend the workshop.	Job posting Applications 23% Promotions: 3% Salary/grade change: 66%

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Between Subjects Designs

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Basic Characteristics

- Two or more treatment conditions.
- Subjects exposed to only one treatment condition and one treatment level.

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Randomized Post-test Only Control Group

	Independent Variable	Dependent Variable
SS ₁ SS ₂ SS ₃	Treatment 1	Measure
SS ₄ SS ₅ SS ₆	Treatment 2	Measure

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Randomized Pre-test Post-test Control Group

	Pre-test	Independent Variable	Post-test
SS ₁ SS ₂ SS ₃	Measure A	Treatment 1	Measure A
SS ₄ SS ₅ SS ₆	Measure A	Treatment 2	Measure A

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Pre-test, Post-test

Benefits.

1. Evaluate the assumption that the groups are alike.
2. Look at the extent of change.
3. Evaluate the influence of participant mortality.

Issues

1. Takes time.
2. Demand characteristics.
3. Carry over effect.
4. Testing reactivity.
5. History.

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Matched Random Assignment

	Independent Variable	Post-test
SS _{1A} SS _{2B} SS _{3C}	Treatment 1	Measure A
SS _{4A} SS _{5B} SS _{6C}	Treatment 2	Measure A

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Matched Random Assignment

Benefits

1. Minimizes probability that groups will be different on a key variable.
2. Reduces random subject error.

Issues.

1. Time consuming.
2. Never sure you have controlled for all variables.
3. Complicated with multiple variables.

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Within
Subjects
Designs

Within Subjects Design

	Independent Variable	Post-test
SS ₁ SS ₂ SS ₃	Treatment 1	Measure A
SS ₁ SS ₂ SS ₃	Treatment 2	Measure A
SS ₁ SS ₂ SS ₃	Treatment 3	Measure A

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Example

	Independent Variable	Post-test
SS ₁ SS ₂ SS ₃	Milk Chocolate	Preference
SS ₁ SS ₂ SS ₃	German Chocolate	Preference
SS ₁ SS ₂ SS ₃	Dark Chocolate	Preference

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Benefits and Issues

Benefits.

1. Fewer participants.
2. Reduce subject variability.

Order effects.

1. Practice effect.
2. Fatigue effect.
3. Carryover effect.
4. Sensitization effect (demand characteristics).

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Counterbalancing

- Varying the order of the presentation of the independent variable.
- Full counterbalancing.
 - Issue here is the number of possibilities is $N!$.
- Randomized blocks.

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Counterbalancing

	Trial 1	Trial 2	Trial 3
S1	Milk Chocolate	German Chocolate	Dark Chocolate
S2	Dark Chocolate	Milk Chocolate	German Chocolate
S3	German Chocolate	Dark Chocolate	Milk Chocolate

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Multiple Variable (Factorial) Designs



Factorial Design

A design in which each participant is exposed to two or more treatments.



Example

Dr. Natalie A. Tired was interested in the influence of anxiety on task performance. She felt that anxiety would enhance performance on easy tasks but would be a detriment when the task was difficult.

Dr. Tired developed both an easy task and a difficult task. She then had three stress conditions: low, moderate, and high.

Her prediction was that subjects would do well on both tasks when the stress level was low. She felt that the performance for the difficult task would decrease as the stress got higher but that the easy-task group's performance would get better as the stress level increased.



Question?

- How many independent variables are there?
- What are they?
- How many dependent variables are there?
- What are they?



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Results

Task	Stress Level			Mean
	Low	Medium	High	
Hard	6.5	4.0	1.0	3.83
Easy	4.0	6.5	10.0	6.83
Mean	5.25	5.25	5.50	

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Outcomes

Main Effect

The influence that one variable alone has independently of the other variables.

Interaction

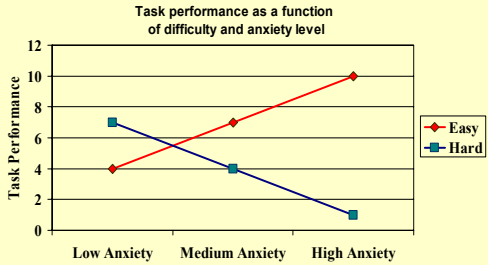
The influence that two or more variables have on the dependent variable over and above their main effects.

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Example



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Uses of Factorial Designs

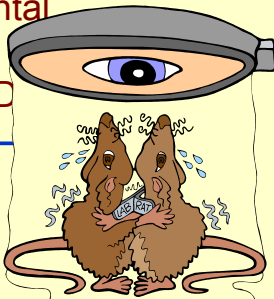
1. Testing for moderator effects.
2. Are there order effects.
3. Controlling extraneous variables.

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Pre-Experimental And Quasi- Experimental D



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Ex Post Facto Approach

	Independent Variable	Dependent Variable
Group 1	Groups divided based on some pre-existing condition.	Measurement(s) made after the assignment to groups
Group 2		

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Benefits and Issues

Benefits.

1. May be the only way to study some influences.
2. May be OK for preliminary research.

Issues.

1. Ss not randomly assigned to treatment conditions.
2. If a person is unusual on one characteristic he may be unusual on others.

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One-Shot Case Study

	Independent Variable	Dependent Variable
Group	Treatment (s) controlled by the experimenter	Measurement(s) made after the treatments are applied.

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Benefits and Issues

Benefits.

1. OK for preliminary research.

Issues.

1. History.
2. Maturation.
3. Regression.



One-group Pre-test Post-test

	Pre-test	Independent Variable	Post-test
Group	Measure A	Treatment 1	Measure A



Benefits and Issues

Benefits.

1. OK for preliminary research.

Issues.

1. History.
2. Maturation.
3. Regression.
4. Testing.
5. Instrument decay.



Non-equivalent Control Group

	Independent Variable	Dependent Variable
Group A	Treatment 1	Measure
Group X	Treatment 2	Measure

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Benefits and Issues

Benefits.

1. May be the only alternative in field experimentation.

Issues.

1. Treatment difference is CONFOUNDED by group difference.

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Thought Problem #1

Patty Kayke decided to evaluate the effects of low-level sound on the sleeping behavior of dogs. She took a group of dogs and through a set of hidden speakers played a 200 Hz sound to the dogs at 20 decibels. She then evaluated their sleeping behavior.

1. **What kind of design is this?**
2. **Is this a good or bad design? Why?**
3. **How could this study be improved?**

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Thought Problem #2

Justa Minnit wanted to measure the effects of music on aggression in a group of residential mental health patients. For one week Minnit plays music from 8:00 AM until 9:30 and aggressive acts are counted for the rest of the day. The next week no music is played and aggressive acts are counted in the afternoons.

1. **What kind of design is this?**
2. **Is this a good or bad design? Why?**
3. **How could this study be improved?**

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Thought Problem #3

Pickup N. Dropoff wanted to evaluate the influence of Jolt on the driving habits. Dropoff had a group of people drink 12 oz of Jolt, then assessed their ability to drive through a set of traffic cones. Dropoff then waited an hour and had the people drive through the cones again. He evaluated the differences number of cones hit.

1. **What kind of design is this?**
2. **Is this a good or bad design? Why?**
3. **How could this study be improved?**

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Thought Problem #4

Petal D. Stamen was interested in the influence that flowers would have on women's affection toward men. Petal sent a dozen roses to a random sample of women then asked them to fill out a well researched affection survey.

1. **What kind of design is this?**
2. **Is this a good or bad design? Why?**
3. **How could this study be improved?**

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The End