

Designing Psychology Experiments: Data Analysis and Presentation

Review of Chapter 4: Designing Experiments

- Develop Hypothesis (or Hypotheses) from Theory
- Independent Variable(s) and Dependent Variable(s)
- Operational Definitions of each
 - Each definition must be measurable (meaning?)
 - Each definition must be reliable (meaning?)
 - Each definition must be valid (meaning?)

Designing Psychology Experiments: Data Analysis and Presentation

Finding Operational Definitions

- Decide on some terms that name or are similar to your variable
- Read the literature to use parameters already developed
- Decision on which OD to use may be based partially on type of scale

Type of scale used helps determine

- the statistical power of the study
- the statistical tests used
- how the results will be presented in the report of the study

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The statistical power of the study:

Your hypothesis says that (all other things being equal) if person hears conversation, participant will make more mistakes than if he/she does not hear conversation

Null hypothesis says (what?)

Your Finding: No diff—does not disprove the Null Hypothesis

BUT suppose

1. You did not run the study session long enough? (e.g. instead, participants had 500 math problems and heard conversation for 5 minutes—more chance to actually make mistakes) and/or
2. There was a between group difference that was consistent but very small, so you needed more participants to find it (to separate the “signal” from the “noise”)

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Then you have committed a Type II error

Type I and Type II Errors

Remember from Statistics class

Type I Error is:

Thinking you disproved the Null Hypothesis because you hit that one chance in 20

Type II Error is:

Accepting the Null Hypothesis when, in fact, your hypothesis was correct

To avoid Type II Error:

Increase statistical power

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How would you increase statistical power?

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How would you increase statistical power?

1. Run more participants (computer programs help you decide this before you begin and/or
2. Use a better, perhaps more precise, operational definition of the dependent variable
3. Other ways as well, but

Type of Scale then does make a difference in your statistical power.

As Power increases, the probability of Type II Error decreases

Designing Psychology Experiments:

Data Analysis and Presentation

Type of Scale determines Presentation of Data

Nominal scale Frequency table (with a percent column) Cross tabulation or Bar Chart.

Mode could be important

Nonparametric stats (e.g. chi square)

Example:

My favorite car color is

blue green red yellow (circle one)

Example of Crosstabulation

Favorite Color	Gender		Total
	Male	Female	
BLUE	15	5	20
GREEN	10	10	20
YELLOW	5	25	30
RED	20	5	25
Total	50	45	95

Cell frequency? Marginal frequency?

Designing Psychology Experiments: Data Analysis and Presentation

Type of Scale determines Presentation of Data

Ordinal scale Frequency table (percent and cumulative percent column); bar chart

Mode and Median could be important

Examples: Lykert scale (with labels on points)

Ranking scale (ipsative)

Ordinal Scale Examples

Lykert Scale

I like RED cars.

1	2	3	4	5
Strongly Agree	Slightly Agree	Neutral	Slightly Disagree	Strongly Disagree

Ranking Scale

Rank each color (Blue, Green, Yellow, Red) as
First, Second, Third or Fourth

Frequency Table

I like RED cars.

	1 Strongly Agree	2 Slightly Agree	3 Neutral	4 Slightly Disagree	5 Strongly Disagree
M	25	10	5	5	5
	50	20	10	10	10
	50	70	80	90	100
F	10	15	10	5	5
	22	34	22	11	11
	22	56	78	89	100

Ranking

Rank each color (Blue, Green, Yellow, Red)
as First, Second, Third or Fourth

Data for RED

	1	2	3	4
M	20	10	10	10
	40%	20%	20%	20%
F	5	20	10	10
	11%	44%	22%	22%

Designing Psychology Experiments: Data Analysis and Presentation

Type of Scale determines Presentation of Data

Interval scale example

When you drink alcohol, how intoxicated do you typically become?

1

2

3

4

Not

Extremely

at all

Bipolar scale: 4 is not necessarily 2X as much as 2

However, Mean really does Mean something

Designing Psychology Experiments: Data Analysis and Presentation

Type of Scale determines Presentation of Data

Ratio Scale has a true zero

During the past 90 days, how many days did you consume alcohol?

Answers can range from 0 to 90, and 90 really does mean 2X as much as 45.

Both Interval and Ratio scale data can be presented with means and standard deviations.

Analyses: can use t-tests, ANOVAs, etc.

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Today

- Learn about Principle of Concomitant Variation
- Learn about different levels of independent variables
- Learn about how Independent variables affect choice of within or between groups designs
- Learn about methods for holding all other variables constant

Designing Psychology Experiments: Defining Independent Variables

Principle of Concomitant Variation:

Change in one variable (DV) occurs as a result of a change (your manipulation) in another variable (IV).

IV in your study was dichotomous

Conversation (Treatment) vs. Silence (Control)

What if it was not “Conversation” per se that slowed people down? What if it was just that any “Distracting Noise” would do it?

Designing Psychology Experiments: Defining Independent Variables

What if IV is redefined as “Distracting Noise”

Designing Psychology Experiments: Defining Independent Variables

What if IV is redefined as “Distracting Noise”

1. Conversation
2. Distracting Noise

Vs Control (Silence) (3 condition study)

Designing Psychology Experiments: Defining Independent Variables

What if IV is redefined as “Distracting Noise”

1. Conversation (Verbal with content)
2. Distracting Noise (no Verbal content)

Vs Control (Silence) (3 condition study)

Maybe even:

1. Conversation (Verbal with content)
2. Nonsense Words (Verbal, No content)
3. Distracting Noise (No Verbal content, just noise)

Vs Control (Silence) (4 condition study)

Designing Psychology Experiments: Defining Independent Variables

What if IV is redefined as “Noise that must be responded to”?

1. Conversation (Verbal content, have to respond)
 2. Music (Verbal content, but don't have to respond)
- Silence (Control)

And so on—depends on how you define IV and how many levels you determine are required to separate out the important components.

Might need to do more than one experiment and hold some variables constant

Designing Psychology Experiments: Defining Independent Variables

Class assignment:

Pair off

Use PsychInfo

Find two experiments that used one independent variable with at least two levels versus a control group

Bring back to class at end of break and present

Designing Psychology Experiments: Defining Independent Variables

In a **Between** Groups study, it is important that the groups be as equivalent as possible to reduce...what?

How to make the groups equivalent?

1. Matching (Using variables that theory suggests are important)

Might be difficult to determine which variables are important
(lose some degrees of freedom with each)

Might be difficult to find a “match” for each participant

2. Random Assignment (**not** first one, then two, etc)
3. Counterbalancing (e.g. within genders)

Designing Psychology Experiments: Defining Independent Variables

In a **Between** Groups study, you also need to reduce or eliminate

Experimenter bias

How might the Experimenter influence the results inadvertently?

How to keep experimenter blind about the experimental condition?

Designing Psychology Experiments: Defining Independent Variables

Between versus **Within** Subjects Designs

Depends on Independent Variable

If application of IV actually changes a subject,
then a Within Subjects design might not be
the best. (Multiple Treatment Interference)

Example in book: Non-verbal communication
and lying (What was that experiment about?)

Without sound: Can be done as within subjects

With sound: Maybe not

Designing Psychology Experiments: Defining Independent Variables

Let's look at the # of Conditions with 2 men and 2 women giving speech

- M1, M2, F1, F2
- M2, F1, F2, M1
- F1, F2, M1, M2
- F2, M1, M2, F1

Are we finished?

Are all possible combinations represented?
(why do that?)

Designing Psychology Experiments: Defining Independent Variables

Within Subjects study:

Still need to keep all other conditions equal and change only the level of the independent variable

Still need matching or counterbalancing or random assignment to sequencing

Still need to keep Experimenter and Participant blind as to which condition is being presented

New Experiment

- Scenario study (factorial design—What's that?)
- More cell phone studies?
- Workplace aggression?
- Views of alcohol and drug users?