

Psychology Research Process

- Logical Processes
- Induction
 - Observation/Association/Using Correlation
 - Trying to assess, through observation of a large group/sample, what is associated with what?
 - Examples: Naturalistic Observation, Surveys, Qualitative studies (e.g. focus groups)
 - Strengths: Helps build theories
 - Weaknesses:
 - 1) Don't know when you're wrong (statistics help...)
 - 2) Cannot show cause and effect

Psychology Research Process

- Logical Processes
- Deduction
 - Using Premises (from theory) to test theory
 - Example:
 - Rape Blame study
 - Women are held responsible when drinking
 - Woman is drinking
 - All other things are held equal (controlled)
 - She will be held responsible (more than when not)
 - Derive Hypothesis
 - Test Hypothesis by setting up situation in which premises occur

Psychology Research Process

- Logical Processes
- Deduction (continued)
 - What if hypothesis shown to be correct?
 - Support for theory (cause and effect)
 - However, problem of confounding variable
 - What if hypothesis found not correct?
 - 1. Maybe theory is wrong
 - 2. Maybe something you did not control for (hold constant) had a strong effect on results (caused much variability)
 - 3. Statistics help with #2; replication helps with #1

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- Terms
 - **Theory**: An organized, systematic explanation of a phenomenon
 - **Hypothesis**: A more specific application of the theory
 - **Particular conditions → Particular outcomes**
 - **(Because....?)**

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Particular conditions → Particular outcomes

Particular conditions / Independent variable

Particular outcome / Dependent variable

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- Independent Variable:
 - A (hypothetical) cause that the experimenter manipulates
- Dependent Variable:
 - The (hypothetical) effect that the experimenter expects to see
 - Experiment we did in class on Wednesday
 - IV? DV?

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Examples: **IV's?** **DVs?**

- 1) Effect of Alcohol Intoxication on Braking Distance When Driving
- 2) Effect of Ambient Room Temperature on Activity Levels of Mice
- 3) Do Specific Examples in Class Produce Better Learning in Psychology Classrooms?
- 4) Instituting a “No Smoking” Policy in a Restaurant: Does It Change the Clientele?

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Operational Definition

“A definition that is specific enough to be used to actually perform an experiment” Pg 46

Must be measurable

Must have some validity

Psychology Research Process

Examples: **Operational definitions?**

- 1) Effect of Alcohol Intoxication on Braking Distance When Driving
- 2) Effect of Ambient Room Temperature on Activity Levels of Mice
- 3) Do Specific Examples in Class Produce Better Learning in Psychology Classrooms?
- 4) Instituting a “No Smoking” Policy in a Restaurant: Does It Change the Clientele?

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Examples: **Hypotheses** probably being tested?

- 1) Effect of Alcohol Intoxication on Braking Distance When Driving
- 2) Effect of Ambient Room Temperature on Activity Levels of Mice
- 3) Do Specific Examples in Class Produce Better Learning in Psychology Classrooms?
- 4) Instituting a “No Smoking” Policy in a Restaurant: Does It Change the Clientele?

Psychology Research Process

Between Groups Vs. Within Groups Designs

- Example: Braking Distance study
- 100 undergrads—random assignment
 - 50 sober; 50 intoxicated
- Distributions do not overlap—everybody who is intoxicated takes way longer to brake

Hypothesis supported.

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Between Groups Vs. Within Groups Designs

- Example: Braking Distance study
- 100 undergrads—random assignment
 - 50 sober; 50 intoxicated
- But what if:
- Distributions overlap because, even sober, braking distance times vary so much...
- Hmm, what to do?

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Between Groups Vs. Within Groups Designs

- Example: Braking Distance study (cont.)
- I Know!!!
- How about a Within Groups Design??
- How would that work?
- But what might be the problems with it?
- How about last Wednesday's study?

Psychology Research Process

Review

- Induction vs. Deduction
- Theory
- Hypothesis
- Independent Variable
- Dependent Variable
- Confounding Variables
- Operational Definition
- Between Group vs. Within Group design

Quick Review of Statistics

Purpose of Statistics in Research

Describe and Summarize the data

Descriptive Statistics

Test the hypothesis or hypotheses

Inferential Statistics

Quick Review of Statistics (cont)

Descriptive Statistics:

Measures of central tendency

Mean

Median

Mode

Measures of variability

Range

Variance

Standard Deviation

Quick Review of Statistics (cont)

Descriptive Statistics (cont):

Measures of Association between two or more variables

Pearson Product-Moment correlation - (symbolized as r).

Most common measure of association

Describes how strongly variables are related to one another.

Quick Review of Statistics (cont)

Inferential Statistics

Hypothesis testing (What does it all mean?)

Your hypothesis versus the null hypothesis

- *t*-test – to compare means of two groups
- *F*- test – to compare means of more than two groups. (Analysis of Variance)
- Chi-square – to compare frequencies (e.g., how many men versus how many women?)

Quick Review of Statistics (cont)

Inferential Statistics (continued)

- Pearson's r-test – to investigate whether there is a linear relationship between two continuous variables.
- Regression – to use one predictor variable to predict a criterion variable.
- Multiple Regression – to use more than one predictor variable to predict a criterion variable.

Quick Review of Statistics (cont)

Inferential Statistics (continued)

- Partial correlation – to partial out the effects of a third variable that is influencing the relationship between two variables.
- Semi-partial correlation – to partial out the effects of a variable that is influencing only one of the other variables.

Data Analysis and Presentation

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 difference, does not support your hypothesis— BUT does not prove the Null Hypothesis

Data Analysis and Presentation

Suppose instead

1. You did not run the 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”)

If you concluded that your hypothesis was wrong

Data Analysis and Presentation

Suppose instead

1. You did not run the 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”)

If you concluded that your hypothesis was wrong:

THEN YOU HAVE COMMITTED A TYPE II ERROR

Data Analysis and Presentation

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

Data Analysis and Presentation

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

As Power increases, the probability of Type II Error decreases

Type I vs Type II Errors		True State of Affairs	
		Null is true	Null is false
Your decision	Reject the null	Type I error (α)	Correct inference (power)
	Fail to reject the null	Correct inference	Type II error (β)

Descriptive Statistics: Variability

Central Tendency:

Mean, Median, Mode

Variability:

Amount of difference within a data set.

Dispersion:

Spread of the numbers that make up the data within a data set

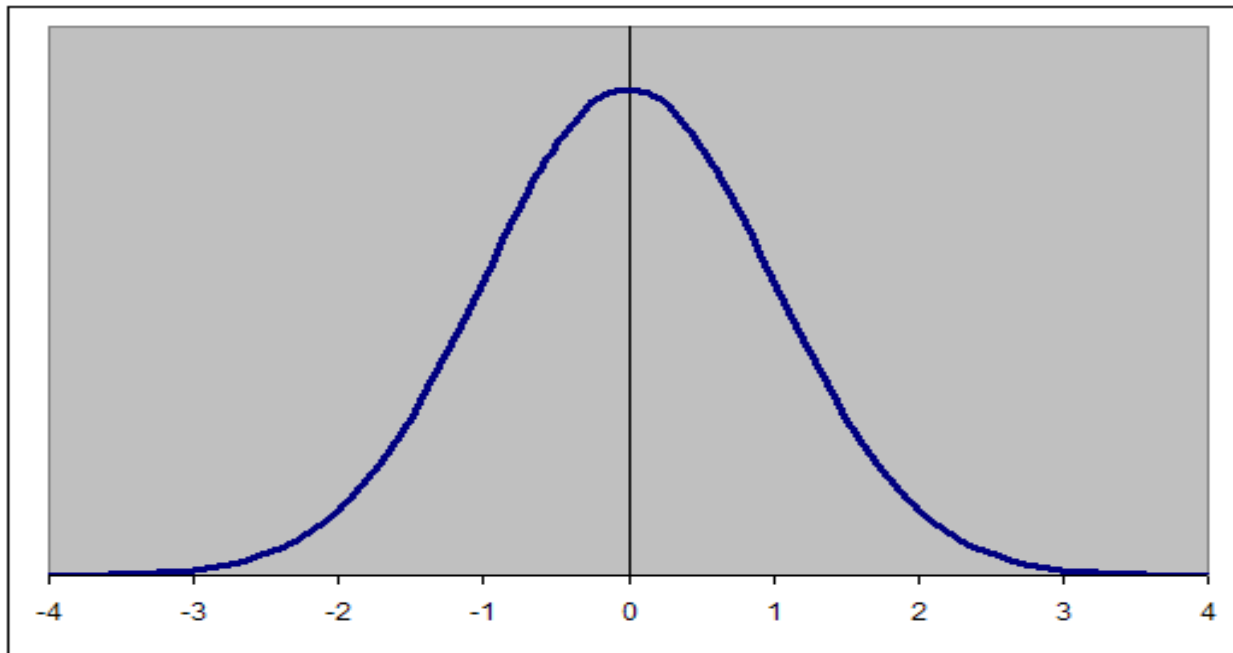
Range:

From the lowest number to the highest number in the distribution

Descriptive Statistics: Variability

Normal Distribution Curve

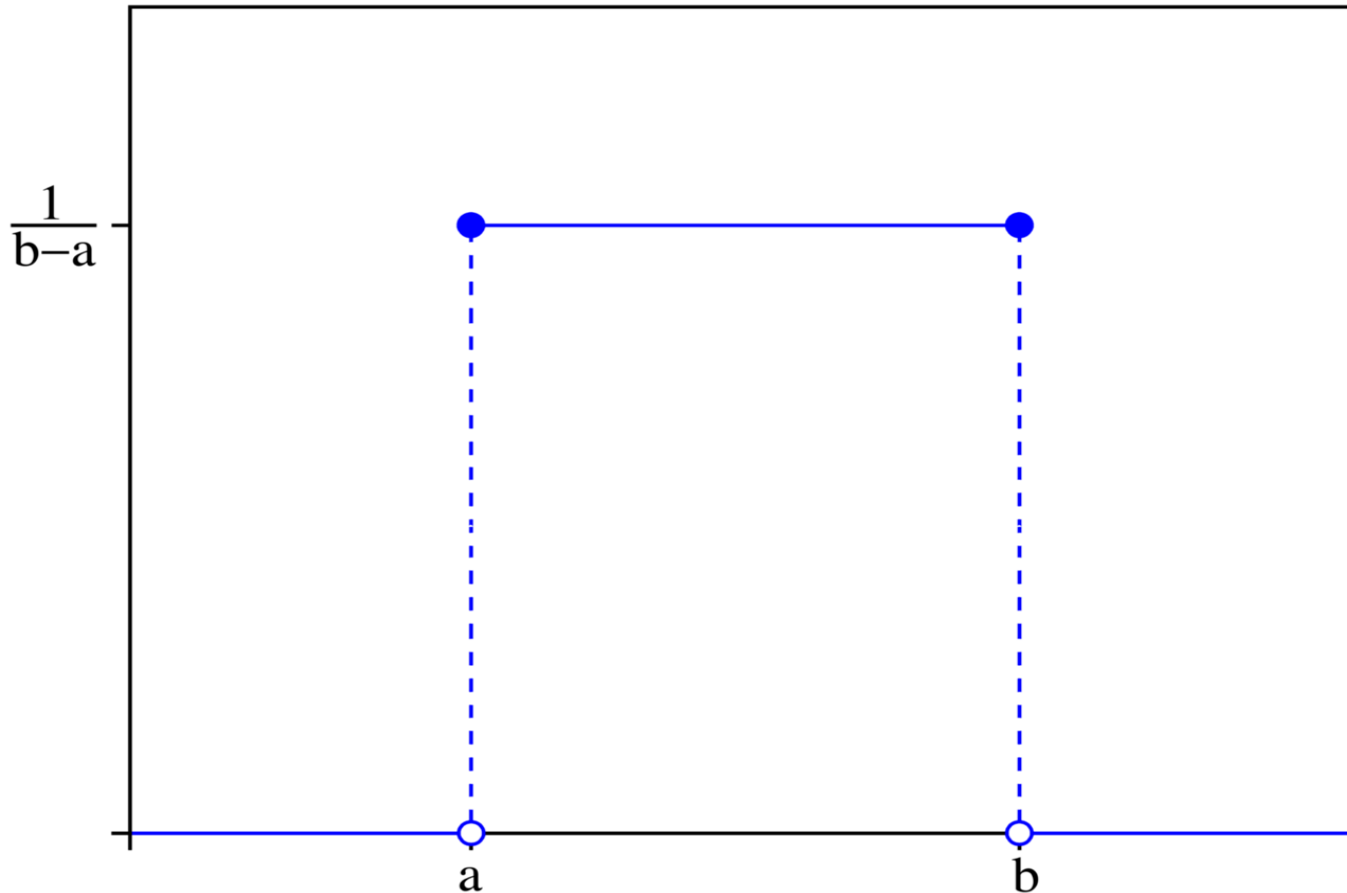
Examples of Normal Distributions?



Descriptive Statistics: Variability

Uniform Distribution (No variability)

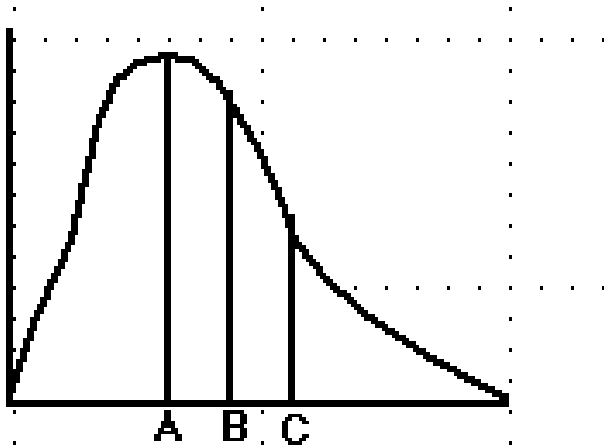
Examples of Uniform Distributions?



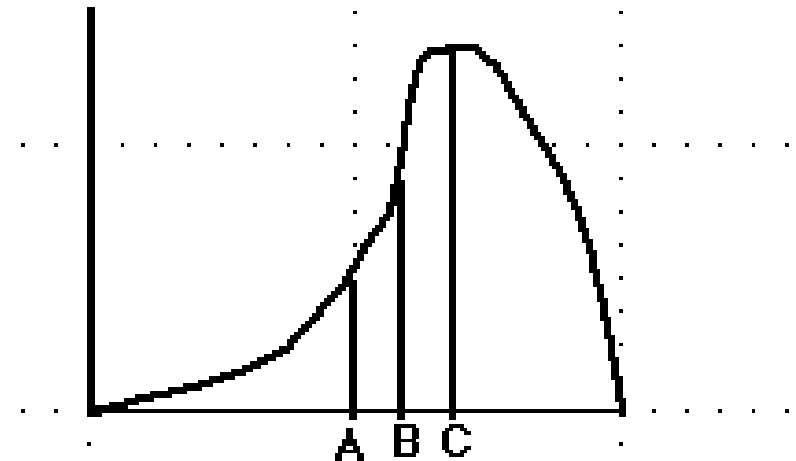
Descriptive Statistics: Variability

Skewed Distributions

Examples of Skewed Distributions?



Positively Skewed Distribution

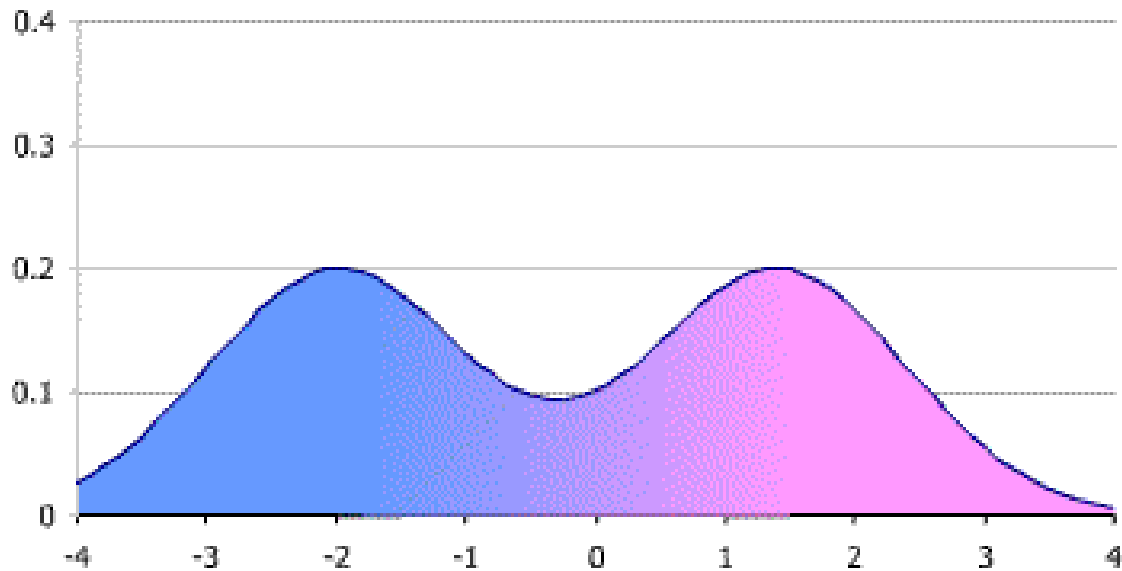


Negatively Skewed Distribution

Descriptive Statistics: Variability

Bimodal Distribution

Examples of Bimodal Distributions?



Descriptive Statistics: Variability

Variance:

Measure of how all the scores in a set of data deviate (differ) from the mean
(Formula and step by step calculation on page 94)

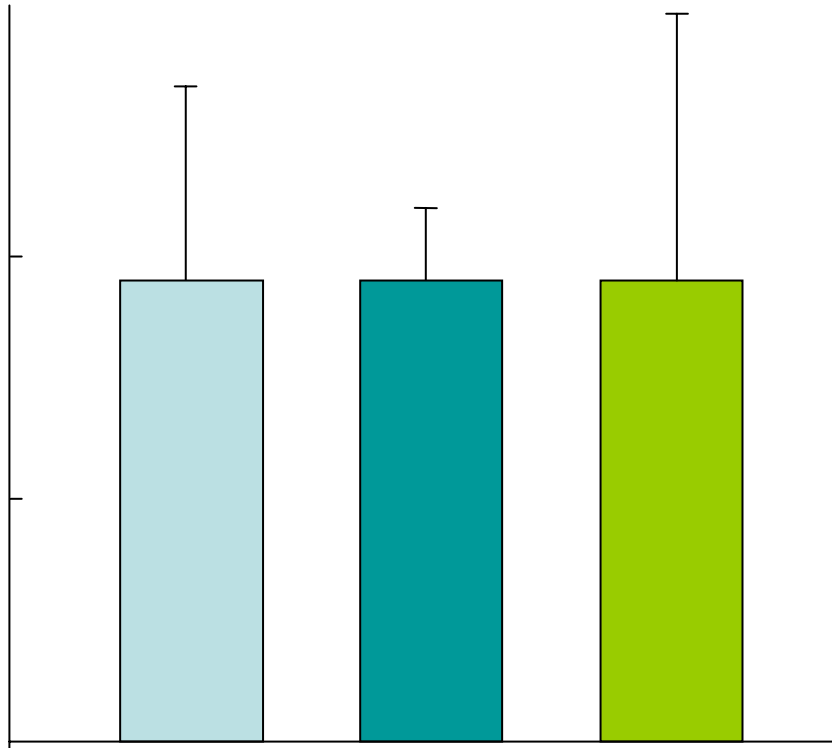
Standard deviation:

Square root of the variance. (see pg 93)

Standard Error of the Mean (SE):

Standard deviation divided by the square root of n (corrects for sample size)

Graphing the Mean and Variance



Z-scores

Method of standardizing (helping to shape like a normal curve)

Formula

$(\text{Score} - \text{Mean}) / \text{standard deviation}$

Examples of this type of presentation:

MMPI test scores

WAIS Scores

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.

Wednesday

- 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

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?