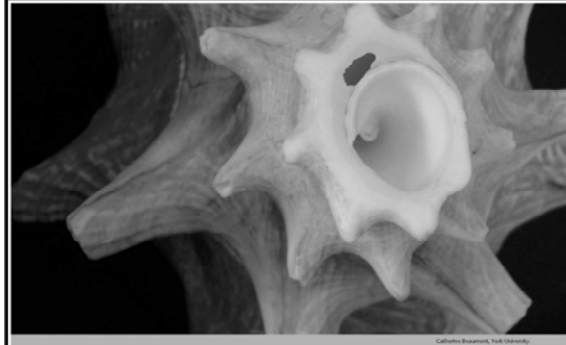


Psychology: Themes and Variations Second Canadian Edition

September 22, 2009



Class 5

Statistics
and Ethics



Strengths and Weaknesses of Experimental Research

- Strengths:
 - conclusions about cause-and-effect can be drawn
- Weaknesses:
 - artificial nature of experiments
 - ethical and practical issues
- Sometimes doing a “true” experiment is simply impossible because we CANNOT manipulate the independent variables

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The power of the experimental method lies in the ability to draw conclusions about cause-and-effect relationships from an experiment. No other research method has this power.

Experimental research does, however, have limitations. Experiments are often artificial; researchers have to come up with contrived settings so that they have control over the environment.

Some experiments cannot be done because of ethical concerns...for example, you would never want to malnourish infants on purpose to see what the effects are on intelligence.

Others cannot be done because of practical issues...there's no way we can randomly assign families to live in urban vs. rural areas so we can determine the effects of city vs. country living.

Pseudo-Independent Variables

- A variable that can't be manipulated, but can be measured
 - Handedness
 - Gender
- Control for confounding variables
- Sampling Bias

Handedness Questionnaire

Most people are either right-handed or left-handed. However, there are different "degrees" of handedness. Some people use one hand for jobs that require skill and the other hand for jobs that involve reaching. Other people use the same hand for these different jobs. Use this "Handedness Questionnaire" to measure the strength of handedness. Place a mark in a box for each question that describes you best.

- | | LEFT | RIGHT | EITHER |
|--|------|-------|--------|
| 1. Which hand do you use to write? | | | |
| 2. Which hand do you use to draw? | | | |
| 3. Which hand do you use to throw a ball? | | | |
| 4. Which hand do you hold a tennis racket? | | | |
| 5. With which hand do you hold a toothbrush? | | | |
| 6. Which hand holds a knife when you cut things? | | | |
| 7. Which hand holds a hammer when you nail things? | | | |
| 8. Which hand holds a match when you light it? | | | |
| 9. Which hand holds an eraser when you erase things? | | | |
| 10. Which hand removes the top card when you deal from a deck? | | | |
| 11. Which hand holds the thread when you thread a needle? | | | |
| 12. Which hand holds a fly swatter? | | | |
| | | | TOTAL |

<http://faculty.washington.edu/chudler/rtablen.html>

How to Determine your Score

1. Count the number of LEFT, RIGHT and EITHER responses.
2. Multiply the number of RIGHT responses by 3. This number = R
3. Multiply the number of EITHER responses by 2. This number = E
4. Add R + E + (number of LEFT responses). This sum is your score.

Here is a table to help:

Number of RIGHT responses x 3 = ____

Number of EITHER responses x 2 = ____

Number of LEFT responses = ____

TOTAL = _____

How to Interpret Your Score

Score Handedness

33 to 36 = Strongly Right-Handed

29 to 32 = Moderately Right-Handed

25 to 28 = Weakly Right-Handed

24 = Ambidextrous

20 to 23 = Weakly Left-Handed

16 to 19 = Moderately Left-Handed

12 to 15 = Strongly Left-Handed

(This questionnaire was adapted from the handedness questionnaire by Stanley Coren, *The Left-Hander Syndrome: The Causes and Consequences of Left-Handedness*, Free Press, New York, 1992.) 5

Descriptive/Correlational Methods: Looking for Links

- Methods used when a researcher cannot manipulate the variables under study
 - Naturalistic observation
 - Case studies
 - Surveys
- Allow researchers to describe patterns of behaviour and discover links or associations between variables but cannot imply causation

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When practical or ethical issues do not allow for variables to be manipulated, researchers rely on descriptive/correlational methods.

Naturalistic observation is when a researcher engages in careful observation of behaviour without intervening directly with the subjects...do more men than women run yellow lights?

A case study is an in-depth investigation of an individual subject...profile of a serial killer, etc.

In a survey, researchers use questionnaires or interviews to obtain specific information about subjects' behaviour...the Kinsey Report on "normal" sexual behaviour. A modern day example: Cooper (1999) set out to determine how much time people spend on online sexual pursuits...conducted an online questionnaire that was posted for seven weeks that invited internet sex pursuers to participate. A self-selected sample such as this is not representative of the population of the US, but it probably was representative of those who visit sexually explicit websites.

Descriptive/Correlational methods allow researchers to discover links or associations between variables, but cannot imply causation.

Statistics and Research: Drawing Conclusions

- Statistics – using mathematics to organize, summarize, and interpret numerical data
 - Descriptive statistics: organizing and summarizing data
 - Inferential statistics: interpreting data and drawing conclusions

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Statistics - using mathematics to organize, summarize, and interpret numerical data...statistical analyses allow researchers to draw conclusions about their data.

Statistics are a part of everyday modern life...batting averages, economic projections, popularity ratings for TV shows, etc.

There are two basic types of statistics, descriptive and inferential.

Descriptive statistics are used to organize and summarize data to provide some sort of overview.

Inferential statistics use the laws of probability to allow researchers to interpret data and draw conclusions.

Descriptive Statistics: Measures of Central Tendency

- Measures of central tendency = typical or average score in a distribution
- Mean: arithmetic average of scores
- Median: score falling in the exact centre
- Mode: most frequently occurring score
 - Which most accurately depicts the typical?

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Measures of central tendency are used to describe the typical or average score in a distribution.

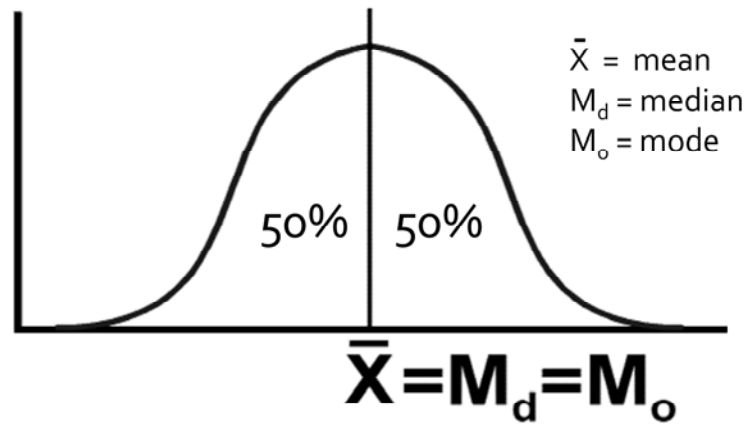
The mean is the arithmetic average and is therefore sensitive to extreme scores.

The median is the score that falls exactly in the centre of the distribution.

The mode is the most frequently occurring score.

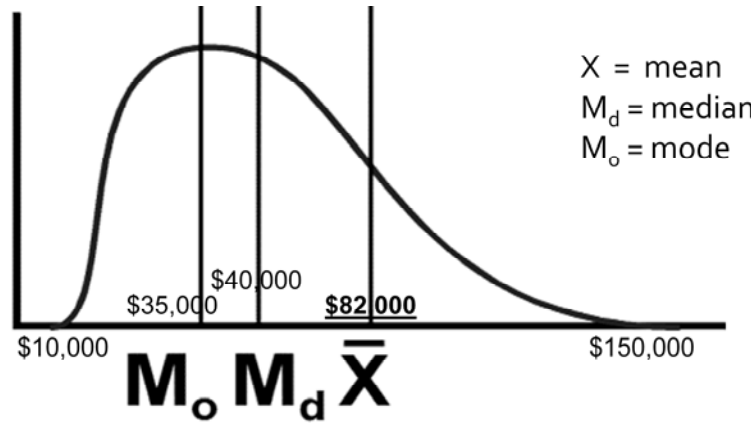
Which one is the most accurate depiction of the typical score? It depends on the data, as depicted on the next slide.

Measures of Central Tendency



Height of students taking PSYC 1001

Measures of Central Tendency



Average Canadian Yearly Income 2007:
Two parent families with children

Descriptive Statistics: Variability

- Variability = how much scores vary from each other and from the mean
 - Standard deviation = numerical depiction of variability
 - High variability in data set = high standard deviation
 - Low variability in data set = low standard deviation

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Variability refers to how much scores in a set of data vary from one another and from the mean...the standard deviation is a numerical index of variability.

If the variability in a data set is high, the standard deviation will be a higher number than if the variability is low, as is evident in Figure 2.6.

Descriptive Statistics: Variability

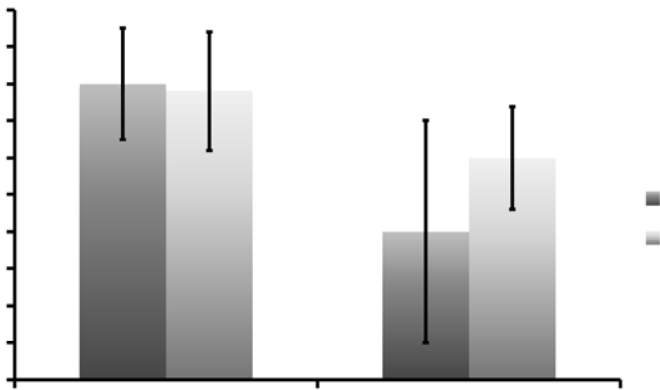
Speed (miles per hour)	
Set A Perfection Boulevard	Set B Wild Street
35	21
34	37
33	50
37	28
38	42
40	37
36	39
33	25
34	23
30	48
35	35
2.87	10.39
	Mean
	Standard deviation

Figure 2.6

Variability and the standard deviation.

Although these two sets of data produce the same mean, or average, an observer on Wild Street would see much more variability in the speeds of individual cars than an observer on Perfection Boulevard would. As you can see, the standard deviation for set B is higher than that for set A because of the greater variability in set B.

Descriptive Statistics: Variability



Descriptive Statistics: Correlation

- When two variables are related to each other, they are correlated.
- Correlation = numerical index of degree of relationship
 - Correlation expressed as a number between 0 and 1
 - Can be positive or negative
 - Numbers closer to 1 (+ or -) indicate stronger relationship

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A correlation exists when two variables are related to each other.

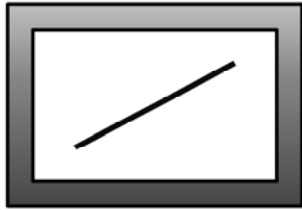
The correlation coefficient is a numerical index of the strength and direction of association between two variables.

A correlation is expressed as a number between 1 and 0, and the number may be positive or negative.

The closer to 1 the number is, whether +1 or -1, the stronger the relationship between the variables...for example, a correlation of .17 is pretty weak, while a correlation of -.89 is pretty strong.

The positive/negative dimension of the correlation coefficient expresses the direction of the relationship. If two variables are positively correlated, they co-vary in the same direction...as scores on one variable go up, scores on the other variable go up too...if two variables are negatively correlated, the variables co-vary in the opposite direction...as one goes up, the other goes down.

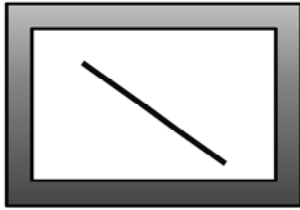
Descriptive Statistics: Correlation



Positive Correlation



No Correlation



Negative Correlation

Correlation: Prediction, Not Causation

- Higher correlation coefficients = increased ability to predict one variable based on the other
 - SAT/ACT scores moderately correlated with first year college GPA
- 2 variables may be highly correlated, but not causally related
 - Foot size and vocabulary positively correlated
 - Do larger feet cause larger vocabularies?
 - The third variable problem

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As a correlation increases in strength (closer to – or + 1), the ability to predict one variable based on knowledge of the other variable increases.

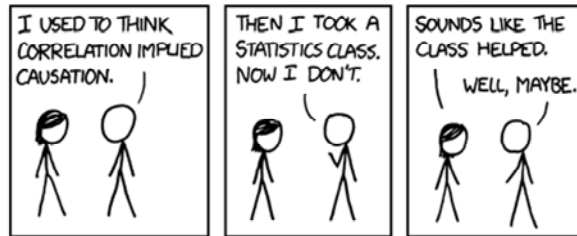
SAT/ACT scores are correlated with first year college GPA at a moderate .40 to .50... this may not be perfect, but it allows admissions committees to predict with some accuracy how well a prospective student will do in college.

Although correlation may allow prediction, it does not infer cause-and-effect.

For example, a strong positive correlation has been shown between foot size in children and vocabulary...as foot size increases, so does vocabulary. Do bigger feet make children learn more words? No. It is a third variable, age, which causes both feet and vocabulary to grow.

Correlation: Prediction, Not Causation

xkcd

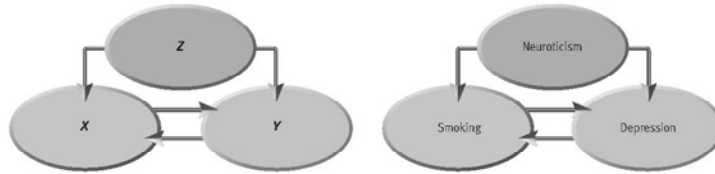


<http://xkcd.com/552/>

Many Different Causal Relationships are Possible

Figure 2.9

Three possible causal relationships between correlated variables. If variables X and Y are correlated, does X cause Y , does Y cause X , or does some hidden third variable, Z , account for the changes in both X and Y ? As the relationship between smoking and depression illustrates, a correlation alone does not provide the answer. We will encounter this problem of interpreting the meaning of correlations frequently in this text.



Inferential Statistics: Interpreting Data and Drawing Conclusions

- Hypothesis testing: do observed findings support the hypotheses?
 - Are findings real or due to chance?
- Statistical significance = when the probability that the observed findings are due to chance is very low
 - Very low = less than 5 chances in 100/ .05 level

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Researchers use inferential statistics to determine whether their data support their hypotheses...with these statistical methods, they can interpret data and draw conclusions.

Inferential statistics use the laws of probability to allow researchers to determine how likely it is that their findings are real, that is, not due to chance.

Statistical significance is said to exist when the probability that the observed findings are due to chance is very low...many psychologists see "very low" as fewer than 5 chances in 100 that results are not real...the .05 level of significance.

Evaluating Research: Methodological Pitfalls

- Sampling bias
- Placebo effects
- Distortions in self-report data:
 - Social desirability bias
 - Response set
- Experimenter bias
 - the double-blind solution

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Sampling bias – when a sample is not representative of the population...poll only men, may get a different outcome if the population is both male and female.

Placebo effects – when a participant's expectations lead them to experience some change even though they receive empty, fake, or ineffectual treatment...cured by a sugar pill.

Distortions in self-report data:

Social desirability bias – a tendency to give socially approved answers to questions about oneself...did you vote?

Response set – a tendency to respond to questions in a particular way (agree with everything, etc.).

Experimenter bias – when a researcher's expectations or preferences about the outcome of a study influence the results obtained...researchers see what they want to see – errors are usually in favor of the hypothesis...similarly, researchers may unintentionally influence the behaviour of their subjects, possibly through body language, smiles, etc. To control for this problem, a double-blind procedure in which neither subjects nor experimenters know which subjects are in the experimental and which are in the control groups is used...a non-directly involved researcher keeps track of everything.

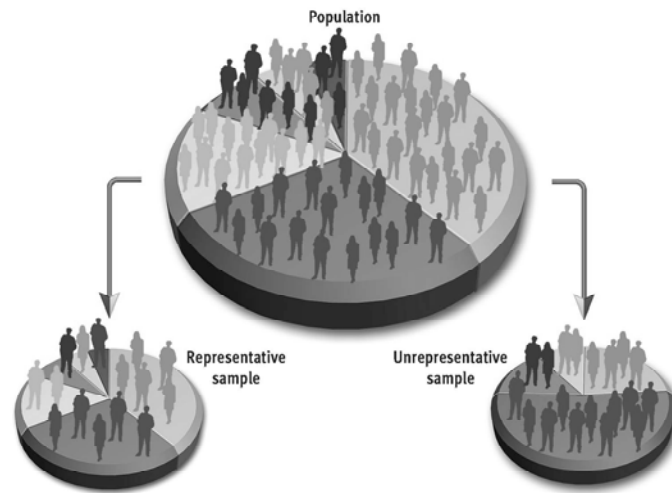


Figure 2.10

The relationship between the population and the sample. The process of drawing inferences about a population based on a sample works only if the sample is reasonably representative of the population. A sample is representative if its demographic makeup is similar to that of the population, as shown on the left. If some groups in the population are overrepresented or underrepresented in the sample, as shown on the right, inferences about the population may be skewed or inaccurate.

Ethics in Psychological Research: Do the Ends Justify the Means?

- The question of deception
- The question of animal research
 - Controversy among psychologists and the public
- Ethical standards for research: the American Psychological Association and CPA
 - Ensures both human and animal subjects are treated with dignity

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The question of deception:

Is it OK to make subjects think they are hurting others? Have homosexual tendencies? Think they are overhearing negative comments about themselves?

The question of animal research:

Controversy regarding humane treatment of animals vs. no use of animals in research.

These and other ethical issues have led the American Psychological Association (APA) to develop a set of ethical standards for research, to ensure that both human and animal subjects are treated with dignity.