Research Designs

Note: Bring Green Folder of Readings

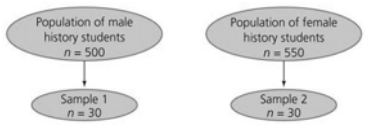
Inferential Statistics

Chapter Eleven

What are Inferential Statistics?

- Refer to certain procedures that allow researchers to make inferences about a population based on data obtained from a sample.
- Obtaining a random sample is desirable since it ensures that this sample is representative of a larger population.
- The better a sample represents a population, the more researchers will be able to make inferences.
- Making inferences about populations is what Inferential Statistics are all about.

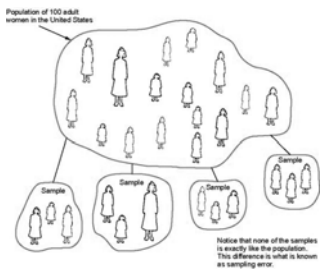
Two Samples from Two Distinct Populations



Sampling Error

- It is reasonable to assume that each sample will give you a fairly accurate picture of its population.
- However, samples are not likely to be identical to their parent populations.
- This difference between a sample and its population is known as Sampling Error.
- Furthermore, no two samples will be identical in all their characteristics.

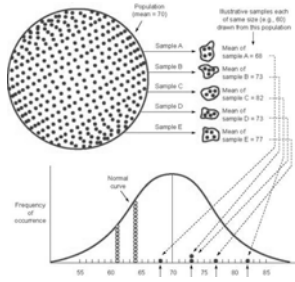
Sampling Error (Figure 11.2)



Distribution of Sample Means

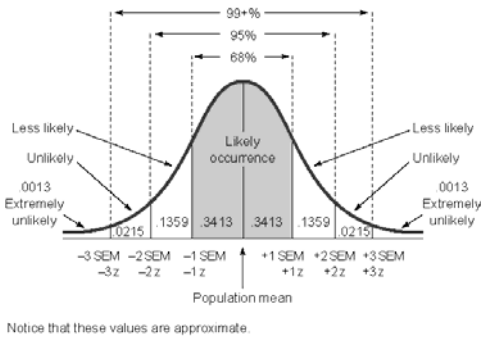
- There are times where large collections of random samples do pattern themselves in ways that will allow researchers to predict accurately some characteristics of the population from which the sample was taken.
- A sampling distribution of means is a frequency distribution resulting from plotting the means of a very large number of samples from the same population

A Sampling Distribution of Means



Distribution of Sample Means

(Figure 11.4)



Notice that these values are approximate.

Standard Error of the Mean

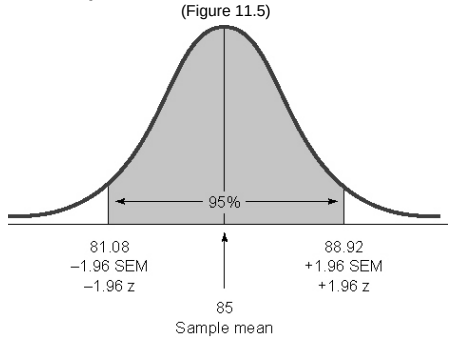
- The standard deviation of a sampling distribution of means is called the Standard Error of the Mean (SEM).
- If you can accurately estimate the mean and the standard deviation of the sampling distribution, you can determine whether it is likely or not that a particular sample mean could be obtained from the population.
- To estimate the SEM, divide the SD of the sample by the square root of the sample size minus one.

Confidence Intervals

- A Confidence Interval is a region extending both above and below a sample statistic within which a population parameter may be said to fall with a specified probability of being wrong.
- SEM's can be used to determine boundaries or limits, within which the population mean lies.
- If a confidence interval is 95%, there would be a 'probability' that 5 out of 100 (population mean) would fall outside the boundaries or limits.

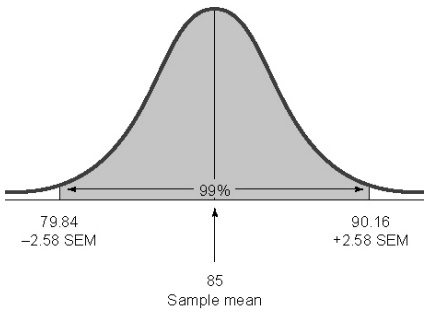
The 95 percent Confidence Interval

(Figure 11.5)

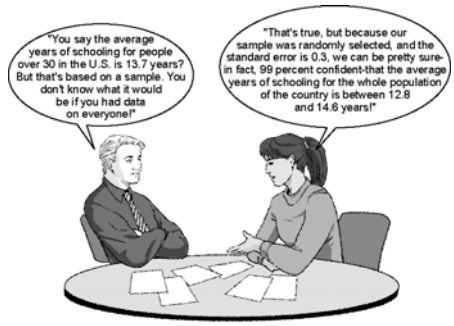


The 99 percent Confidence Interval

(Figure 11.6)



We Can Be 99 percent Confident



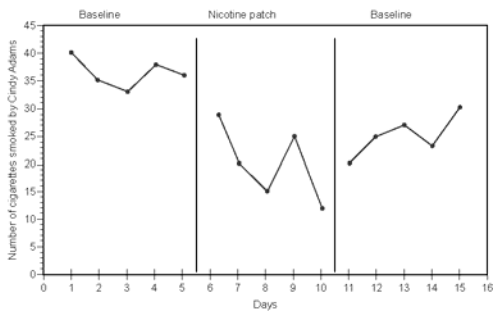
Scientific America

Single-Subject Research

Chapter Fourteen

Single-subject Research

Chapter Fourteen



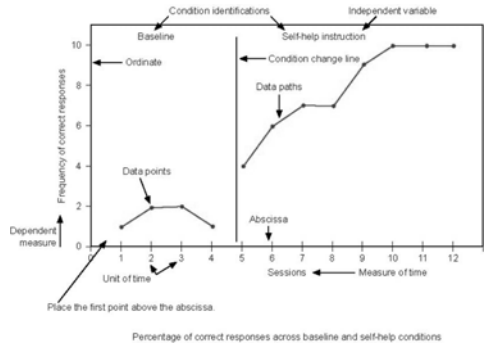
Essential Characteristics of Single-subject Research

- There are reasons why single subject research is selected instead of the study of groups.
- Instruments can be inappropriate at times and intense data collection on a few individuals can make more sense.
- Single-subject designs are adaptations of the basic time-series design where data is collected and analyzed for only one subject at a time.

Single-subject Designs

- Single-subject designs use line graphs to present their data and to illustrate the effects of a particular intervention or treatment on an individual.
- The first condition is usually the baseline, followed by the intervention (independent variable).
- Condition lines show if the condition has changed or separated.
- Data points represent when the data was collected during the study.

Single-Subject Graph

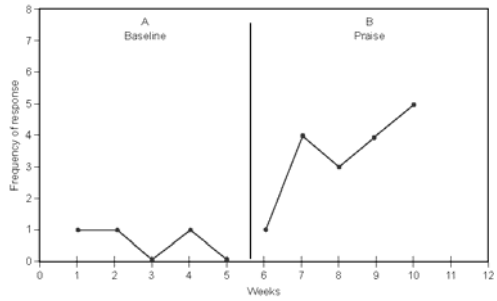


Percentage of correct responses across baseline and self-help conditions

Types of Single-subject Designs

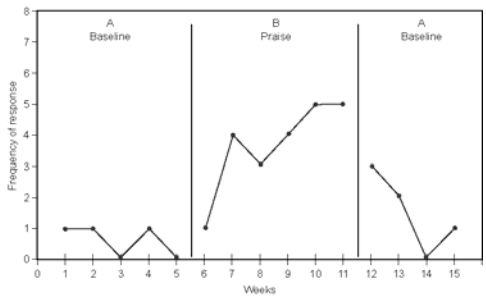
- The A-B design.
  - Exposes the same subject, operating under his or her own control, to two conditions or phases, after establishing a baseline.
- The A-B-A design.
  - Called a reverse design, researchers add another baseline period to the A-B design.
- The A-B-A-B design.
  - Two baseline periods are combined with two treatment periods.
- The B-A-B design.
  - Used when an individual's behavior is so severe that a researcher cannot wait for a baseline to be established.
- The A-B-C-B design.
  - The "C" condition refers to a variation on the intervention in the "B" condition. The intervention is changed during the "C" phase to control for any extra attention the subject may have received during the "B" phase.

An A-B Design



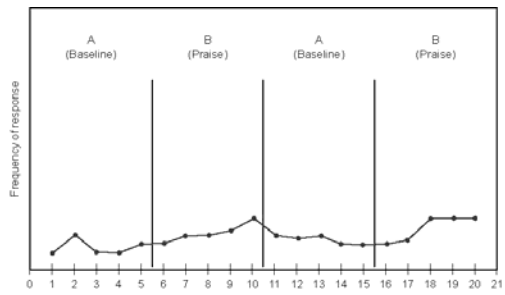
Frequency of response across baseline and praise conditions

An A-B-A Design

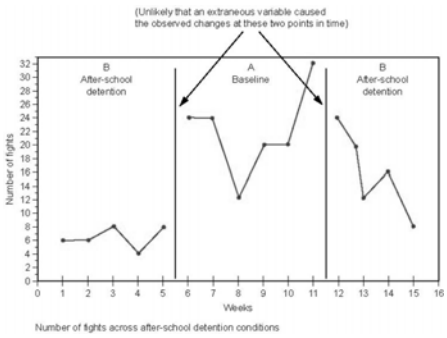


Frequency of response across baseline and praise conditions

Illustrations of the Results of a Study Involving an A-B-A-B Design

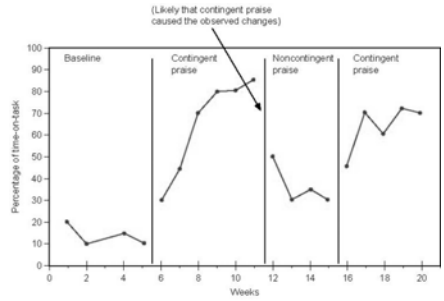


A B-A-B Design



Number of fights across after-school detention conditions

An A-B-C-B Design



Percentage of time-on-task across baseline, contingent praise, and noncontingent praise conditions

Multiple-Baseline Designs

- This is considered an alternative to the A-B-A-B design.
- Multiple-baseline designs are typically used when it is not possible or ethical to withdraw a treatment and return to the baseline condition.
- Researchers collect data on several behaviors compared to focusing on just one per subject, obtaining a baseline for each during the same period of time.
- The researcher applies the treatment at different times for each behavior until all of them are undergoing the treatment.
- If behavior changes in each case only after the treatment has been applied, the treatment is judged to be the cause of the change.

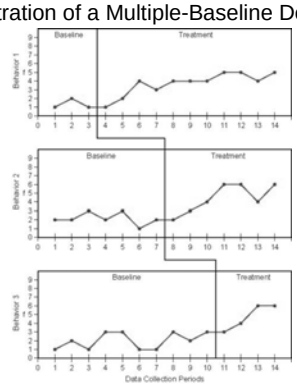
Multiple-Baseline Design

Behavior 1 O O O O X O X O X O X O X O X O X O X O X O

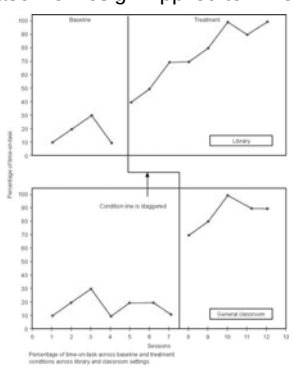
Behavior 2 O O O O O O O X O X O X O X O X O X O X O X O

Behavior 3 O O O O O O O O O O O X O X O X O X O X O X O

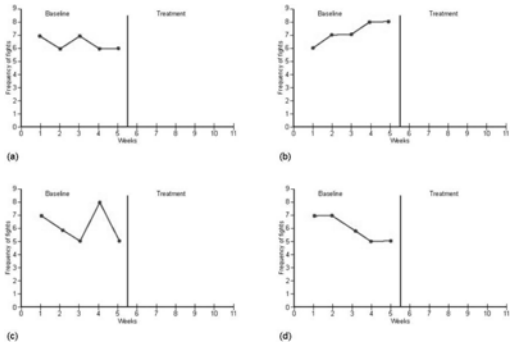
Illustration of a Multiple-Baseline Design



A Multiple-Baseline Design Applied to Different Settings



Variations in Baseline Stability

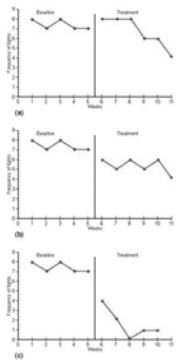


Threats to Internal Validity in Single-Subject Research

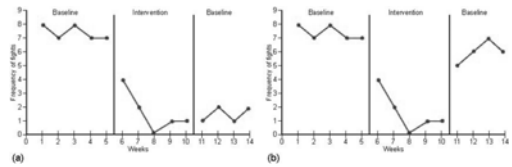
The following threats can affect the Internal Validity in Single-Subject Studies

- **Condition length** (how long the baseline and intervention conditions are in effect)
- **Number of variables changed when moving from one condition to another** (it is important that one variable be changed at a time, when moving from one condition to another)
- **Degree and speed of change** (magnitude with which the data change at the time the intervention condition is implemented)
- **Return to baseline level** (level should quickly return if the intervention was the causal factor)
- **Independence of behaviors** (are behaviors that are being measured dependent upon one another, or related?)
- **Number of baselines** (did an extraneous event cause the change during the introduction times?)

Differences in Degree and Speed of Change



Differences in Return to Baseline Conditions



Controlling Threats in a Single-subject Study

- Single subject designs are most effective in controlling for the following:
  - Subject characteristics
  - Mortality
  - Testing
  - History
- They are less effective with the following:
  - Location
  - Data collector characteristics
  - Maturation
  - Regression
- They are even weaker with the following:
  - Collector bias
  - Attitude
  - Implementation

External Validity and Single-Subject Research

- Single-subject studies are weak when it comes to external validity (i.e., generalizability).
- Treatment on one subject would not be appropriate.
- As a result, these studies must rely on replications, across individuals rather than groups, if such results are to be found worthy of generalizability.