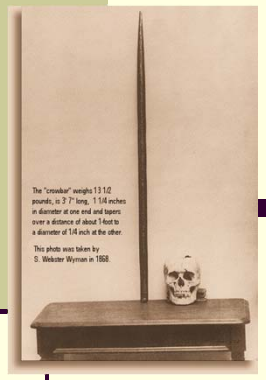
# Psychological Research Methods






## Levels of Analysis~1

- MICRO Level –
  - Research conducted at this level focuses on very small units of analysis such as might be found in the…
    - …study of hormones and behavior; or, in the study of…
    - …brainwaves and perception, e.g. P-300 brain waves.
- MOLECULAR Level –
  - Most psychologists conduct research at this level. This level focuses on individuals in depth and might involve research on:
    - …body language; or,
    - …individual reaction times to stimuli; or,
    - …cognitive functions such as memory & perception.



## Levels of Analysis~2

- MOLAR Level –
  - Molar level research studies persons in complex social and/or cultural situations.
    - Examples include research on:
      - sexual attraction;
      - violence;
      - worker morale;
      - patient- therapist interactions; or,
      - the causes of prejudice.



## Psychology's Functional Relationships~1

- Psychological research can also be described by examining the kinds of "functional relationships" it studies using math-like "formulas" for clarity.
- The generic function formula is: **B = f (X)**
  - **B** stands for some observable behavior, *e.g.*, speed of reaction to a visual stimulus;
  - **f** should be read using the phrase "occurring as a function of..." ;and,
  - **X** is a some variable specified uniquely in each case below.
- The formula shows us that what is being studied is the relationship between some behavior, **B**, and some other influential variable or factor, **X**.

## Psychology's Functional Relationships~2

- B = f (S)
  - **S**, substituting for the generic **X**, now represents some stimulus variable.
  - The question being addressed here is how is behavior (B) affected, changed or not changed, by some stimulus (S)?
  - In this relationship B stands for the *dependent variable* and S for the *independent variable* in the typical experiment.
    - For Example:
      - A researcher might investigate whether having background music (S) piped into a study area improves learning (B)?
      - A pharmaceutical manufacturer may wish to learn if a new tranquilizer (S) will affect a person's ability to drive a car (B)?



## Psychology's Functional Relationships~3

- B = f (O)
  - **O**, substituting for the generic **X**, now represents some organismic variable.
  - The question being addressed here is how is behavior (B) affected by some factor coming from within the organism (O), so-called *personal* or *dispositional* factors?
  - For Example:
    - One psychologist may wish to investigate the role of chemical imbalances in brain (O) and mental illness (B)?
    - A second may wish to study the hereditary basis (O) for the condition called schizophrenia (B)?



## Psychology's Functional Relationships~4

- B2 = f (B1)
  - **B1**, substituting for **X**, now stands for some behavior observed on occasion one(1).
  - **B2**, substituting for the generic **B**, represents some behavior observed on a second occasion(2).
- The issue being addressed here is how behavior observed on one occasion (B1) is or is not functionally related to, specifically correlated with, behavior observed on a second occasion (B2)?
  - For Example:
    - A psychologist may wish to determine how well SAT scores (B1) predict college success(B2).
    - Another may wish to learn if a child's IQ Score at age 5(B1) allows us to predict her score at age 13(B2), …is IQ consistent across time?
- This type of investigation basically has two dependent variables, two measures that are examined to see whether or not they functionally vary together in some systematic way allowing one to make predictions about one behavior (B2) based on a knowledge of another (B1).



## Steps in the Scientific Method~1

- FORMULATION OF A QUESTION
  - Following some behavioral *OBSERVATION*, a psychologist *DEFINES A QUESTION* to be investigated.
  - The *question* must be answerable with the research tools available to the psychologist.
- REVIEW OF THE LITERATURE
  - Literature reviews are conducted to:
    - …determine whether her question has been asked before and also…
    - …if it has, what others have found regarding the question.
    - Later, this preliminary research forms the text for the *Introduction* section of the published results.

## Steps in the Scientific Method~2

- PROPOSING AN HYPOTHESIS
  - The hypothesis is a prediction about research outcomes based perhaps on a researcher's…
    - …intuition (a gut feeling based on experience);
    - …beliefs about likely outcomes based on other information about the issue;
    - …findings in earlier investigations; or,
    - …the tenets of a theory which are to be tested.



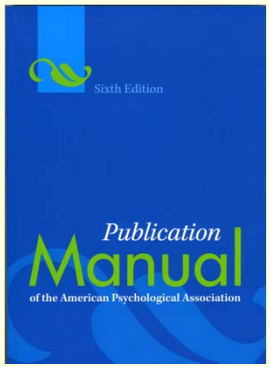
## Steps in the Scientific Method~3

- COLLECTING DATA AND TESTING THE HYPOTHESIS
  - Methods of gathering evidence in the *collection of data* vary.
  - Furthermore, although only well controlled experiments can establish cause and effect connections, other research methods are also used, for example,
    - case studies
    - naturalistic observation
    - surveys
    - correlation
- Finally, statistics are applied to the data collected to find out if the hypothesis supported or rejected.



## Steps in the Scientific Method~4

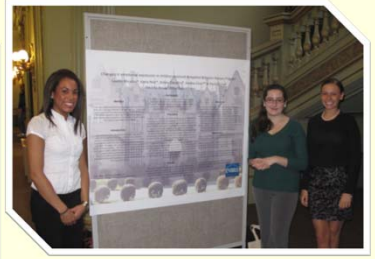
- PUBLISH THE RESULTS
  - All the sciences require that researchers share their research findings with their peers.
  - Furthermore, strict guidelines need to be followed regarding a report's structural content, footnoting, and research citation format.
  - In psychology the guidelines are set forth in the *APA's* 272 page *Publication Manual*( 6th Ed., 2010).
  - Finally only professional technical journals refereed by the scientist's professional peers are approved sources for scientific peer-to-peer communication.
  - Thus, the *Journal of Experimental Psychology* would be an approved journal. *House and Garden* would NOT.






## Steps in the Scientific Method~5

Research is also Often Reported at Scientific Conventions



**Salve students conduct research with Salve's psychology faculty & regularly report their results at national and regional professional psychology conventions.**

## Steps in the Scientific Method~6

- Theory Building
  - The final step in this process involves *theory building*.
  - A *theory* interrelates concepts and facts in a way that summarizes a large number of research observations.
  - Good theories explain existing data, predict new observations, and guide further research.
  - For example, a good theory will generate numerous hypotheses which are tested one at a time.
    - If the research evidence supports the hypothesis under scrutiny, our confidence in the theory grows.
    - If an hypothesis is not supported, our confidence in the theory diminishes and we must then revise the theory or discard it.
    - The process is gradual.



## Research Methods


Naturalistic Observation
Clinical or Case Study Method
Surveys and Interviews
Experiments
Correlation



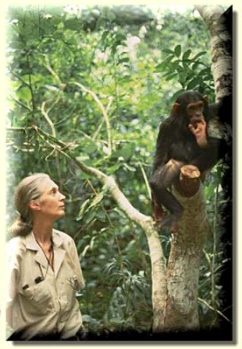
## Naturalistic Observation~1

- This technique involves collecting information about behavior without trying to change it; and,
- …it usually takes place in the environment in which the behavior normally occurs, although not always.
- The observer may participate in that which she is observing or not.
  - Thus, this method comes in two flavors:
    - Non-Participant Observation
    - Participant Observation



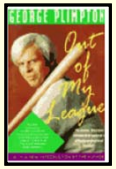
## Naturalistic Observation~2

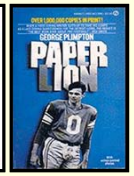
- Non-Participant Observation
  - In non-participant observation, the scientist observer purposely tries NOT to influence that which she is observing.
- Commencing in 1960 Jane Goodall established the *Gombe Stream Research Center* to study chimpanzees and has been a tireless defender of their welfare to this day, over 50 years!
- Her research method, non-participant observation.
- To this day she can be found on the lecture circuit speaking out in defense of these endangered animals, our closest genetic relatives in the animal kingdom.



# Naturalistic Observation~3

- Participant Observation
  - In participant observation, the scientist observer purposely tries to experience first hand that which he is observing.
  - George Plimpton(1927-2003), "the father of participatory journalism," tried things few of us could or would ever try although we might dream about it.
  - He went through boxing training, got in the ring with the then light-heavyweight champion, Archie Moore, & wrote about it in *Shadow Box;*
  - …he played with a professional baseball team and wrote about it in *Out of my League;*
  - …he did the same with the Detroit Lions football team and wrote *Paper Lion…*
  - …he then played professional hockey and wrote about it in *Open Net…* and for one more example, he wrote…
  - *Bogey Man*…an account of his experiences on the professional golf circuit…TO NAME A FEW…
  - …all to participate, observe, and tell us what it was like *first hand!*






# Clinical or Case Study Method

- This technique involves, in the first instance, studying single individuals over lengthy periods of time; and,
- …in the second instance, taking advantage of an unusual circumstance, an accident perhaps, that could not be simulated in a lab, to study an individual or group affected by it.
  - Freud's use of the case study to formulate his psychoanalytic theory and write about it in *Studies in Hysteria* & elsewhere is an example of the first type.
  - Studying the aftereffects on people's lives caused by hurricanes, earthquakes, floods, train wrecks, explosions, mining accidents are examples of the second.
    - Phineas Gage's 1848 construction site accident is the prototypical premier example of the second type.



# The Case of the "Crowbar Skull"

On September 13th, 1848, in Cavendish, VT, in the process of setting an explosive powder charge on a railroad construction site, the charge unexpectedly exploded.

The explosion sent a 13 1/2 pound 3' 7" inch long "tamping iron" (historically known as a "crowbar") through the head of 25 year old Phineas Gage.

Remarkably, Phineas was not killed immediately; but, he remained conscious & pain free & received medical treatment.

Even more remarkable at a time when pain killers and antibiotics were unknown, …he lived for 12 years thereafter!

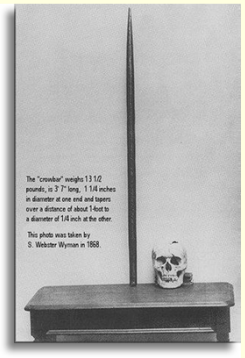
However, his personality and social behavior changed dramatically after this experience and he has remained an object of scientific study to this day.




# The Case of the "Crowbar Skull"

In 1998 the town of Cavendish, Vermont hosted a celebration of the 150th Anniversary of this event attracting scholars from around the globe. The unveiling of a commemorative memorial was a high point of the occasion.


Image from John Fleischman, *Phineas Gage: A Gruesome but True Story About Brain Science*, Boston:Houghton Mifflin, 2002, p.74.



## The Case of the "Crowbar Skull"

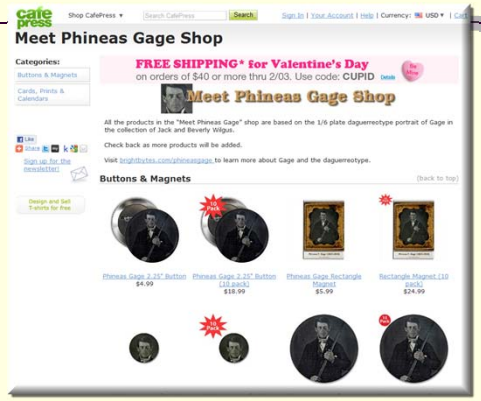
Over 160 years after Gage's accident, in 2009, Jack and Beverly Wilgus, collectors of old daguerreotypes, discover that they are the owners of the first positively identified photo of Phineas Gage, a photo that had been in their collection for over 30 years(below).


Another turned up in a family album of a Gage descendent that same year!



## The Case of the "Crowbar Skull"

And, only in America can you now purchase Gage buttons, magnets, postcards, posters, tee shirts, neckties, hoodies and more commemorating his experience!






## SURVEYS & INTERVIEWS

- These techniques allow for the collection of vast amounts of data from large numbers of people through the use of QUESTIONNAIRES which are either…
  - …mailed, as with SURVEYS; or,
  - …administered by a technician one-on-one, as in INTERVIEWS.
- INTERVIEWS, furthermore, may be …
  - STRUCTURED, requiring the technician to follow a precise series of "structured" questions in a particular pre-determined order; or,
  - UNSTRUCTURED, in which case the technician is allowed to deviate from the printed questions and go on "fishing expeditions" as her judgment dictates.



## The Experimental Method~1

- As the MOST RIGOROUS OF THE RESEARCH METHODS, experimentation requires…
  - …precise manipulation of one or more independent variables;
  - …under very controlled conditions;
  - …involving one or more experimental groups;
  - …who are compared to a control group (or to themselves);
  - …on a behavioral response measure called the dependent variable.
- This Is the only research method that is capable of determining *CAUSE AND EFFECT CONNECTIONS* and supporting or refuting an hypothesis with reasonable certainty.

## The Experimental Method~2

- RESEARCH VARIABLES DEFINED
  - *VARIABLE* ~ any stimulus factor or behavior that can change on some dimension and that can be observed, sometimes controlled, and measured.
    - In scientific investigations variables that can be quantified are preferred.
  - EXTRANEOUS VARIABLE ~ in an experiment, a variable or variables that COULD have an effect on the dependent variable but which are controlled so that it does, or they do, not do that.
  - When uncontrolled extraneous variables influence experimental outcomes the results are said to be confounded, i.e., made ambiguous.



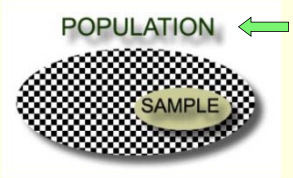
## The Experimental Method~3

- RESEARCH VARIABLES DEFINED
  - *INDEPENDENT VARIABLE* ~ in an experiment, the variable under the control of the investigator and…
    - …one which she believes to have the potential to alter or influence the dependent variable
  - *DEPENDENT VARIABLE* ~ in an experiment, the response or behavior being studied in order to determine if it has been influenced by or altered by the independent variable.
  - Sidebar: On the DOUBLE BLIND procedure.



## The Experimental Method~4

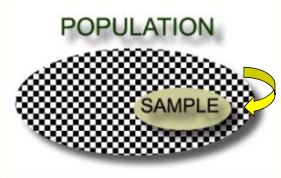
- POPULATION
  - This term refers to the entire collection or set of objects, people, events, *etc.*, of interest in a particular context.
  - For example, we can speak of…
    - …the *population* of people who reside in the U.S.; or,
    - …the *population* of Newport, RI in February, 2011; or,
    - …all freshman enrolled in SRU in the Spring, 2011; or,
    - … all SRU freshman with a combined SAT Score of 1300.



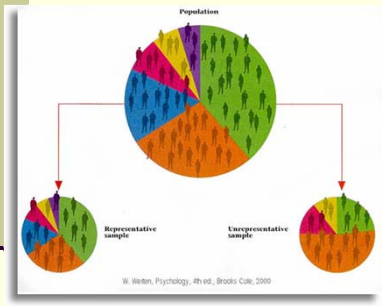



## The Experimental Method~5

- SAMPLE
  - This term refers to a subset of objects, people, observations, *etc.*, selected from a *population*.
    - By studying the sample a researcher hopes to draw useful conclusions about the larger group.
    - Samples are usually chosen because populations are too large to be easily accessible.
- Sampling procedure examples:
  - Random Sampling
  - Stratified Sampling



## The Experimental Method~6

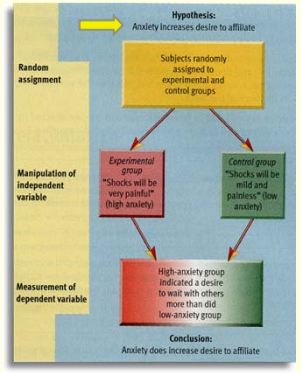




President Harry S. Truman(1884 -1972) after winning the 1948 Presidential election. Notice that the Chicago paper got it wrong BIG TIME!



## The Experimental Method ~ 7



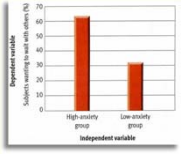

Does misery love company?

Stanley Schacter's research sought to find out.

He hypothesized that persons exposed to high anxiety would want to "hang" with other people more than those exposed to low anxiety.

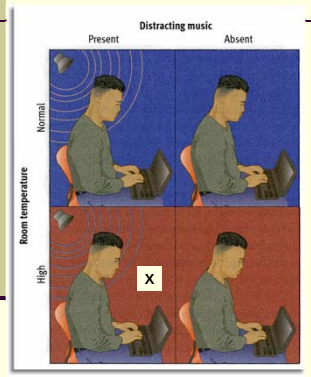
His hypothesis was supported.

More than 60% of the "miserable" wanted company compared to 30% of the others.






## The Experimental Method ~ 8




In this more complex experiment, two independent variables are being studied, *distracting music* and *room temperature*.

This allows a researcher to determine if two variables interact but doing so requires 4 experimental groups.

An interaction means that the effect of one variable is dependent on the other.

**X** marks the spot of the only significant outcome here.

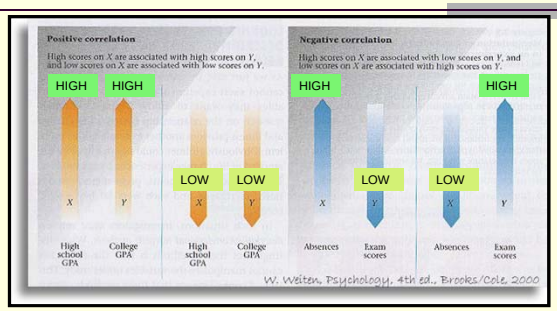
*Distracting music only effects typing performance when the temperature is high*.



## Correlation ~ 1

- Correlation determines the extent to which a pair of quantitative variables…
  - …co-relate with each other, *i.e.*, co-vary with each other, in a measurably consistent way.
- When the correlation is statistically significant and strong enough, *we can predict the value of one measure knowing the other*.
- Correlation is used widely in psychology and medicine examining correlations between variables such as:
  - …high school grades & college success ;or
  - …smoking and health; or
  - …fiber in diets and colon cancer rates; or
  - …*IQ Scores* at age 5 and *IQ Scores* in adulthood.

# Correlation ~ 2




In a POSITIVE CORRELATION, high values on one measure are associated with high values on the other and low values on one measure associated with low on the other.

In a NEGATIVE CORRELATION, high values on one measure are associated with low values on the other and low values on one measure associated with high on the other.



# Correlation ~ 3

- Correlation is measured by a statistic called the Pearson r ranging in value from -1.00 ~ +1.00
  - +1.00 is called a *Perfect Positive Correlation*
  - -1.00 is called a *Perfect Negative Correlation*
  - *Perfect positive* or *negative* correlations occur ONLY in the physical sciences and never in the social sciences.
  - Tests such as those used to predict possible university, graduate school or law school success have Pearson r values much lower than +1.00.

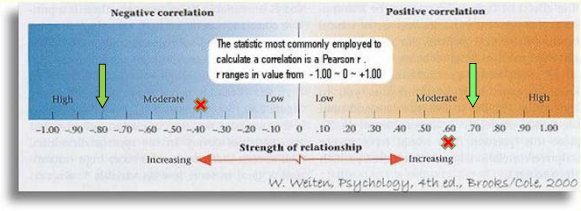
Take Note:

- The word NEGATIVE in the term "*Negative Correlation*" does not mean the statistic is not good, or even less useful than a "positive correlation."

  The word negative simply points to the direction of the relationship.



# Correlation ~ 4




Take Note: It is the absolute size of the correlation statistic and NOT its sign (- or +) that determines strength.

For, while an **r = +.60** shows a stronger correlation than an **r = -.40** ~

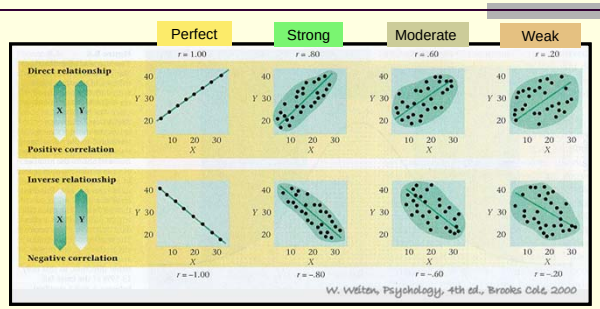
…an **r = -.80** shows a stronger correlation than an **r = +.70**.



# Correlation ~ 5

- *Examples of Positive Correlations:*
  - Cold drinks consumed at Fenway Park and air temperature.
  - Hours spent studying and GPA.
  - Number of cigarettes smoked and number of health problems.
  - Saturated fat volume in the diet & body weight.
- *Examples of Negative Correlations:*
  - Hot beverages consumed at Fenway Park and air temperature.
  - Number of extracurricular involvements and grades.
  - Dietary fiber consumption and colon cancer rates.
  - Exercise and blood pressure.

## Correlation ~ 6



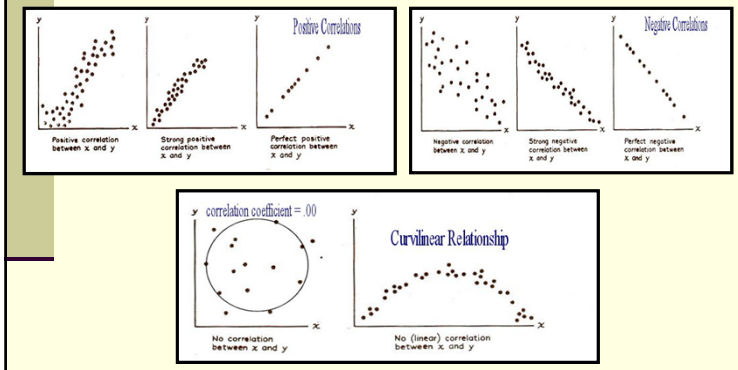

Scatter plots are useful ways to examine the relationship between potentially correlated variables.

Plots with a *linear trend* from lower left to upper right a show positive correlation.

Plots with a *linear trend* from upper left to lower right a show negative correlation.



## Correlation ~ 7





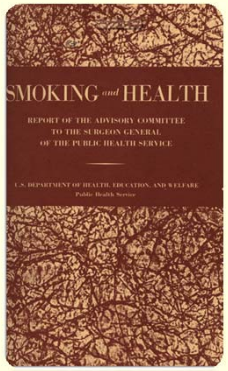

## Correlation ~ 8




## Correlation ~ 9

## Correlation ~ 10

**SURGEON GENERAL'S WARNING: Smoking Causes Lung Cancer, Heart Disease, Emphysema, and May Complicate Pregnancy.**




**Correlation does not imply causation.**

True.

**Experiments are the best way to demonstrate cause-and-effect connections.**

Also true.

**Sometimes, however, the preferred method, the experiment, can not be used for ethical and practical reasons.**

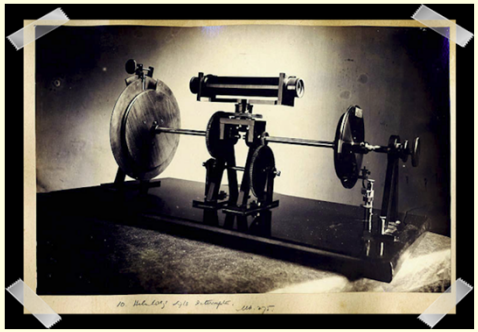
Such was the case with the 1964 Federal study, viz., *Smoking and* Health…[the] *report to the Surgeon General* describing research on the relationship between smoking and health.

Despite this circumstance, the results in this report are based on such enormous numbers that the only conclusion one can draw is that *smoking causes large numbers of health problems.*

…and so the people are warned.



## Appendix





## Commonly Used Statistics

**Measures of Central Tendency**

**MEAN** ~ found by adding up all the scores or values and dividing by the number of scores or values. This is what is customarily known as an AVERAGE.

**MEDIAN** ~ found by rearranging the scores or values from low to high and finding the value right in the middle.

**MODE** ~ found by determining which score or value has occurred most often.

**EXAMPLE**:

Scores: 6, 1, 3, 2, 3

**MEAN** = 6 + 1 +3 +2 + 3 = 15/5 = 3

**MODE** = 3 (it occurs twice)

**MEDIAN** = 1 2 3 3 6

- *Measures of Central Tendency*
- These strive to tell us the most representative numerical value in a set of values,
  - the most typical grade on an exam, for example.
  - They answer a question like, "How did the class do on Exam 1?"
- The mean is a simple average;
- the median is the value in the middle when all values are arranged from high to low; and,
- the mode is the most frequent value.
- Knowing all 3 is best.



## Measures of Variability

**Variability**

**Variability** refers to the spread of the number values in a data set. The more the values differ from each other and deviate from the set's mean the greater the variability.

**Examples**:

**Class "A" Grades**: 75,75, 75,75,75,75 Everyone has the same grade, **no variability.**

**Class "B" Grades**: 75,40, 95,60,20,88,69 Many different grades, **much variability**.

**The RANGE as a Measure of Variability**

**RANGE** ~ calculates the difference between the highest and lowest values in a data set. The larger the RANGE the greater the variability.

**Examples**:

**Group A**: Range=75-75=0 (no variability)

**Group B**: Range=87-80=7 (little variability)

**Group C**: Range=95-50=45 (much variability)

**The larger the RANGE the greater the variability.**

**More sophisticated measures of variability examine ALL the values, not just two.**

## Case Study ~ Advantages/Disadvantages

- Advantages:
  - Good source of hypotheses;
  - Can provide compelling illustrations to support a theory; and,
  - Well suited for the study of individual idiosyncrasies.
- Disadvantages:
  - Individuals may not be representative;
  - Little control is possible;
  - Interpretation of findings potentially flawed by subjectivity; and,
  - Does not allow for cause-and-effect connections.



## Naturalistic Observation ~ Advantages/Disadvantages

- Advantages:
  - Minimizes artificiality;
  - Can be a good place to start when little is known about some phenomenon; and,
  - A good source of hypotheses.
- Disadvantages:
  - Little or no control of the situation;
  - Observations may be biased;
  - Researcher may unintentionally alter what is being observed; and,
  - Does not allow for cause-and-effect connections.



## Surveys ~ Advantages/Disadvantages

- Advantages:
  - Can acquire large amounts of data on large numbers of people quickly;
  - Can acquire information on behaviors not easily studied any other way; and,
  - Can generate multiple hypotheses for further study.
- Disadvantages:
  - Obtaining representative samples is difficult;
  - Self-report data is often unreliable due to:
    - Intentional deception
    - Social desirability bias
    - Memory lapses
    - Wishful thinking



## Correlation ~ Advantages/Disadvantages

- Advantages:
  - Demonstrates the relationship between two or more variables;
  - Can be used in the lab, clinic, and natural settings; and,
  - Allows predictions to be made for associated variables.
- Disadvantages:
  - Little or no control is possible;
  - Relationships may be coincidental;
  - It's ill-suited to demonstrate cause-and-effect connections but can do so under when more rigorous experiments are not possible.

## Experimentation ~ Advantages/Disadvantages

- Advantages:
  - Researcher has precise control over the entire situation; and,
  - It allows researchers to find definitive cause-and-effect connections without having to wait for a natural event.
- Disadvantages:
  - Controlled situations may be artificial;
  - Results may not generalize to the real world;
  - Some behavior is not easily studied in the laboratory;
  - Ethical considerations and practical realities prevent experimentation on many important questions; and,
  - Controls are needed even to prevent experimenter bias, e.g., double blind controls.



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