CHAPTER 4

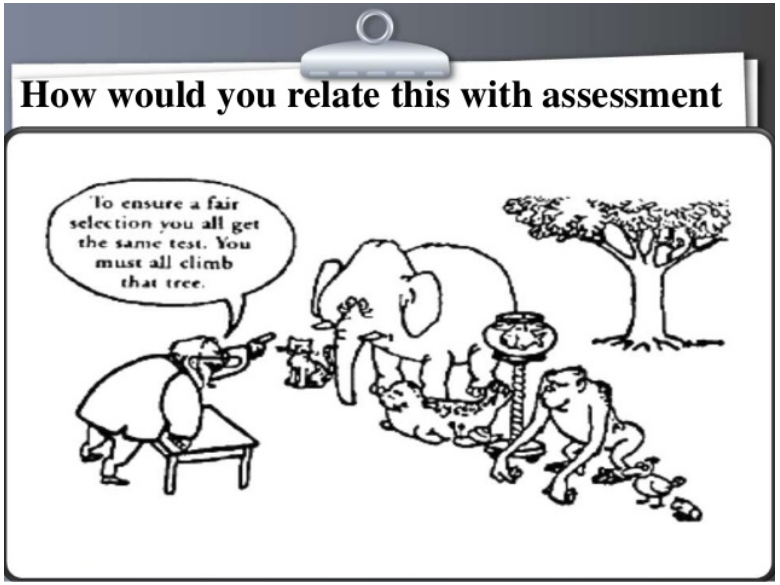
FUNDAMENTAL RESEARCH ISSUES

LEARNING OBJECTIVES

- ✓ Define variables and describe the operational definitions of variables
- ✓ Describe the different relationships between variables:
  - ✓ Positive
  - ✓ Negative
  - ✓ Curvilinear
  - ✓ No relationship
- ✓ Compare and contrast non-experimental and experimental research methods
- ✓ Distinguish between an independent variable and a dependent variable
  - Discuss the limitations of laboratory experiments and the advantage of using multiple methods of research
  - Distinguish between construct validity, internal validity, and external validity

VALIDITY

- ✓ **Validity** is the extent to which a concept, conclusion, or measurement is well-founded and corresponds accurately to the real world.
- ✓ It encompasses the entire experimental concept and establishes whether the results obtained meet all of the requirements of the scientific research method.
- ✓ There are three key types of validity:
  - Construct validity
  - Internal validity
  - External validity



VALIDITY

- **Construct validity** *concerns whether one's methods of studying variables are accurate.*
  - That is, "the degree to which a **test** measures what it claims, to be measuring."
  - You might think of construct validity as a "labeling" issue.
    - When you measure what you term "self-esteem" is that what you were really measuring?
    - Or, are you measuring "self-conceit" or "arrogance" instead?
  - **Operational Definitions**: description of something in terms of the **operations** (procedures, actions, or processes) by which it could be observed and measured
    - *It helps researchers communicate their ideas with others!*

VALIDITY

- **Internal validity** refers to the accuracy of conclusions about *cause and effect*.
  - It is NOT relevant in most observational or descriptive studies, for instance.
  - Internal Validity is important for studies that assess the effects of social programs or interventions.
    - You would like to be able to conclude that your program or treatment made a difference (i.e., the cause). And NOT to other possible causes for the outcome (i.e., "alternative explanations").
      - improved test scores
      - reduced symptomology

VALIDITY

- **External validity** *concerns whether one can generalize the findings of a study to other settings.*
  - *External Validity* involves generalizing from your study context to other people, places or times
    - (can it be repeated across people, places and times),
  - *Construct Validity* involves generalizing from your measures to the *concept* of your measures
    - *(Is it measuring the concepts that you say you're measuring:* operationalization*).*

VARIABLES

- Any event, situation, behavior, or individual characteristics that varies
- The elements we observe, compare, and measure in research
  - A *variable* is any entity that can take on different values.
- When constructing your hypotheses and analyzing data, Important to know:
  - how many
  - what types
  - Their relationships to other variables.

OPERATIONAL DEFINITIONS OF VARIABLES

- Consider the claim that "90% of the mind's power is unused."
  - The Nobel Prize winning neurophysiologist, Sir John Eccles, apparently repeated that idea at a lecture at the University of Colorado.
  - The claim may go all the way back to Freud's statement that 90% of the mind is "under the surface" like an iceberg!
- To adopt a scientific attitude toward this claim, think about how you would test it. First you would have to define the terms.
  - What is "the mind's power"?
  - How do you measure it?
  - How do you take a percentage of it?
- In all likelihood the claim that "90% of mind power is unused" has *never been tested*.

OPERATIONAL DEFINITIONS OF VARIABLES

- ✓ A set of procedures used to
  - ✓ measure variables
  - ✓ manipulate variables
- ✓ This allows variables to be studied empirically
- ✓ *It helps accurately communicate ideas to others*
- **Construct validity** refers to the adequacy of the operational definition of variables:
  - Does the operational definition of a variable actually reflect the true **theoretical** meaning of the variable?

"Our goal is to establish language that is gender-neutral, ethnic-neutral and age-neutral, while celebrating our spirit of diversity."

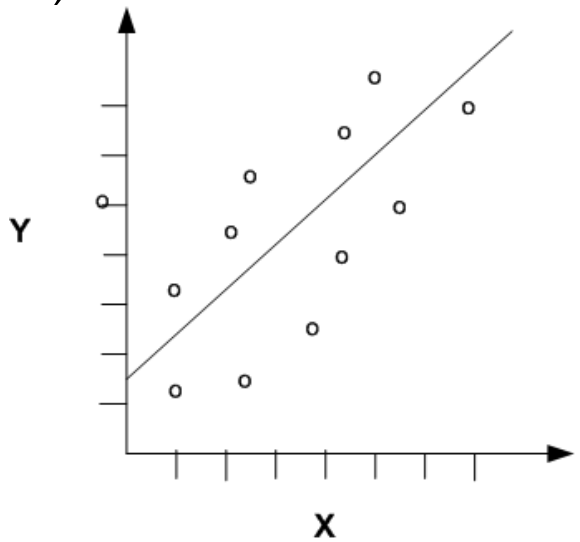
LINEAR RELATIONSHIPS BETWEEN VARIABLES

- A Linear relationship:
  - statistical term used to describe the relationship between two variables.
  - the value of one variables depends on the value of another variable.
- They can be expressed in a graphical format where the independent variable and dependent variables are connected by a straight line

$$y = mx + b$$

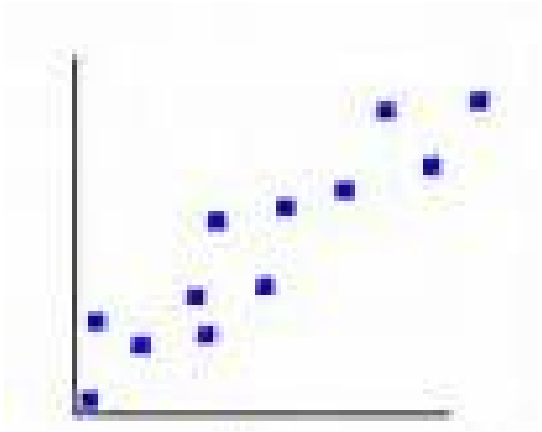
(Graphically, $y = mx + b$ plots in the x-y plane as a line with slope "m" and y-intercept "b".)

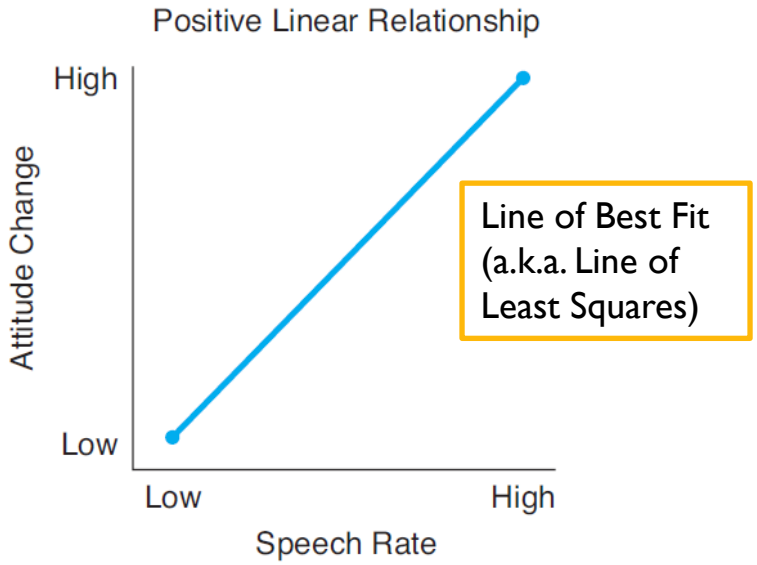
- x = independent variable
- y = dependent variable
- In statistics, this is regression.



RELATIONSHIPS BETWEEN VARIABLES

- **Positive linear relationship**
  - *Increase in one variable results in increase in another*

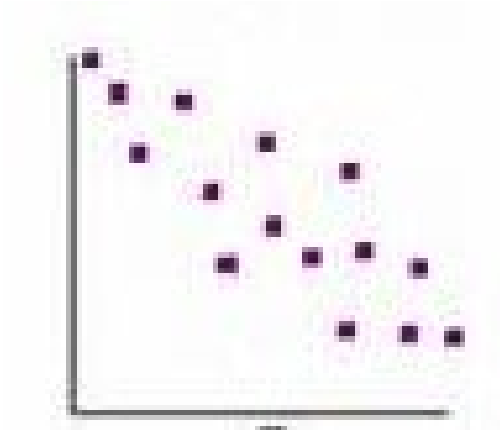


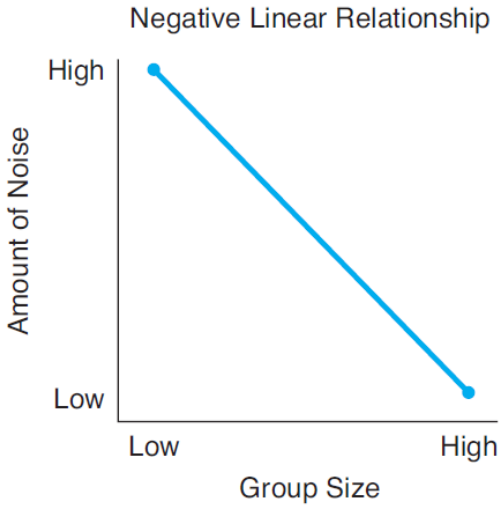


  - **Positive Graph**: As Attitude Change increases, Speech Rate increases.

RELATIONSHIPS BETWEEN VARIABLES

- **Negative linear relationship**
  - *Increase in one variable results in decrease in another*





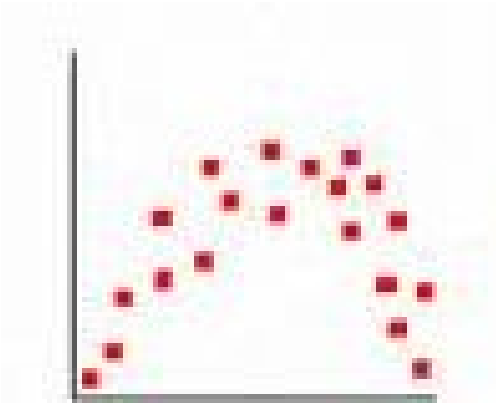
  - **Negative Graph**: As Stress Increases, Grades Decrease.

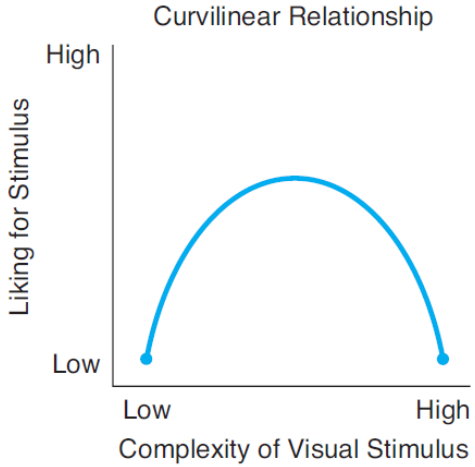
RELATIONSHIPS BETWEEN VARIABLES

- **Curvilinear relationship**
  - *A Curvilinear Relationship:*
    - *a relationship between two variables where as one variable increases, so does the other variable, but only up to a certain point,*
    - *At that point, as one variable continues to increase, the other decreases.*
  - For example: A curvilinear relationship would be staff cheerfulness and customer satisfaction. The more cheerful a service staff is, the higher the customer satisfaction, but only up to a certain point.
    - When a service staff is too cheerful, it might be perceived by customers as fake or annoying, bringing down their satisfaction level.

RELATIONSHIPS BETWEEN VARIABLES

- **Curvilinear relationship**
  - Includes U-shaped and inverted U-shaped curves

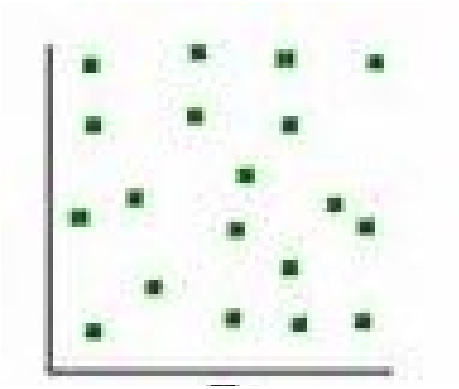


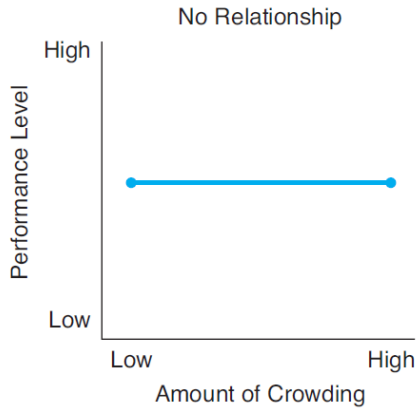


  - **Curvilinear Graph**: As Liking for Stimulus continues to increase, Complexity of Visual Stimulus will increase but then at a certain threshold, it will begin to decrease.

RELATIONSHIPS BETWEEN VARIABLES

- **No relationship**
  - When there is no relationship between the two variables, the graph is simply a flat line.





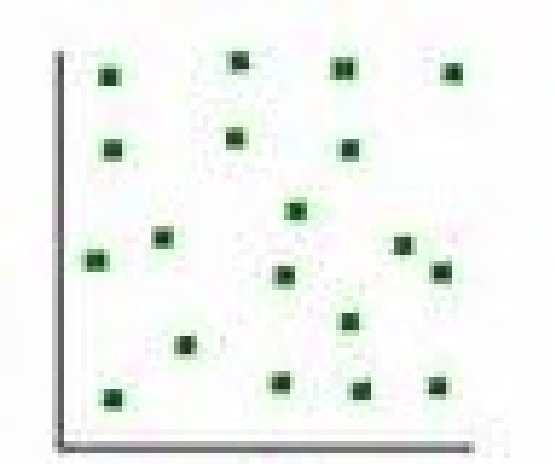
  - **Flat-line graph**: There is no relationship between Performance Level and Amount of Crowding

RELATIONSHIPS BETWEEN VARIABLES

- **Correlation coefficients:** explain how strongly variables are related to one another.
  - Statistically Denoted by ***r***
  - tells us how closely data in a scatterplot fall along a straight line
- ***r*** = 1 or -1 = data is perfectly aligned
- ***r*** close to zero = little to no relationship

RELATIONSHIPS BETWEEN VARIABLES

- When a relationship between variables is detected, uncertainty is reduced.
- *Uncertainty* = implies there is randomness in events
  - Scientists refer to this as *random variability* in events
  - Random variability is reduced by identifying systematic relationships
  - High random variability =



NONEXPERIMENTAL VERSUS EXPERIMENTAL METHODS

- **Nonexperimental method:** relationships are studied by making observations or taking measures of variables
  - Variables are observed as they occur naturally.
    - Asking people to describe their behavior (e.g., surveys)
    - Directly observing behavior
    - Recording physiological responses
    - Examining public records (e.g., census data)
  - CANNOT determine which variable causes the other
    1. No manipulation of IV
    2. No random selection
    3. No controlling for extraneous variables

NONEXPERIMENTAL VERSUS EXPERIMENTAL METHODS

- **Nonexperimental method**
  - *A **third variable** is any variable that is **extraneous** to the two variables being studied.*
  - *An uncontrolled third variable = **confounding variable**.*
  - *If two variables are confounded, they are intertwined*
    - *one cannot determine which of the variables is operating in each situation.*
    - *The weakness of the nonexperimental method is the inability to attribute causation between the IV & DV*

NONEXPERIMENTAL VERSUS EXPERIMENTAL METHODS

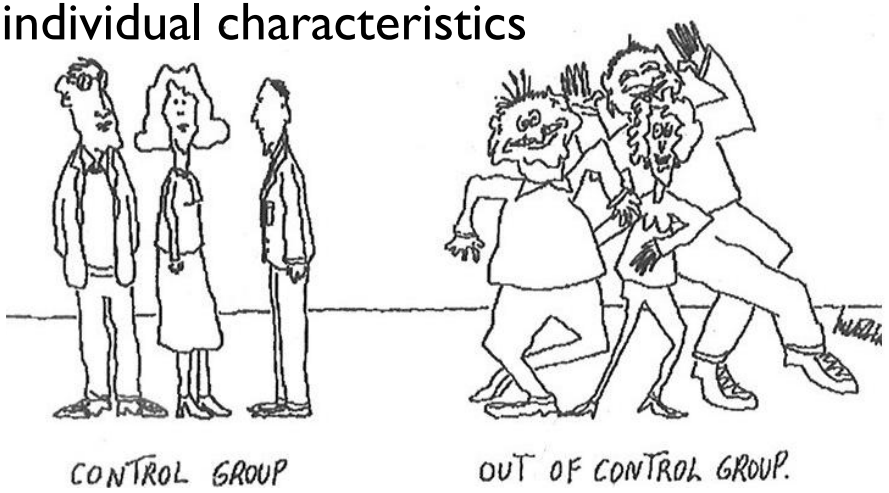
- **Nonexperimental method**
  - *Nonexperimental studies make it difficult to tell if a confounding variable is responsible for an outcome.*
  - Because the nonexperimental method allows one to observe covariation between variables, this procedure is called the *correlational method*.
  - Weakness of the nonexperimental method come from:
    - No manipulation of the independent variable
    - Extraneous variables are not kept constant
    - No random selection of sample

NONEXPERIMENTAL VERSUS EXPERIMENTAL METHODS

- **Experimental method**
  - Experimental method reduces ambiguity
    1. IV is manipulated
    2. Controlling for extraneous variables
    3. Random selection (randomization)
  - *Manipulated Variable* = ***Independent Variable***
  - *Measured Variable* = ***Dependent Variable***
  - Extraneous variables are kept constant = **experimental control**
    - If a variable is held constant = cannot be responsible for results
    - a.k.a. any variable held constant = cannot be confounding variable

NONEXPERIMENTAL VERSUS EXPERIMENTAL METHODS

- **Experimental method**
  - **Randomization** eliminates influence of Extraneous Variables
    - ensures that an extraneous variable is just as likely to affect one experimental group as it is to affect the other group.
  - **Randomization**: assign participants to two or more groups in a random fashion
    - Eliminates influence of individual characteristics



INTERNAL VALIDITY AND CAUSALITY

- **Internal validity** *is the ability to draw conclusions about causal relationships from the results of a study.*
  - High Internal Validity = strong inferences can be made that one variable caused changes in the other variable.
  - When Experimental Method is used = strong causal inferences can be made more easily.

INTERNAL VALIDITY AND CAUSALITY

- **Strong internal validity requires 3 elements:**
  - *Temporal precedence:*
  - *Covariation between the two variables*
  - *Elimination of plausible alternative explanations*

INTERNAL VALIDITY AND CAUSALITY

- **Temporal precedence:**
  - The cause happened before the effect
  - If one cannot specify which variable is the cause and which is the effect ≠ Temporal Precedence
    - BUT if the variables are statistically significant = two variables are only "Related"
      - cannot say they are causally related

INTERNAL VALIDITY AND CAUSALITY

- **Temporal precedence:**
  - For example, does inflation cause unemployment?
    - It seems possible that as inflation increases, more employers find that to meet costs they have to lay off employees.
    - Both inflation and employment rates are occurring together on an ongoing basis.
    - Is it possible that fluctuations in employment can affect inflation?
    - If we have an increase in the work force (i.e., lower unemployment) we may have more demand for goods, which would tend to drive up the prices (i.e., inflate them) at least until supply can catch up.
    - So which is the cause and which the effect, inflation or unemployment?

INTERNAL VALIDITY AND CAUSALITY

- **Covariation between the two variables** = establishing that the experiment or program had some measurable effect.
  - Without the program, there is no outcome.
  - More of the program equals more of the outcome.
  - Less of the program equals less of the outcome.
- Covariation CANNOT explain what causes the effect
- OR establish whether it is due to the expected manipulated variable or to a confounding variable.

INTERNAL VALIDITY AND CAUSALITY

- **Elimination of plausible alternative explanations**
  - Achieved through strong experimental design,
    - Randomization,
    - control groups
    - repeating experiments
  - For example, if we study the effects of activity level on weight gain, it would be important to control for:
    - age, illnesses, family obesity history, etc.

DEPENDENT AND INDEPENDENT VARIABLES

- Variables Being Studied =
  - **Independent Variables** (IV)
    - Considered to be the cause
    - Usually manipulated by the researcher
  - **Dependent Variables** (DV)
    - Considered to be the effect
    - Usually measured by the researcher

ISSUES WHEN CHOOSING A METHOD

- **External Validity** = the extent to which results can be generalized to other populations and settings
- Another alternative = conduct experiment in a field setting
  - **Field Experiment:** IV is manipulated in a natural setting
- Artificiality of experiments occurs in more controlled environments (e.g., laboratories)

ISSUES WHEN CHOOSING A METHOD

- **Ethical and Practical Considerations**
  - Sometimes the Experimental Method is not feasible
    - experimentation would be either unethical or impractical.
      - e.g., child-rearing practices using spanking
- **Participant variables** (a.k.a. *subject variables* & *personal attributes*) are characteristics of individuals
  - age, gender, ethnic group, nationality, birth order, personality, or marital status.
  - Nonexperimental
  - Must be measured
  - Often referred to as demographic data

ISSUES WHEN CHOOSING A METHOD

- **Description of behavior**
  - Much research is to describe behavior
    - Causal Inferences are not relevant to descriptive research
  - A classic example of descriptive research = Jean Piaget
    - carefully observed the behaviour of his own children as they matured
    - Through observation and description, he constructed his own developmental theory:
      - 4 stages of cognitive development
        - Sensorimotor
        - Preoperational
        - Concrete Operational
        - Formal Operational

ISSUES WHEN CHOOSING A METHOD

- **Making Successful predictions of future behavior**
  - For example, success in school, ability to learn a new job, or interest in various college majors
  - In such circumstances, there may be no need to know about cause and effect.
  - Designing measures that increase the accuracy of predicting future behavior can be very useful for research, business, education, government.

ISSUES WHEN CHOOSING A METHOD

- **Advantages of multiple methods**
  - A complete understanding of any phenomenon requires study using multiple methods
    - both experimental and nonexperimental
  - No method is perfect
  - No single study is definitive
  - The more ways a phenomenon is studied the more **confident** we can be in understanding it.

EVALUATING RESEARCH: Summary of the Three VALIDITIES

- *Validity* refers to "truth"
  - the accurate representation of information
- 3 types of validity:
  - **Construct validity**
    - refers to the adequacy of the operational definitions of variables
  - **Internal validity**
    - refers to one's ability to accurately draw conclusions about causal relationships
  - **External validity**
    - is the extent to which results of a study can be generalized to other populations and settings