# Science & Psychology

1. **Science**

#### Research Methods

1. **Statistics**

#### Ethics

Science

## Ways to Gain Knowledge

## Introspection

## Artistic

## Theological

## Philosophical

## Scientific

## And perhaps others

## While science is one of many ways to gain knowledge about the world, it is the one we will focus on in this class.

## Rules of Science

## Universe is assumed to be orderly. So, events have specific causes.

## It is publicly verifiable. Ex. You can go to the library (there is a body of literature).

## It is repeatable for a given lab, as well as across different labs.

## Procedures of Science

## Ask a question about the world.

## Operationally define the relevant terms. *Operational definition* - a concept defined by how it is measured.

## Choose a research method. We will talk about several.

## Collect & statistically analyze (make sense of) the data.

## Report the results publicly (i.e., publish or present it).

## Branches of Science

## Physics - matter, energy, & their interactions.

## Chemistry - matter: composition, structure, & properties.

## Biology - life: development, structure, function.

## Psychology - behavior & mental processes.

## Anthropology - people: origins, history, geographical distribution.

## Sociology - society, social institutions, etc.

## Political Science - description & analysis of government institutions.

## Economics - production, distribution, & consumption of commodities.

Research Methods

## Naturalistic Observation - Important issues:

## Unobtrusiveness

## Naturalness

## Systematic Recording

* Frequency - How many times does the behavior occur.
* Duration - How long does the behavior last.
* Latency - How much time passes until the behavior occurs.
* Time Sampling – involves cycles of each animal being looked at regular intervals in sequence.

## Surveys

## Includes:

### Questionnaires - without human contact.

### Interviews - voice or face-to-face contact.

## Important issues:

### Question Structure - Should not be leading.

### Who is Surveyed? - Should use a *random sample* (each member of the *population* has an equal chance of being in the sample).

## Case Studies

## Used a lot by clinicians.

## Is basically a detailed study of the *cohort* (a person or group of people of interest).

## Are several types:

* Retrospective - looks back at past events.   
  Adv: easy. Disadv: memory is poor.
* Longitudinal/Proactive - follows events as they occur.  
  Adv: accurate. Disadv: expensive (money & time).
* Cross Sectional - involves studying different age groups.   
  Adv: can see developmental progression. Disadv: generation effects.
* Mixed Longitudinal Design - uses cross sectional technique, but observes for a period of time.

## Test Methods

## A way to operationally defines variables.

## Examples include:

### IQ test - Intelligence Quotient

### TMAS - Taylor Manifest Anxiety Scale

### BDI – Beck Depression Interview

### SOS - Sexual Opinion Survey

### ACT - American College Testing Assessment Test

## Experiments

## Involves manipulating something we choose.

## As a result, it is the most powerful method because it allows us to determine cause & effect.

## Purpose is to see if one variable *causes* changes in another.

## Definitions

## Variable - Characteristic of a person or thing that can occur in different amounts or kinds.

## Independent Variables (IVs) - We select and manipulate these.

## Dependent Variables (DVs) - We measure these.

## Extraneous Variables or Confounding Variables (EVs) - Variables other than the IV which can influence the DV. We worry about these.

## Advanced

## Factorial Designs - employ >1 IV. Ex. Weil, Zinberg, & Nelson, 1968

## Meta Analyses - combines the results of a large number of experiments on the same topic.

Statistics

## *Many people use statistics in much the same way as a drunkard uses a lamp pole; more for support than for illumination.*

## Distributions – Data (collections of numbers that represent info). All have 3 characteristics:

## Shape

## Refers to what the distribution looks like when it is plotted.

## Some examples include:

### Normal

### Positive Skew

### Negative Skew

## Central Tendency

## Refers to the average or single score that best represents all the scores.

## Are several measures, including:

### Mean - Sum of the scores divided by the number of them. Is sensitive to every score.

### Median - Middle score; cuts the distribution in half.

### Mode - Most frequently occurring score.

## Variability

## Refers to how much the scores differ from each other.

## Are several measures, including:

### Range - The highest minus the lowest score. R = XH - XL

### Standard Deviation - More complicated, but a better measure.

## Examples

## Significance of Differences

## In an experiment with 2 groups, there are 2 reasons why differences may occur.

### Independent Variable (or *treatment effect*)

### Chance (or *sampling error*)

## Statistics helps us to decide whether the difference is due to the IV (significant).

## Important concepts:

### Probability (p) of difference do to chance. Ranges from 0 to 1.

* Alpha level () - arbitrary level chosen to separate probable from improbable.
* The Test - determines the p that a given difference is due to chance. If the p ≤ , the difference is significant (or reliable).
* Be careful because figures can “*lie*”. The statistical test says whether the difference is worth paying attention to, not how impressive the figure makes the difference look.

## Correlation

## Refers to a relationship between variables (i.e., whether they “*go together*”).

## Correlation Coefficient - measures quantitatively the extent to which 2 variables are related.

## One common example is *Pearson r*.

## Is illustrated with a *scatterplot* (a collection of pairs of scores).

## Examples: 1, 2, 3, 4, 5, 6 & Summary

## Correlation & Causality

Possibilities - Let: A = TV violence, B = Real life violence, C = another variable (e.g., stress).

* 1. A → B
  2. A ← B
  3. etc

## Thus, correlation tells us nothing about causality (e.g., correlation ≠ causality).

## Summary

|  |  |  |
| --- | --- | --- |
|  | Sign | Number |
| r = | ± | (0  1) |
|  |  Direction |  Magnitude |

The sign of the number gives the direction of the correlation & a larger number means more of a correlation.

Ethics

## Human Participants - Institutional Review Board (IRB). Deception, informed consent, stress, & confidentiality are issues.

## Animal Subjects - Institutional Animal Care & Use Committee (IACUC). Pain, stress, & privation are issues.

## In all cases a Cost/Benefit Analysis is used.

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Benefit** | |
| Low | High |
| **Cost** | Low | *maybe?* | *do it!* |
| High | *don’t do it* | *tough decision* |