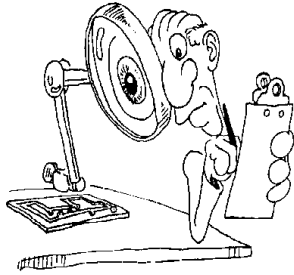


# Experimental Design



## Terminology

- **Experimental Units:** the individuals/items on which the experiment is done
  - When the units are human beings, they are called **subjects**.
- **Treatment:** A specific experimental condition applied to the unit. Can be multiple treatments in one experiment.

## Experiment

- **Experiment:** Researchers impose some change (treatment) and measure the result or response.



## Factors & Level

- **Factors:** the explanatory variables in an experiment
- **Level:** the specific level/value of each factor.
  - **Example:**
  - Factor: Sleep.
  - Level: 6 hours, 7 hours and 8 hours of sleep.

## Principles of Experiment Design

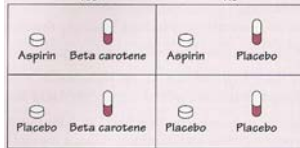
- **Randomization:** unknown and uncontrollable difference are handled by randomizing who receives what treatments.
- **Replication:** treatments need to be repeated on a sufficient number of subjects.
- **Generalizability:** ability to repeat an experiment in a variety of settings.

## The Physicians' Health Study

Does regularly taking aspirin help protect people against heart attacks? The Physicians' Health Study looked at the effects of two drugs: aspirin and beta carotene. The body converts beta carotene into vitamin A, which may help prevent some forms of cancer. A combination of the drugs were given to 21,996 male physicians. Name the subjects, treatments and factors?

## The Physicians' Health Study

- Subjects?
  - Physicians
- Treatments?
  - 4 (the groups->
- Factors?
  - 2 (aspirin & beta carotene)



## Specific Types of Experiments

- Double-Blind
- Single-Blind
- Matched Pairs
- Block Design

## Lurking Variables

- **Lurking variables:** a variable that drive two other variables, creating the mistaken impression that the two other variables are related by cause and effect.
- **Example:** As shoe size increases, reading scores increase....what is the lurking variable?

## Double-Blind

- In a double-blind experiment, neither the subjects nor the experimenters know which treatment a subject received.

## Placebo v. Treatment

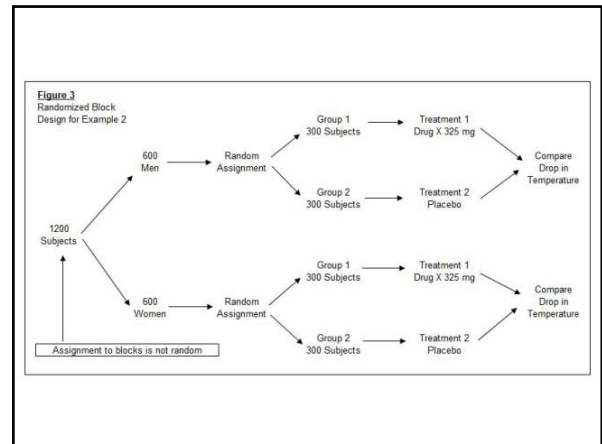
- People who receive the placebo are members of the control group.
- People who receive the "real" treatment are the treatment group.

## Matched Pair Design

- In a matched pair design, subjects are paired by matching common important attributes.
- Some times the results are a pre-test and post-test with the unit being "matched" to itself.

## Matched Pair Design

- **Example:**
  - Tire wear and tear.
  - Put one set of tires on the left side of the car and a different set on the right side of the car.
  - This would help control the lurking variable of different driving styles (between teenage boys and teachers) and mileage driven.



## Block Design

- A block is a group of experimental units or subjects that are known before the experiment to be similar in some way that is expected to affect the response to the treatments.
- In a block design, the random assignment of units to treatments is carried out separately within each block.
- Helps control for lurking variables.

## Block Design

- Experiments are often blocked by
  - Age
  - Gender
  - Race
  - Achievement Level (Regular, Honors, AP, etc.)

