

# Controlled Variables

- A controlled variable is not changed
- Also called constants
- Allow for a "fair test"
- Answers the question "What do I keep the same?"

Students of different ages were given the same jigsaw puzzle to put together. They were timed to see how long it took to finish the puzzle.

Identify the variables in this investigation.

What was the independent variable?

- Ages of the students
  - Different ages were tested by the scientist

What was the dependent variable?

- The time it to put the puzzle together
  - The time was observed and measured by the scientist

# What was a controlled variable?

- Same puzzle
  - All of the participants were tested with the same puzzle.
  - It would not have been a fair test if some had an easy 30 piece puzzle and some had a harder 500 piece puzzle.

# Beware of Confounding Variables



If I wanted to prove that smoking causes heart issues, what are some confounding variables?

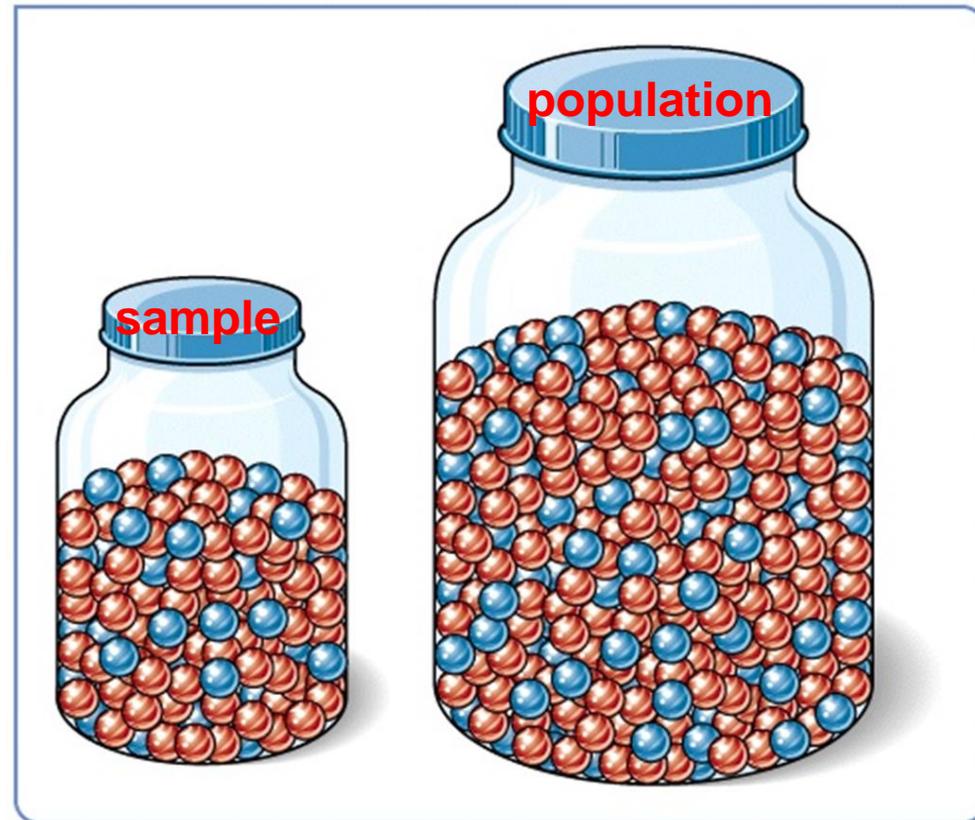
- The object of an experiment is to prove that A causes B.
- a confounding is a variable that may inadvertently affect the outcome.



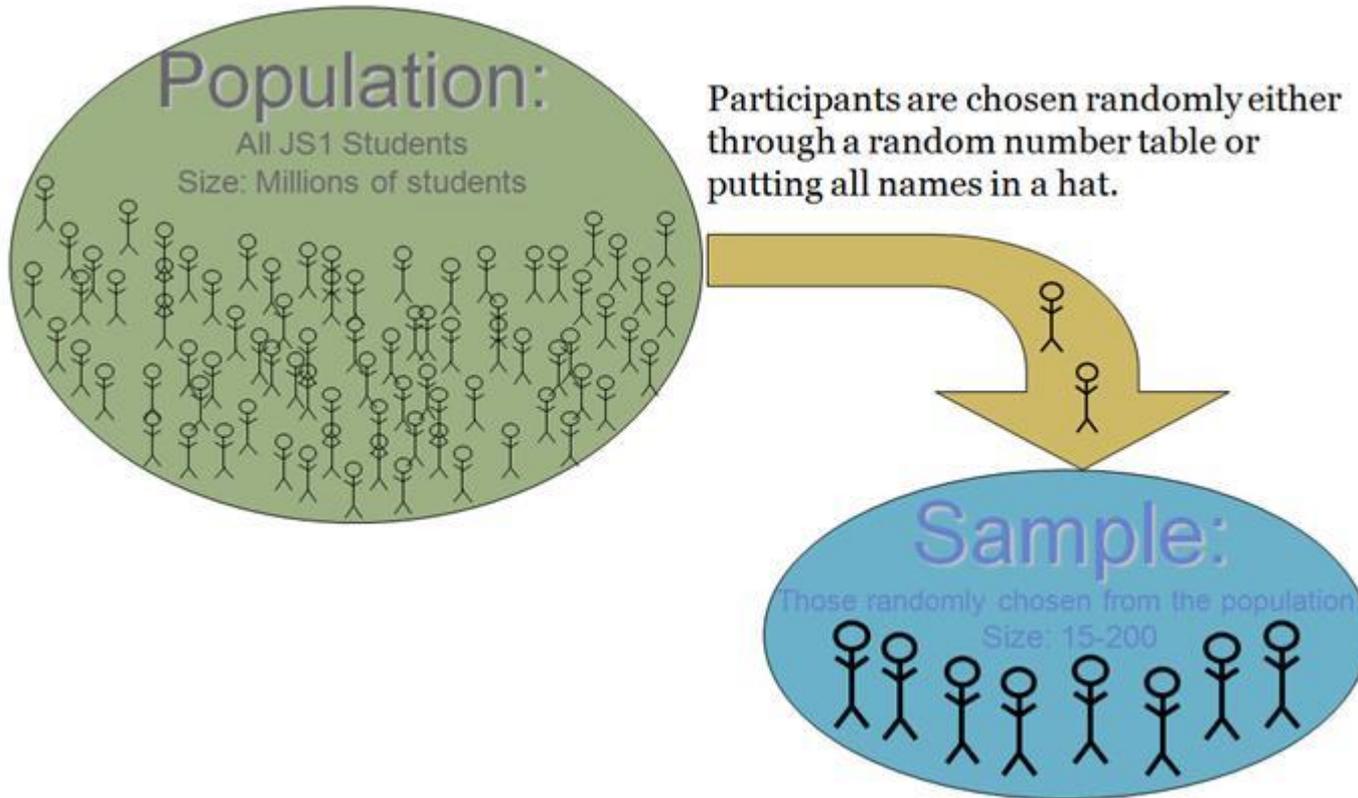
Lifestyle and family history may also effect the heart.

# Sampling

- Identify the population you want to study.
- The sample must be representative of the population you want to study.
- **GET A RANDOM SAMPLE.**



# Random Sampling



A sampling is used when you cannot study the entire population you want to consider.

# Random Assignment



- Once you have a random sample, randomly assigning them into two groups rules out confounding variables.
- Experimental Group v. Control Group.

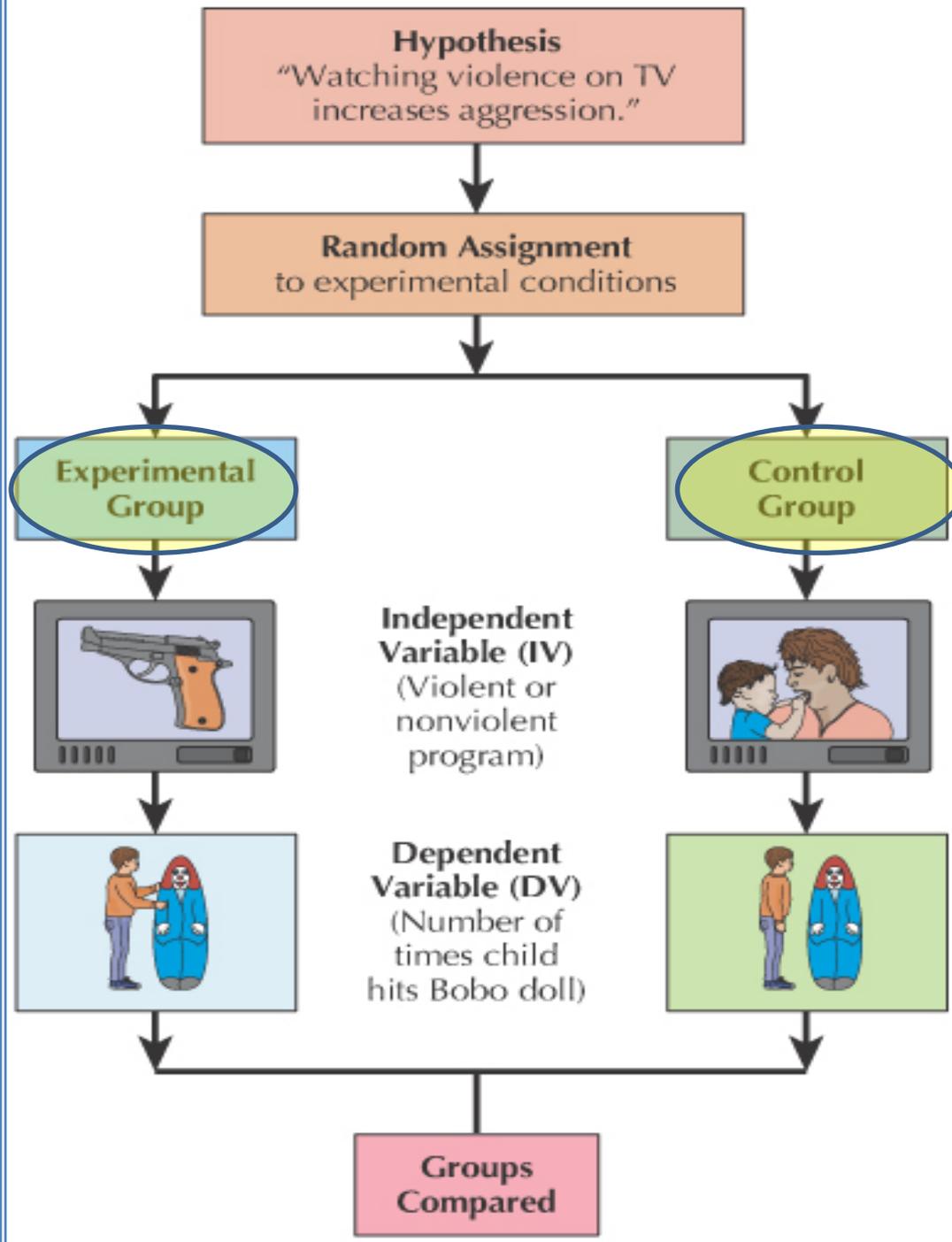
Breast milk makes children smarter!

Random assignment  
(controlling for other variables such as parental intelligence and environment)



Assigning participants to experimental (Breast-fed) and control (formula-fed) conditions by random assignment minimizes pre-existing differences between the two groups.

Condition	Independent variable	Dependent variable
Experimental	Breast milk	Intelligence score, age 8
Control	Formula	Intelligence score, age 8



*Random assignment is needed to accurately infer cause and effect relationships.*

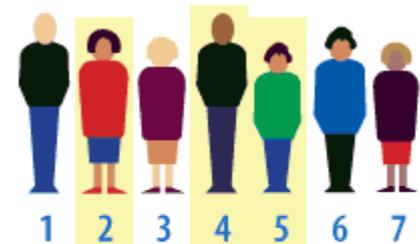
# One, both, or neither?

It is possible to have either random selection or random assignment but not the other in a study.

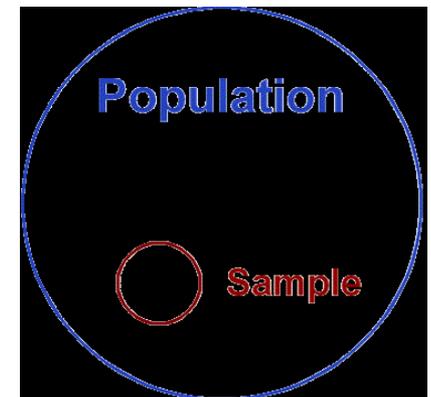
- For instance, if you do not randomly draw 100 students from JMB, but instead just take the first 100 on an alphabetical list, you do not have random selection.
- But you could still randomly assign this nonrandom sample to treatment versus control. Or, you could randomly select 100 students from JMB and then nonrandomly (haphazardly) assign them to treatment or control.

Also, it's possible to have *neither* random selection nor random assignment.

- You might nonrandomly choose two classes to be in your study. (This is nonrandom selection.)
- Then, you could arbitrarily assign one to get the new educational program and the other to be the control. This is nonrandom (or nonequivalent) assignment.



Assign Numbers,  
Auto-Generate Random  
Selections



# What is a quasi-experiment?

- ❑ When the investigator has no control over the independent variable, but has power over how the dependent variable is measured.
- ❑ Membership in the treatment level is determined by conditions beyond the control of the experimenter.
- ❑ Used extensively in the social sciences and psychology.
- ❑ If the subjects have NOT been randomly assigned to the treatment condition, the experiment is a quasi- experiment.

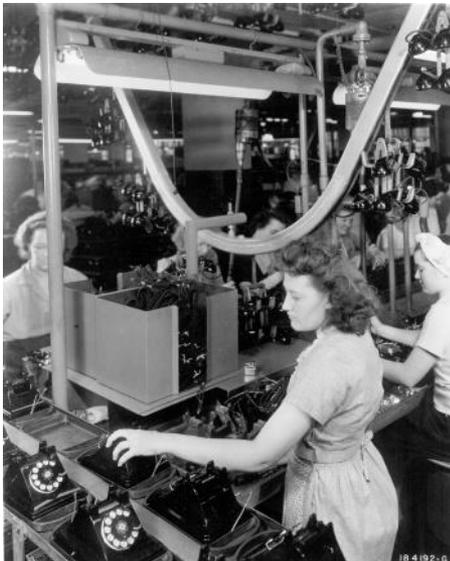
**If comparing males v. females  
- it is a quasi-experiment**



# Hawthorne Effect



- But even the control group may experience changes.
- Just the fact that you know you are in an experiment can cause change.



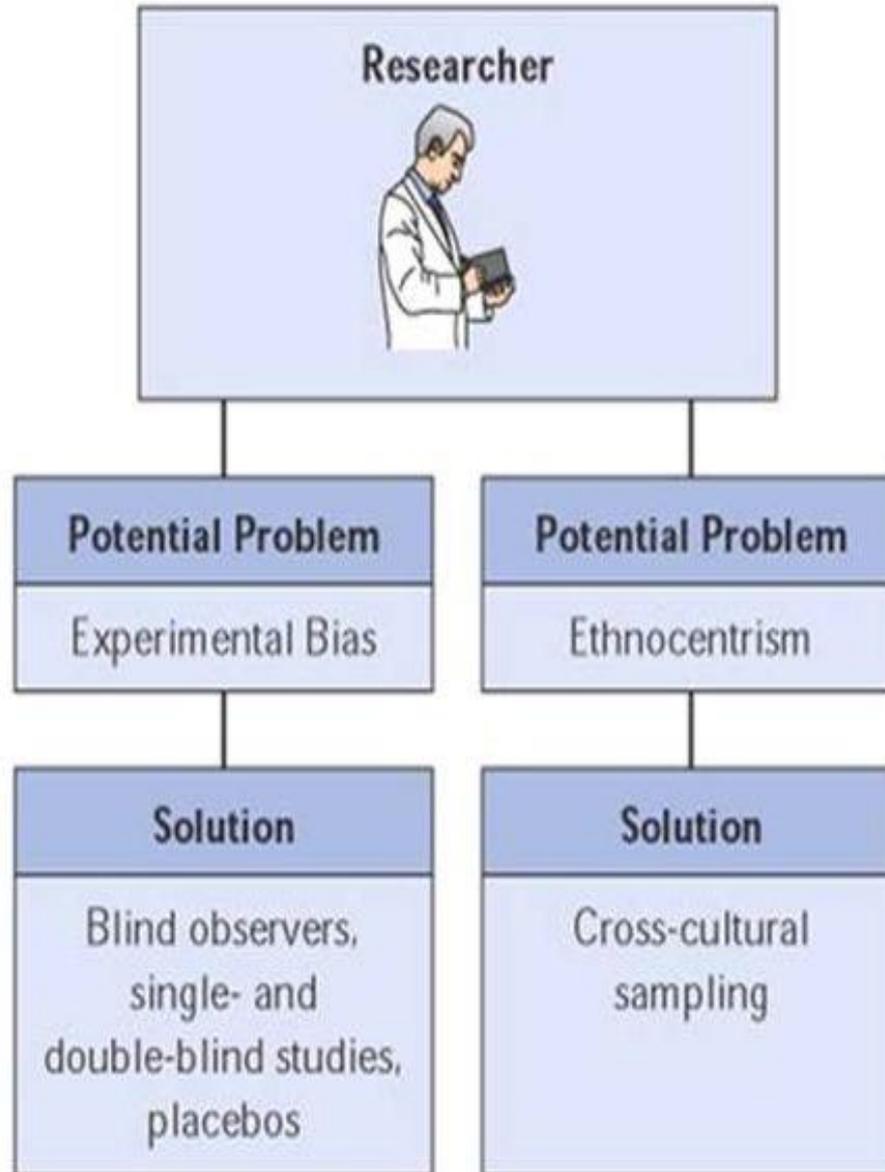
Whether the lights were brighter or dimmer, production went up in the Hawthorne electric plant.

# Hawthorne Effect

FOR EXAMPLE, if a school principal observes a classroom of students reacting politely and enthusiastically to a new student teacher, can he be sure that the students are behaving appropriately because the teacher is excellent?



# Potential Researcher Problems:



# Potential Researcher Problem Solutions:



**BLIND OBSERVERS:** Neutral people other than the researcher

**SINGLE-BLIND STUDY:**

Either the researcher or the subject do not know which group received the experimental treatment.

**DOUBLE-BLIND STUDY:**

The researchers and the subject do not know which group received the experimental treatment.

**PLACEBO:** Inactive substance or fake treatment used as a control.

