

Lesson 27: Experiments

HW 27 - Section 4-2:

Terms

- Experimental Units – The things on which the experiment is done.
- Subjects – When the experimental units are human beings
- Treatment – A specific experimental condition applied to the units. These are the explanatory variables in an experiment. Sometimes, these are called the “factors”
- Level – The specific value of the treatment to be administered
- Observational study – Observes individuals and measures variables of interest but does not attempt to influence the responses.
- Experiment – Deliberately imposes some treatment on individuals to measure their responses.

Advantages of an experiment:

- 1.) A well designed experiment can give good evidence for causation.
- 2.) An observational study or survey cannot find evidence of causation.
- 3.) We can study the specific factors we are interested in while controlling the effects of lurking variables.
- 4.) Experiments also allow us to study the combined effects of several factors.

Are the following an experiment or an observational study?

- 1.) A medical team examines the records of 5 large hospitals and compares the survival times of those cancer patients who had surgery versus those who had chemotherapy.
- 2.) In a gym class, the effect of exercise on blood pressure is studied by requiring that half of the students walk a mile each day while the other students run a mile each day.
- 3.) The relationship between weights of bears and their lengths is studied by measuring bears that have been anesthetized.
- 4.) People who smoke are asked to halve the number of cigarettes consumed each day so that any effect on pulse rate can be measured.
- 5.) One effect of alcohol is a drop in body temperature. To study this effect, researchers give several amounts of alcohol to mice, and then measured the change in each mouse's body temperature.
- 6.) A study is done to try and find the correlation between verbal and math SAT scores. The scientist wants to use the verbal score to predict the math score.
- 7.) Some breast cancer patients were given each a new treatment. The patients were closely followed to see how long they lived following surgery.
- 8.) To find out how well a child's height predicts their age a study was done where they measured the heights of a group of children at age 6, wait until they are 16 and then measure their heights again.

TERMS:

Lurking Variable

A variable that is not among the explanatory or response variables in a study but that may influence the response variable.

Confounding

Confounding is when two variables are associated in such a way that their effects on a response variable cannot be distinguished from each other. We cannot state the effect of the explanatory variable on the response variable because there is another variable that could also have affected the response variable.

When a lurking variable is not addressed in the design of the experiment, then the results are confounded.

Examples:

There is a positive association between ice cream consumption and drowning deaths. So as ice cream goes up, drowning goes up. The confounding variable (the season) influences both variables: during the summer, warmer temperatures lead to increased ice-cream consumption as well as more people swimming and thus more drowning deaths.

Smoking, drinking alcohol, and diet are lifestyle activities that are related. A risk assessment that looks at the effects of smoking but does not control for alcohol consumption or diet may overestimate the risk of smoking. When there is not a large sample population of non-smokers or non-drinkers in a particular occupation, the risk assessment may be biased towards finding a negative effect on health.

Examples - Determine the lurking variable:

Researchers find that the size of the group you are with at midnight of new year's eve has a strong positive correlation to auto accidents.

A study concludes that sunburns cause shark attacks because they find that 65% of people attacked had complained of a sunburn earlier that day.

Researchers find that the members of the American Association of Retired Persons (AARP) are at a much greater risk of death than the general population.

Daily Data Collection

In groups: Think of a food/drink that has an effect on people.

Create a hypothesis for the effect:

As _____ increases, _____ will Increase / Decrease.

Describe the population: _____

Describe the sample: _____

Describe the treatment: _____

CHECK YOUR UNDERSTANDING

1. Does reducing screen brightness increase battery life in laptop computers? To find out, researchers obtained 30 new laptops of the same brand. They chose 15 of the computers at random and adjusted their screens to the brightest setting. The other 15 laptop screens were left at the default setting—moderate brightness. Researchers then measured how long each machine's battery lasted. Was this an observational study or an experiment? Justify your answer.



Questions 2 to 4 refer to the following setting. Does eating dinner with their families improve students' academic performance? According to an ABC News article, "Teenagers who eat with their families at least five times a week are more likely to get better grades in school."¹⁹ This finding was based on a sample survey conducted by researchers at Columbia University.

2. Was this an observational study or an experiment? Justify your answer.
 3. What are the explanatory and response variables?
 4. Explain clearly why such a study cannot establish a cause-and-effect relationship. Suggest a lurking variable that may be confounded with whether families eat dinner together.
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