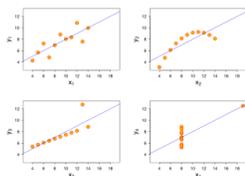


Do Changes In One Variable Influence Another? Cause-and-Effect

J. Garvin



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Types of Relationships

Cause-and-Effect Relationship

Changes in one variable cause changes in another variable.

Some cause-and-effect relationships are easy to detect.

- Increasing the force by which an object is thrown increases the distance it travels.
- Decreasing the pressure on a gas increases its volume.

Others are not so obvious.

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Types of Relationships

Common-Cause Factor

An external variable causes two variables to change in the same manner.

Common-cause factors occur frequently in statistical analysis, and should be considered before making any conclusions about cause-and-effect.

For example, the number of umbrella sales may have a strong, positive correlation with the number of highway accidents.

In this case, it is very unlikely that an increase in umbrella sales is causing an increase in accidents.

Instead, rainy weather causes both variables to increase.

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Types of Relationships

Reverse Cause-and-Effect Relationship

The dependent and independent variables are switched.

While the variables are usually easy to identify (e.g. time influences distance, rather than the other way around), the distinction is not always clear.

For instance, a strong positive correlation is found between the number of answers provided by students during class discussions and their marks.

While it is possible to conclude that answering more questions in class results in a higher mark, it is more likely that students with higher marks answer more questions in class.

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Types of Relationships

Accidental Relationship

A correlation exists between two variables, even though there is no cause-and-effect relationship.

For example, the amount of trans fat in foods is found to have a strong negative correlation with the number of females in computer science programs.

Over the past few years, an increase in health-awareness issues has caused companies to prepare foods using fewer trans fats.

At the same time, post-secondary institutions have tried to narrow the gender gap in computer science by recruiting, and accepting, more female applicants.

These two things have occurred during the same time-frame, but are not related to one another.

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Types of Relationships

Presumed Relationship

A correlation does not appear to be accidental, but no cause-and-effect relationship or common-cause factor is evident.

For instance, the number of job offers from a hospital increases at the same time as more students graduate from nursing programs at two local colleges.

It seems logical that there is a relationship between an increase in graduates and an increase in job offers, but it would be difficult to find a link showing that one variable directly affects the other.

We presume that there is some relationship, but we cannot prove it to be true.

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Extraneous Variables and Control Groups

Sometimes, causal relationships can be affected by external factors.

Extraneous Variables

External factors that affect either the independent or dependent variable.

For example, a study of gymnasts expects to find a strong positive correlation between the number of hours practiced and their performance.

Other factors that may influence the performances, however, include diet, age, coaching, etc.

To establish a cause-and-effect relationship, extraneous variables need to be identified and, if possible, accounted for.

Extraneous Variables and Control Groups

One such method to reduce the effect of extraneous variables is to use both an *experimental group* and a *control group* in a study.

Experimental and Control Groups

The independent variable is varied for an experimental group, but not the control group.

This ensures a “baseline” for comparison, since if the two groups are as similar as possible, then most of the changes in the dependent variable should be explained by the independent variable.

Extraneous Variables and Control Groups

For example, a study investigates the effect of a drug intended to reduce addiction to nicotine.

Two groups are created for the study, each containing individuals with similar characteristics including age, sex, smoking frequency, etc.

The experimental group is given the new drug, while the control group is given a *placebo*.

In the experimental group, half of the individuals have a reduction in their smoking habits, while in the control group, there is little change.

This suggests that the new drug has some effect on the experimental group. While there may be other extraneous variables at play, it is likely that there is some cause-and-effect relationship present.

Questions?

