Encyclopedia of Research Design

Confounding

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Edited by: Neil J. Salkind
Book Title: Encyclopedia of Research Design
Chapter Title: "Confounding"
Pub. Date: 2010
Access Date: February 7, 2017
Publishing Company: SAGE Publications, Inc.
City: Thousand Oaks
Print ISBN: 9781412961271
Online ISBN: 9781412961288
DOI: http://dx.doi.org/10.4135/9781412961288.n70
Print pages: 221-222

Confounding occurs when two variables systematically covary. Researchers are often interested in examining whether there is a relationship between two or more variables. Understanding the relationship between or among variables, including whether those relationships are causal, can be complicated when an independent or predictor variable covaries with a variable other than the dependent variable. When a variable systematically varies with the independent variable, the confounding variable provides an explanation other than the independent variable for changes in the dependent variable.

Confounds in Correlational Designs

Confounding variables are at the heart of the third-variable problem in correlational studies. In a correlational study, researchers examine the relationship between two variables. Even if two variables are correlated, it is possible that a third, confounding variable is responsible for the apparent relationship between the two variables. For example, if there were a correlation between icecream consumption and homicide rates, it would be a mistake to assume that eating ice cream causes homicidal rages or that murderers seek frozen treats after killing. Instead, a third variable—heat—is likely responsible for both increases in ice cream consumption and homicides (given that heat has been shown to increase aggression). Although one can attempt to identify and statistically control for confounding variables in correlational studies, it is always possible that an unidentified confound is producing the correlation.

Confounds in Quasi-Experimental and Experimental Designs

The goal of quasi-experimental and experimental studies is to examine the effect of some treatment on an outcome variable. When the treatment systematically varies with some other variable, the variables are confounded, meaning that the treatment effect is comingled with the effects of other variables. Common sources of confounding include history, maturation, instrumentation, and participant selection. History confounds may arise in quasi-experimental designs when an event that affects the outcome variable happens between pretreatment measurement of the outcome variable and its posttreat-ment measurement. The events that occur between pre- and posttest measurement, rather than the treatment, may be responsible for changes in the dependent variable. Maturation confounds are a concern if participants could have developed—cognitively, physically, emotionally—between pre- and posttest measurement of the outcome variable. Instrumentation confounds occur when different instruments are used to measure the dependent variable at pre-and posttest or when the instrument used to collect the observation deteriorates (e.g., a spring loosens or wears out on a key used for responding in a timed task). Selection confounds may be present if the participants are not randomly assigned to treatments (e.g., use of intact groups, participants self-select into treatment groups). In each case, the confound provides an alternative explanation—an event, participant development, instrumentation changes, preexisting differences between groups—for any treatment effects on the outcome variable.

Even though the point of conducting an experiment is to control the effects of potentially confounding variables through the manipulation of an independent variable and random assignment of participants to experimental conditions, it is possible for experiments to contain confounds. An experiment may contain a confound because the experimenter intentionally or unintentionally manipulated two constructs in a way that caused their systematic variation. The Illinois Pilot Program on Sequential, Double-Blind Procedures provides an example of an experiment that suffers from a confound. In this study commissioned by the Illinois legislature, eyewitness identification procedures conducted in several Illinois police departments were randomly assigned to one of two conditions. For the sequential, double-blind condition, administrators who were blind to the suspect's identity showed members of a lineup to an eyewitness sequentially (i.e., one lineup member at a time). For the single-blind, simultaneous condition, administrators knew which lineup member was the suspect and presented the witness with all the lineup members at the same time. Researchers then examined whether witnesses identified the suspect or a known-innocent lineup member at different rates depending on the procedure used. Because the mode of lineup presentation (simultaneous vs. sequential) and the administrator's knowledge of the suspect's identity were confounded, it is impossible to determine whether the increase in suspect identifications found for the single-blind, simultaneous presentations is due to administrator knowledge, the mode of presentation, or some interaction of the two variables. Thus, manipulation of an independent variable protects against confounding only when the manipulation cleanly varies a single construct.

Confounding can also occur in experiments if there is a breakdown in the random assignment of participants to conditions. In applied research, it is not uncommon for partners in the research process to want an intervention delivered to people who deserve or are in need of the intervention, resulting in the funneling of different types of participants into the treatment and control conditions. Random assignment can also fail if the study's sample size is relatively small because in those situations even random assignment may result in people with particular characteristics appearing in treatment conditions rather than in control conditions merely by chance.

Statistical Methods for Dealing with Confounds

When random assignment to experimental conditions is not possible or is attempted but fails, it is likely that people in the different conditions also differ on other dimensions, such as attitudes, personality traits, and past experience. If it is possible to collect data to measure these confounding variables, then statistical techniques can be used to adjust for their effects on the causal relationship between the independent and dependent variables. One method for estimating the effects of the confounding variables is the calculation of *propensity scores*. A propensity score is the probability of receiving a particular experimental treatment condition given the participants' observed score on a set of confounding variables. Controlling for this propensity score provides an estimate of the true treatment effect adjusted for the confounding variables. The propensity score technique cannot control for the effects of unmeasured confounding variables. Given that it is usually easy to argue for additional confounds in the absence of clean manipulations of the independent variable and random assignment, careful experimental design that rules out alternative explanations for the effects of the independent variable is the best method for eliminating problems associated with confounding.

- propensity score
- independent variables
- dependent variables
- experimental condition
- quasi-experimental designs
- experimental designs

- blinds

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http://dx.doi.org/10.4135/9781412961288.n70

See also

- Experimental Design
- Instrumentation
- Propensity Score Analysis
- Quasi-Experimental Design
- Selection

Further Readings

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