

## 2.3: Major Classes of Designs

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There are many ways to classify systematic, scientific research designs, but the most common approach is to classify them as experimental or observational. **Experimental designs** are most easily thought of as a standard laboratory experiment. In an experimental design the researcher controls (holds constant) as many variables as possible and then assigns subjects to groups, usually at random. If randomization works (and it will if the sample size is large enough, but technically that means infinite in size), then the two groups are identical. The researcher then manipulates the experimental treatment (independent variable) so that one group is exposed to it and the other is not. The dependent variable is then observed. If the dependent variable is different for the two groups, we can have quite a bit of confidence that the independent variable caused the dependent variable. That is, we have good internal validity. In other words, the conditions that need to be satisfied to demonstrate causality can be met with an experimental design. Correlation can be determined, time order is evident, and spuriousness is not a problem—there simply is no alternative explanation.

Unfortunately, in the social sciences, the artificiality of the experimental setting often creates suspect external validity. We may want to know the effects of a news story on views towards climate change so we conduct an experiment where participants are brought into a lab setting and some (randomly selected) see the story and others watch a video clip with a cute kitten. If the experiment is conducted appropriately, we can determine the consequences of being exposed to the story. But, can we extrapolate from that study and have confidence that the same consequences would be found in a natural setting, e.g., in one's living room with kids running around and a cold beverage in your hand? Maybe not. A good researcher will do things that minimize the artificiality of the setting, but external validity will often remain suspect.

**Observational** designs tend to have the opposite strengths and weaknesses. In an observational design, the researcher cannot control who is exposed to the experimental treatment; therefore, there is no random assignment and there is no control. Does smoking cause heart disease? A researcher might approach that research question by collecting detailed medical and lifestyle histories of a group of subjects. If there is a correlation between those who smoke and heart disease, can we conclude a causal relationship? Generally, the answer to that question is no, because any other difference between the two groups is an alternative explanation (meaning that the relationship might be spurious). For better or worse, though, there are fewer threats to external validity (see below for more detail) because of the natural research setting.

A specific type of observational design, the **natural experiment**, requires mention because they are increasingly used to great value. In a natural experiment, subjects are exposed to different environmental conditions that are outside the control of the researcher, but the process governing exposure to the different conditions arguably resembles random assignment. Weather, for example, is an environmental condition that arguably mimics random assignment. For example, imagine a natural experiment where one part of New York City gets a lot of snow on election day, whereas another part gets almost no snow. Researchers do not control the weather but might argue that patterns of snowfall are basically random, or, at the very least, exogenous to voting behavior. If you buy this argument, then you might use this as a natural experiment to estimate the impact of weather conditions on voter turnout. Because the experiment takes place in a natural setting, external validity is less of a problem. But, since we do not have control over all events, we may still have internal validity questions.

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