Research Variables

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The research variables, of any scientific experiment or research process, are factors that can be manipulated and measured.

Any factor that can take on different values is a scientific variable and influences the outcome of experimental research.

Gender, color and country are all perfectly acceptable variables, because they are inherently changeable.

Most scientific experiments measure quantifiable factors, such as time or weight, but this is not essential for a component to be classed as a variable.

As an example, most of us have filled in surveys where a researcher asks questions and asks you to rate answers. These responses generally have a numerical range, from '1 - Strongly Agree' through to '5 - Strongly Disagree'. This type of measurement allows opinions to be statistically analyzed and evaluated.

Dependent and Independent Variables

The key to designing any experiment [1] is to look at what research variables could affect the outcome.

There are many types of variable but the most important, for the vast majority of research methods, are the independent [2] and dependent [3] variables.

A researcher must determine which variable needs to be manipulated to generate quantifiable results.

The independent variable is the core of the experiment and is isolated and manipulated by the researcher. The dependent variable is the measurable outcome of this manipulation, the results of the experimental design [4]. For many physical experiments [5], isolating the independent variable and measuring the dependent is generally easy.

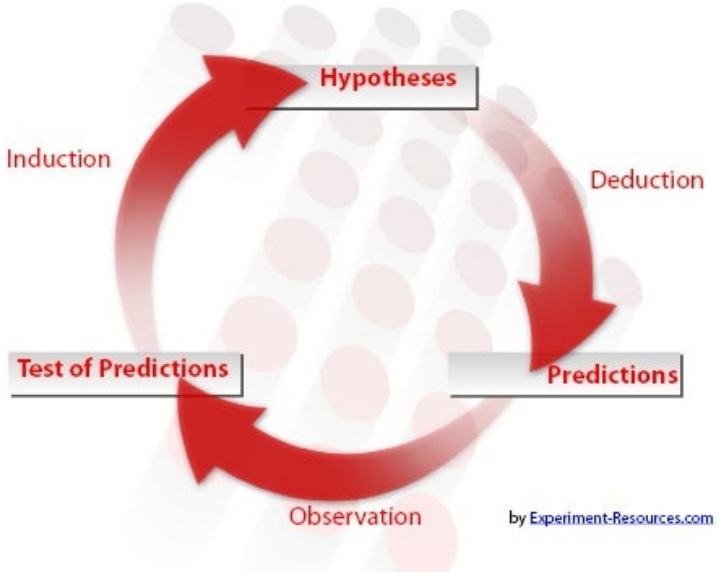
If you designed an experiment to determine how quickly a cup of coffee cools, the manipulated independent variable is time and the dependent measured variable is temperature.

In other fields of science, the variables are often more difficult to determine and an experiment needs a robust design. Operationalization [6] is a useful tool to measure fuzzy concepts which do not have one obvious variable.

The Difficulty of Isolating Variables

In biology [7], social science and geography, for example, isolating a single independent variable [2] is more difficult and any experimental design must consider this.

For example, in a social research setting, you might wish to compare the effect of different foods upon hyperactivity in children. The initial research and inductive reasoning [8] leads you to postulate that certain foods and additives are a contributor to increased hyperactivity. You decide to create a hypothesis and design an experiment [1], to establish if there is solid evidence behind the claim.



The type of food is an independent variable, as is the amount eaten, the period of time and the gender and age of the child. All of these factors must be accounted for during the experimental design stage. Randomization [9] and controls [10] are generally used to ensure that only one independent variable is manipulated.

To eradicate some of these research variables [11] and isolate the process, it is essential to use various scientific measurements [12] to nullify or negate them.

For example, if you wanted to isolate the different types of food as the manipulated variable, you should use children of the same age and gender.

The test groups should eat the same amount of the food at the same times and the children should be randomly [9] assigned to groups. This will minimize the physiological differences between children. A control group [10], acting as a buffer against unknown research variables, might involve some children eating a food type with no known links to hyperactivity.

In this experiment, the dependent variable [3] is the level of hyperactivity, with the resulting statistical tests easily highlighting any correlation [13]. Depending upon the results [14], you could try to measure a different variable, such as gender, in a follow up experiment.

Converting Research Variables Into Constants

Ensuring that certain research variables are controlled [15] increases the reliability and validity [16] of the experiment, by ensuring that other causal effects [17] are eliminated. This safeguard makes it easier for other researchers to repeat [18] the experiment and comprehensively test the results.

What you are trying to do, in your scientific design, is to change most of the variables into constants, isolating the independent variable. Any scientific research does contain an element of compromise and inbuilt error [19], but eliminating other variables will ensure that the results are robust and valid [20].

Links
[1] https://explorable.com/design-of-experiment [2] https://explorable.com/independent-variable [3] https://explorable.com/dependent-variable [4] https://explorable.com/true-experimental-design [5] https://explorable.com/physics-experiments [6] https://explorable.com/operationalization [7] https://explorable.com/biology-experiments [8] https://explorable.com/inductive-reasoning [9] https://explorable.com/random-sampling-error [10] https://explorable.com/scientific-control-group [11] http://www.socialresearchmethods.net/kb/variable.php [12] https://explorable.com/scientific-measurements [13] https://explorable.com/statistical-correlation [14] https://explorable.com/statistically-significant-results [15] https://explorable.com/controlled-variables [16] https://explorable.com/validity-and-reliability [17] https://explorable.com/causal-reasoning [18] https://explorable.com/reproducibility [19] https://explorable.com/type-I-error [20] https://explorable.com/internal-validity