Encyclopedia of Research Design

Hypothesis

Contributors: Jie Chen & Neal Kingston & Gail Tiemann & Fei Gu
Editors: Neil J. Salkind
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A hypothesis is a provisional idea whose merit requires further evaluation. In research, a hypothesis must be stated in operational terms to allow its soundness to be tested.

The term *hypothesis* derives from the Greek, which means “to put under” or “to suppose.” A scientific hypothesis is not the same as a scientific theory, even though the words *hypothesis* and *theory* are often used synonymously in common and informal usage. A theory might start as a hypothesis, but as it is subjected to scrutiny, it develops from a single testable idea to a complex framework that although perhaps imperfect has withstood the scrutiny of many research studies.

This entry discusses the role of hypotheses in research design, the types of hypotheses, and writing hypothesis.

Hypothesis in Research Design

Two major elements in the design of research are the researcher's hypotheses and the variables to test them. The hypotheses are usually extensions **[p. 586 ↓]** of existing theory and past research, and they motivate the design of the study. The variables represent the embodiment of the hypotheses in terms of what the researcher can manipulate and observe.

A hypothesis is sometimes described as an educated guess. However, this statement is also questioned to be a good description of hypothesis. For example, many people might agree with the hypothesis that *an ice cube will melt in less than 30 minutes if put on a plate and placed on a table.* However, after doing quite a bit of research, one might learn about how temperature and air pressure can change the state of water and restate the hypothesis as *an ice cube will melt in less than 30 minutes in a room at sea level with a temperature of 20°C or 68°F.* If one does further research and gains more information, the hypothesis might become *an ice cube made with tap water will melt in less than 30 minutes in a room at sea level with a temperature of 20°C or 68°F.* This example shows that a hypothesis is not really just an educated guess. It is a tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation. In other words, a hypothesis is a tentative statement about

the expected relationship between two or more variables. The hypothesis is tentative because its accuracy will be tested empirically.

Types of Hypotheses

Null Hypothesis

In statistics, there are two types of hypotheses: null hypothesis (H_0) and alternative/research/maintained hypothesis (H_a). A null hypothesis (H_0) is a falsifiable proposition, which is assumed to be true until it is shown to be false. In other words, the null hypothesis is presumed true until statistical evidence, in the form of a hypothesis test, indicates it is highly unlikely. When the researcher has a certain degree of confidence, usually 95% to 99%, that the data do not support the null hypothesis, the null hypothesis will be rejected. Otherwise, the researcher will fail to reject the null hypothesis.

In scientific and medical applications, the null hypothesis plays a major role in testing the significance of differences in treatment and control groups. Setting up the null hypothesis is an essential step in testing statistical significance. After formulating a null hypothesis, one can establish the probability of observing the obtained data.

Alternative Hypothesis

The alternative hypothesis and the null hypothesis are the two rival hypotheses whose likelihoods are compared by a statistical hypothesis test. For example, an alternative

hypothesis can be a statement that the means, variance, and so on, of the samples being tested are not equal. It describes the possibility that the observed difference or effect is true. The classic approach to decide whether the alternative hypothesis will be favored is to calculate the probability that the observed effect will occur if the null hypothesis is true. If the value of this probability (*p* value) is sufficiently small, then the null hypothesis will be rejected in favor of the alternative hypothesis. If not, then the null hypothesis will not be rejected.

Examples of Null Hypothesis and Alternative Hypothesis

If a two-tailed alternative hypothesis is *that application of Educational Program A will influence students' mathematics achievements (H*
a

: μ
Program

A ≠ μ
control

), the null hypothesis is *that application of Program A will have no effect on students' mathematics achievements* (*H*
0

: μ
program A

= μ
control

). If a one-tailed alternative hypothesis is *that application of Program A will increase students' mathematics achievements* (*H*
a

: μ
Program A

<μ
control

), the null hypothesis remains *that use of Program A will have no effect on students' mathematics achievements* (*H*
0

: μ
Program A

= μ
control

). It is not merely the opposite of the alternative hypothesis—that is, it is not *that the application of Program A will not lead to increased mathematics achievements in students.* However, this does remain the true null hypothesis.

Hypothesis Writing

What makes a good hypothesis? Answers to the following three questions can help guide **[p. 587 ↓]** hypothesis writing: (1) Is the hypothesis based on the review of the existing literature? (2) Does the hypothesis include the independent and dependent variables? (3) Can this hypothesis be tested in the experiment? For a good hypothesis, the answer to every question should be “Yes.”

Some statisticians argue that the null hypothesis cannot be as general as indicated earlier. They believe the null hypothesis must be exact and free of vagueness and ambiguity. According to this view, the null hypothesis must be numerically exact—it must state that a particular quantity or difference is equal to a particular number.

Some other statisticians believe that it is desirable to state direction as a part of null hypothesis or as part of a null hypothesis/alternative hypothesis pair. If the direction is

omitted, then it will be quite confusing to interpret the conclusion if the null hypothesis is not rejected. Therefore, they think it is better to include the direction of the effect if the test is one-sided, for the sake of overcoming this ambiguity.

Jie Chen, Neal Kingston, Gail Tiemann, and Fei Gu

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See also

Further Readings

Agresti, A., & Finlay, B. (2008). Statistical methods for the social sciences (4th ed.). San Francisco, CA: Dellen.

Nolan, S. A., & Heinzen, T. E. (2008). Statistics for the behavioral sciences (3rd ed.). New York: Worth.

Shavelson, R. J. (1998). Statistical reasoning for the behavioral sciences (3rd ed.). Needham Heights, MA: Allyn & Bacon.

Slavin, R. (2007). Educational research in an age of accountability. Upper Saddle River, NJ: Pearson.