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Null Hypothesis

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The null hypothesis, H_0, is an essential part of any research design, and is always tested, even indirectly.

The simplistic definition of the null is as the opposite of the alternative hypothesis, H_1, although the principle is a little more complex than that.

The null hypothesis (H_0) is a hypothesis which the researcher tries to disprove, reject or nullify.

The 'null' often refers to the common view of something, while the alternative hypothesis is what the researcher really thinks is the cause of a phenomenon.

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An experiment conclusion always refers to the null, rejecting or accepting H_0 rather than H_1.

Despite this, many researchers neglect the null hypothesis when testing hypotheses, which is poor practice and can have adverse effects.

Examples of the Null Hypothesis

A researcher may postulate a hypothesis:

> H_1: Tomato plants exhibit a higher rate of growth when planted in compost rather than in soil.

And a null hypothesis:

> H_0: Tomato plants do not exhibit a higher rate of growth when planted in compost rather than soil.

It is important to carefully select the wording of the null, and ensure that it is as specific as possible. For example, the researcher might postulate a null hypothesis:

> H_0: Tomato plants show no difference in growth rates when planted in compost rather than soil.

There is a major flaw with this H_0. If the plants actually grow more slowly in compost than in soil, an impasse is reached. H_1 is not supported, but neither is H_0, because there is a difference in growth rates.

If the null is rejected, with no alternative, the experiment may be invalid. This is the reason why science uses a battery of deductive [1] and inductive [2] processes to ensure that there are no flaws in the hypotheses.

Reasoning Cycle - Scientific Research

Many scientists neglect the null, assuming that it is merely the opposite of the alternative, but it is good practice to spend a little time creating a sound hypothesis. It is not possible to change any hypothesis retrospectively, including H_0.

Significance Tests

If significance tests [3] generate 95% or 99% likelihood that the results do not fit the null hypothesis, then it is rejected, in favor of the alternative.

Otherwise, the null is accepted. These are the only correct assumptions, and it is incorrect to reject, or

accept, H_1.

Accepting the null hypothesis [4] does not mean that it is true. It is still a hypothesis, and must conform to the principle of falsifiability [5], in the same way that rejecting the null does not prove the alternative.

Perceived Problems With the Null

The major problem with the H_0 is that many researchers, and reviewers, see accepting the null as a failure of the experiment [6]. This is very poor science, as accepting or rejecting any hypothesis is a positive result.

Even if the null is not refuted, the world of science has learned something new. Strictly speaking, the term 'failure', should only apply to errors [7] in the experimental design [8], or incorrect initial assumptions.

Development of the Null

The Flat Earth model was common in ancient times, such as in the civilizations of the Bronze Age or Iron Age. This may be thought of as the null hypothesis, H_0, at the time.

> H_0: World is Flat

Many of the Ancient Greek philosophers assumed that the sun, moon and other objects in the universe circled around the Earth. Hellenistic astronomy established the spherical shape of the earth around 300 BC.

> H_0: The Geocentric Model: Earth is the centre of the Universe and it is Spherical

Copernicus had an alternative hypothesis [9], H_1 that the world actually circled around the sun, thus being the center of the universe. Eventually, people got convinced and accepted it as the null, H_0.

> H_0: The Heliocentric Model: Sun is the centre of the universe

Later someone proposed an alternative hypothesis that the sun itself also circled around the something within the galaxy, thus creating a new H_0. This is how research works - the H_0 gets closer to the reality each time, even if it isn't correct, it is better than the last H_0.

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Links
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