STATISTICAL SIGNIFICANCE

For those not versed in the subject, the notion of significance is perhaps the most misunderstood concept in the realm of statistics.

To begin with, statistical significance is an outcome, as such it is the end result of a process.

So, it is important to think of significance not as a "word", but rather as a process.

Accordingly, the concept of significance is more accurately viewed in terms of "an assessment of significance".

The Process of Assessing Significance:

1) **As part of the design of an experiment, a predetermined level/threshold of what constitutes significance is selected by those conducting the research. (The most commonly used threshold is .05)**
2) **Sample data are employed to conduct an appropriate statistical test or model**
3) **This statistical test or model determines/calculates a p-value**
4) **The p-value is compared to the significance threshold**
5) **A decision is made based on comparing the p-value to the significance threshold**

A result that is not statistically significant occurs:

If the calculated p-value is greater than predetermined significance threshold; then, we fail to reject the null hypothesis.

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A result that is statistically significant occurs:

If the calculated p-value is less than or equal to the predetermined significance threshold; then, the null hypothesis is rejected. Consequently, the alternative hypothesis is accepted.

The p-value of an outcome can be influence by several factors (more on this below) …

However, for a chosen hypothesis (and data) with a predetermined significance threshold, an appropriate analysis either reveals a statistically significant result or it does not.

In other words, for a particular designed experiment, the statistical significance of an outcome is based on the results of the analysis.

Researchers often speak of the necessity and desire to find statistical significance.

In actuality, the experiment, collected data, and chosen analysis yield results that are either statistically significant or they are not.

If the data do not support what the researchers hypothesized, for that particular experiment, then there isn't much that can be done regarding achieving statistical significance.

Factors that Influence Statistical Significance

- **Chosen alpha threshold -- The greater the selected level of significance the more likely the process of finding significance will be satisfied. (This factor is self-evident.)**

- **Sample size -- Larger sample sizes result in calculations that yield smaller p-values thereby increasing the likelihood of finding significance. Conversely, smaller sample sizes yield larger p-values and decrease the chance of finding significance.**

- **The size the effect /difference -- Large differences are easier to detect thereby increasing the likelihood of finding significance; conversely, smaller differences are more difficult to detect thereby decreasing the likelihood of finding significance. (This factor is self-evident.)**

- **Spread of the data -- The dispersion of observations in a dataset is commonly measured with standard deviation. The larger the standard deviation, the greater the spread of observations. This decreases the calculated p-value and increases the probability of significance. Conversely, smaller spreads have smaller standard deviations, increased p-values, and decreases the likelihood of finding significance.**

- **Type of test -- Certain tests are more sensitive to differences. For example, comparing one-sided vs. two-sided tests, a two-sided scenario divides the significance level by two, thereby making a significant outcome less probable.**

Increasing the probability of statistical significance can be achieved by changes to these aforementioned factors. However, the results of such changes must be viewed in terms of whether a statistically significant result is meaningful in terms of its practical significance.