

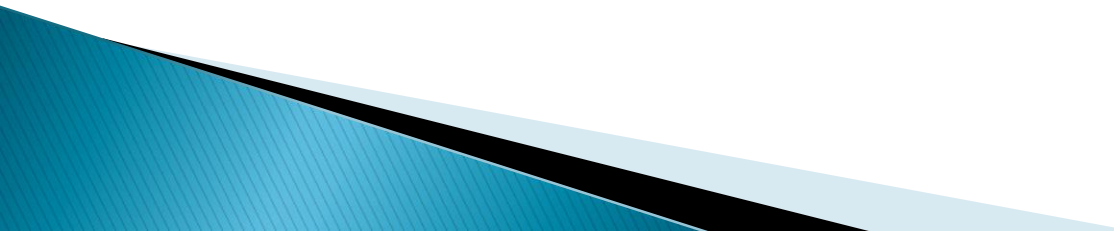
# TYPE I AND TYPE II ERROR

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# The Boy who Cried Wolf

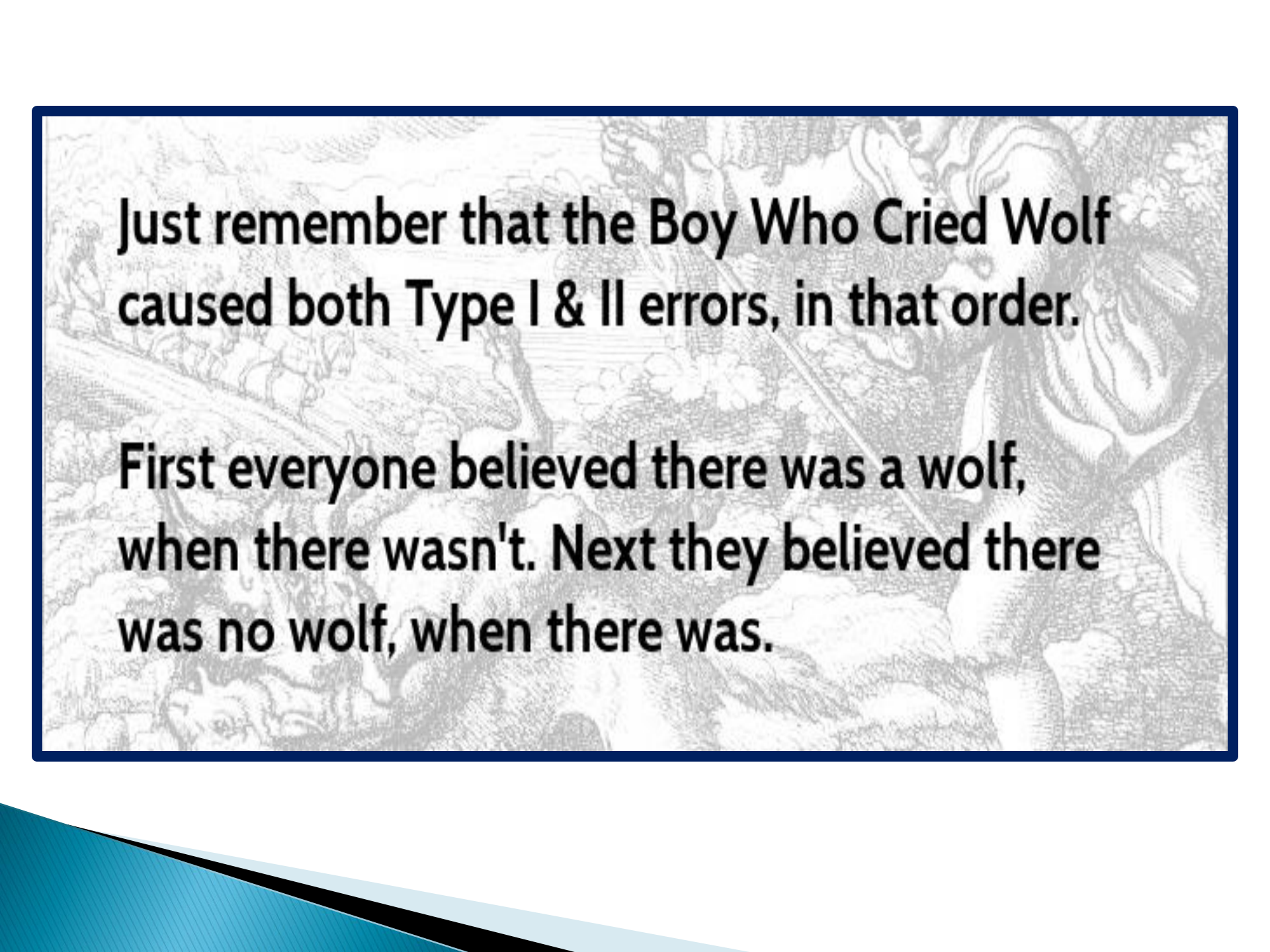
# Introduction

The testing of hypothesis is a common procedure that researchers use to prove the validity, that determines whether a specific hypothesis is correct or not. The result of testing is a cornerstone for accepting or rejecting the null hypothesis ( $H_0$ ). The null hypothesis is a proposition that does not expect any difference or effect. An alternative hypothesis ( $H_1$ ) is a premise that expects some difference or effect.



# ...Introduction

There are primarily two types of errors that occur, while hypothesis testing is performed, i.e. either the researcher rejects  $H_0$ , when  $H_0$  is true, or he/she accepts  $H_0$  when in reality  $H_0$  is false. So, the former represents **type I error** and the latter is an indicator of **type II error**. There are slight and subtle differences between type I and type II errors, that we are going to discuss in this article.

A grayscale illustration of a boy crying wolf. The boy is in the foreground, looking distressed and shouting. Behind him, a crowd of people is shown in various states of panic and confusion, some running and some looking back over their shoulders. The scene is set in a rural, hilly landscape with trees and a fence. The entire illustration is framed by a dark blue border.

**Just remember that the Boy Who Cried Wolf caused both Type I & II errors, in that order.**

**First everyone believed there was a wolf, when there wasn't. Next they believed there was no wolf, when there was.**

# EXAMPLES

**What do you see?  
A box with one color?  
or  
A box with different shades of Grey?**



# O.J. Simpson trial: the situation

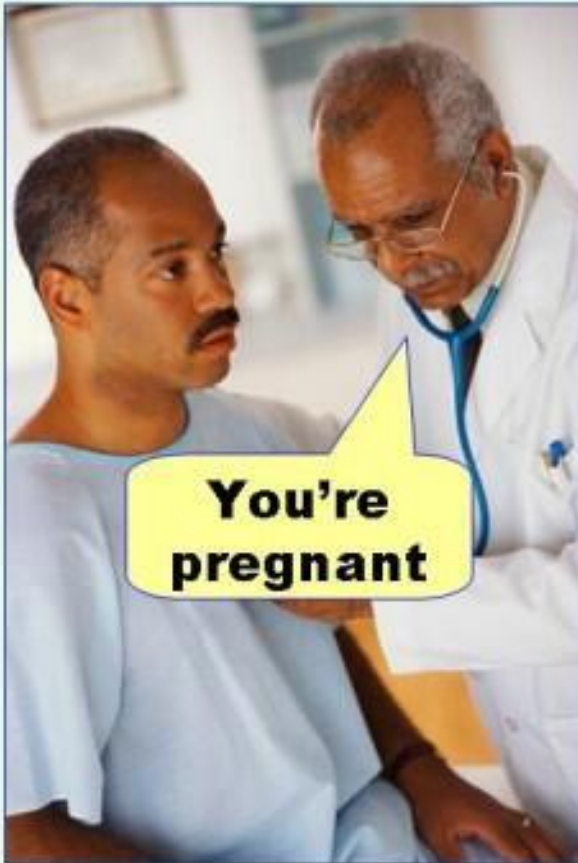


- ▶ O.J. is assumed innocent.
- ▶ Evidence collected:  
size 12 Bruno Magli bloody footprint, bloody glove, blood spots on white Ford Bronco, the knock on the wall, DNA evidence from above, motive(?), etc...



# THE PREGNANCY TEST

**Type I error**  
(false positive)



**Type II error**  
(false negative)

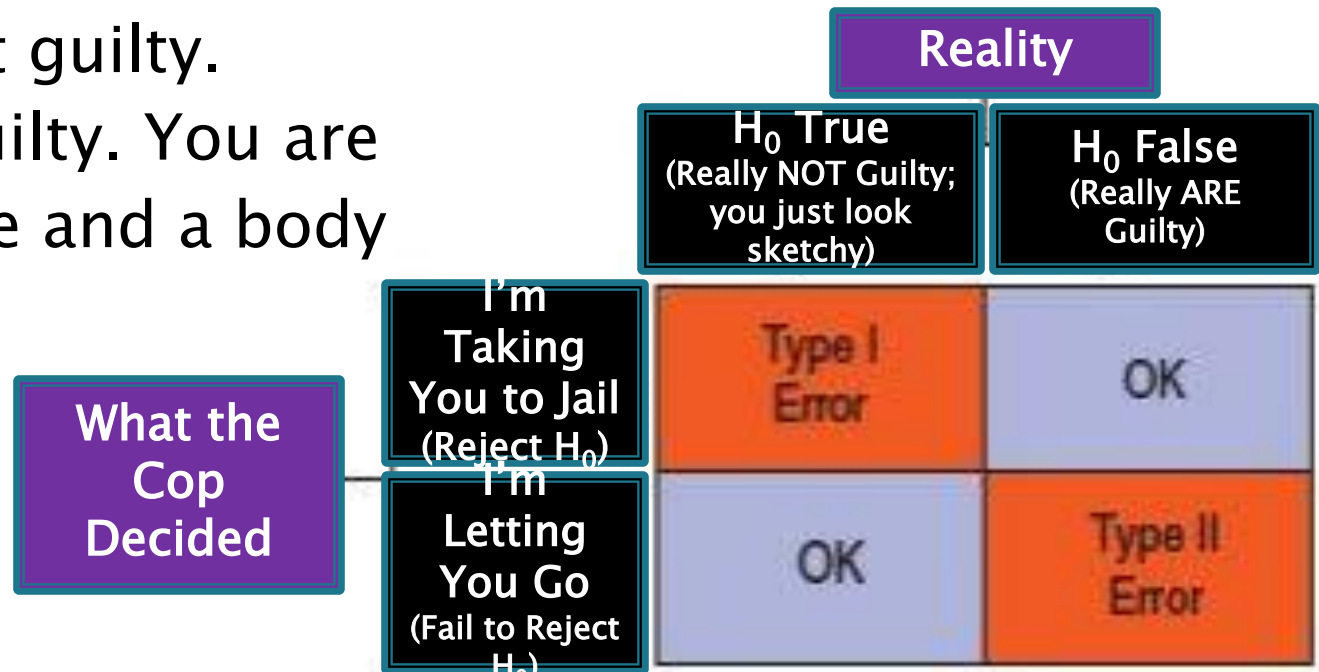


# Getting Picked Up By the Cops

The scenario: A cop pulls you over and suspects that you have just committed a **murder**. He is trying to figure out whether or not to take you to jail. The cop needs to do a little hypothesis test in his head to figure out whether to bring you in.

$H_0$ : You are not guilty.

$H_A$ : You ARE guilty. You are hiding evidence and a body in your trunk.

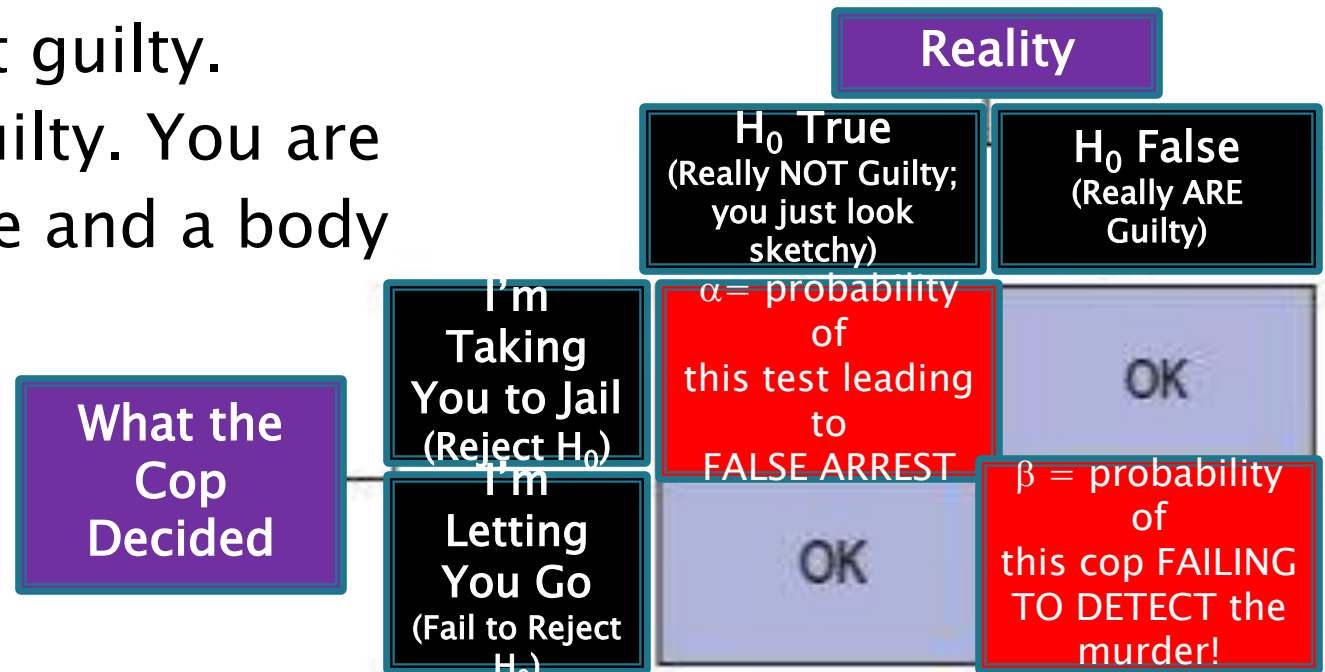


# Getting Picked Up By the Cops

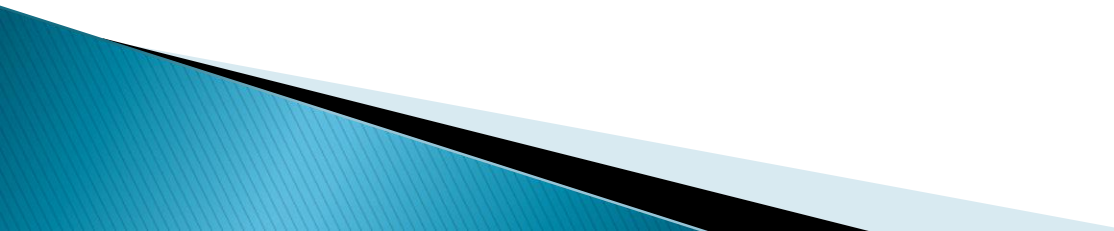
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$H_0$ : You are not guilty.

$H_A$ : You ARE guilty. You are hiding evidence and a body in your trunk.



# TYPE I ERROR

- ▶ In statistics, type I error is defined as an error that occurs when the sample results cause the rejection of the null hypothesis, in spite of the fact that it is true. In simple terms, the error of agreeing to the alternative hypothesis, when the results can be ascribed to chance.
- 

# ...TYPE I ERROR

- ▶ Also known as the alpha error, it leads the researcher to infer that there is a variation between two observances when they are identical. The likelihood of type I error, is equal to the level of significance, that the researcher sets for his test. Here the level of significance refers to the chances of making type I error.

# ...TYPE I ERROR

- ▶ E.g. Suppose on the basis of data, the research team of a firm concluded that more than 50% of the total customers like the new service started by the company, which is, in fact, less than 50%.

# TYPE II ERROR

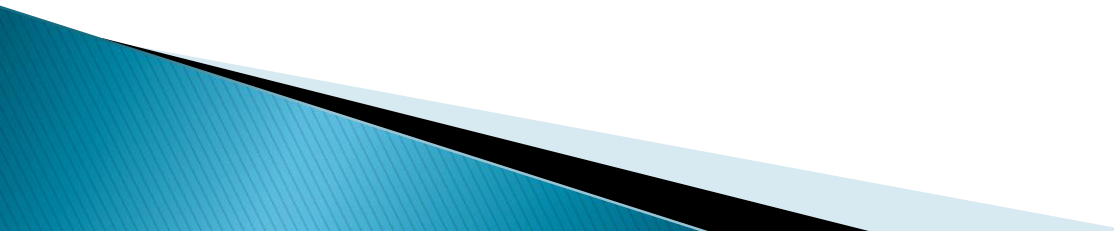
- ▶ When on the basis of data, the null hypothesis is accepted, when it is actually false, then this kind of error is known as Type II Error. It arises when the researcher fails to deny the false null hypothesis. It is denoted by Greek letter 'beta ( $\beta$ )' and often known as beta error.

# ...TYPE II ERROR

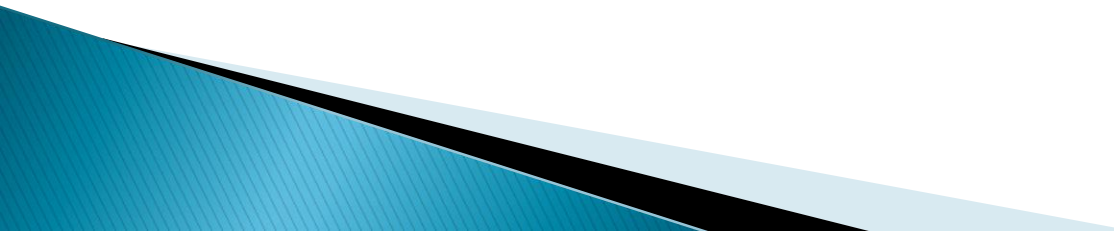
- ▶ Type II error is the failure of the researcher in agreeing to an alternative hypothesis, although it is true. It validates a proposition; that ought to be refused. The researcher concludes that the two observances are identical when in fact they are not.



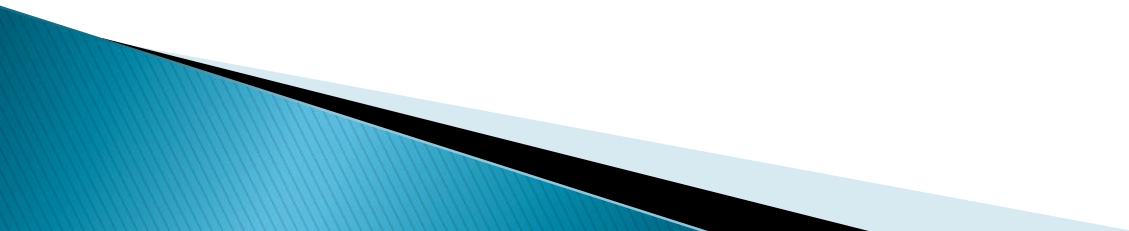
## ...TYPE II ERROR

- ▶ The likelihood of making such error is analogous to the power of the test. Here, the power of test alludes to the probability of rejecting of the null hypothesis, which is false and needs to be rejected. As the sample size increases, the power of test also increases, that results in the reduction in risk of making type II error.
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## ...TYPE II ERROR

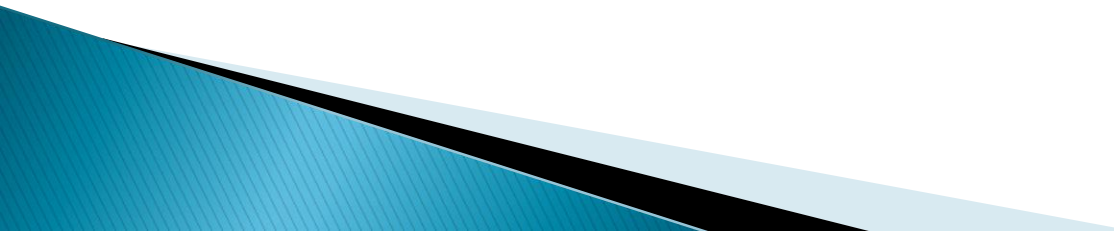
- ▶ E.g. Suppose on the basis of sample results, the research team of an organization claims that less than 50% of the total customers like the new service started by the company, which is, in fact, greater than 50%.
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# **Key Differences Between Type I and Type II Error**



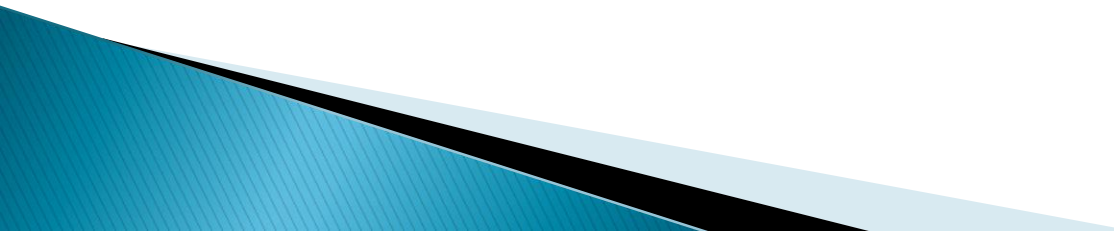
## Key Differences Between Type I and Type II Error

1. Type I error is an error that takes place when the outcome is a rejection of null hypothesis which is, in fact, true. Type II error occurs when the sample results in the acceptance of null hypothesis, which is actually false.



## ...Key Differences Between Type I and II Error

2. Type I error or otherwise known as false positives, in essence, the positive result is equivalent to the refusal of the null hypothesis. In contrast, Type II error is also known as false negatives, i.e. negative result, leads to the acceptance of the null hypothesis.



## ...Key Differences Between Type I and II Error

3. When the null hypothesis is true but mistakenly rejected, it is type I error. As against this, when the null hypothesis is false but erroneously accepted, it is type II error.

## ...Key Differences Between Type I and II Error

4. Type I error tends to assert something that is not really present, i.e. it is a false hit. On the contrary, type II error fails in identifying something, that is present, i.e. it is a miss.

## ...Key Differences Between Type I and II Error

5. The probability of committing type I error is the same as the level of significance. Conversely, the likelihood of committing type II error is the same as the power of the test.

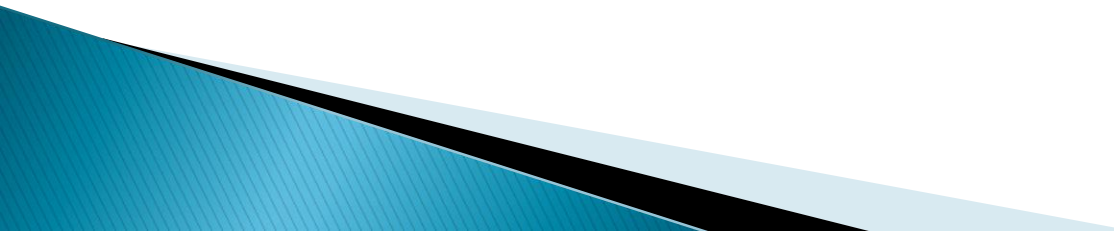


...Key Differences Between Type I and II Error

6. Greek letter ' $\alpha$ ' indicates type I error. Unlike, type II error which is denoted by Greek letter ' $\beta$ '.

# Conclusion

By and large, Type I error crops up when the researcher notices some difference, when in fact, there is none, whereas type II error arises when the researcher does not discover any difference when in truth there is one. The occurrence of the two kinds of errors is very common as they are a part of the testing process. These two errors cannot be removed completely but can be reduced to a certain level.



# Reference

<http://keydifferences.com/difference-between-type-i-and-type-ii-errors.html#ixzz4k3WtcS1Y>