

Statistical Errors and Power of a Test

Purpose

1. Review the concept of power of the test
2. Determine the required sample size, n , to have a pre-specified power $(1 - \beta)$ for tests concerning the mean at significance level α

Power of a test

Type I error: Probability of rejecting the null hypothesis, H_0 , when the null is true. Designated by α .

Type II error: Probability of failing to reject the null hypothesis, H_0 , when the alternative, H_1 , is true. Designated as β .

Power: Probability of accepting the alternative hypothesis, H_1 , when the alternative is true. [The probability that the test will correctly lead to the rejection of the null hypothesis for a particular value of *in the alternative hypothesis*]. Designated as $1 - \beta$.

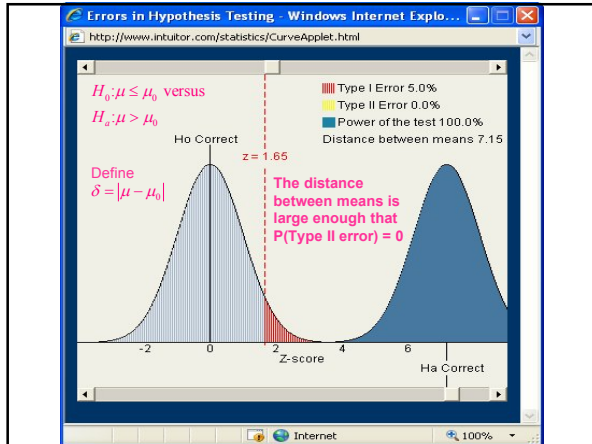
Power of a test

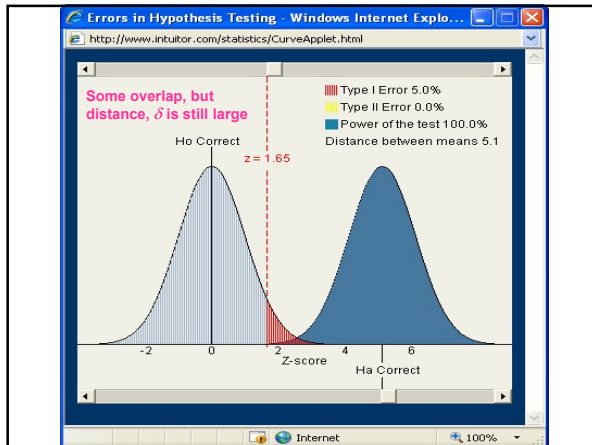
Truth about the population

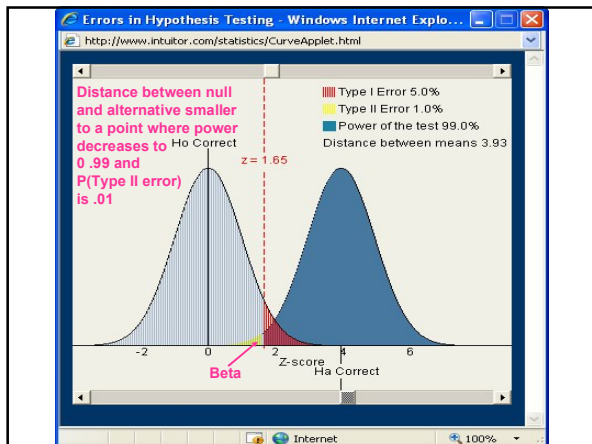
		Truth about the population	
		H_0 True	H_1 True
Decision based on sample data	Reject H_0	Type I Error	Correct Decision
	Fail to reject H_0	Correct Decision	Type II Error

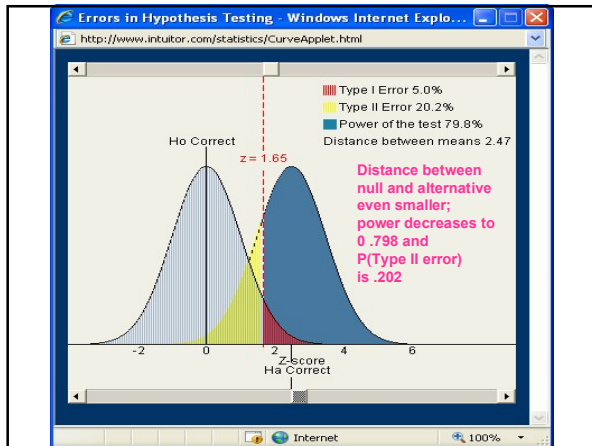
When designing a study we should be interested in both α and $1 - \beta$

See <http://www.intuit.com/statistics/T1T2Errors.html> for a conceptual discussion. See applet at <http://www.intuit.com/statistics/CurveApplet.html>





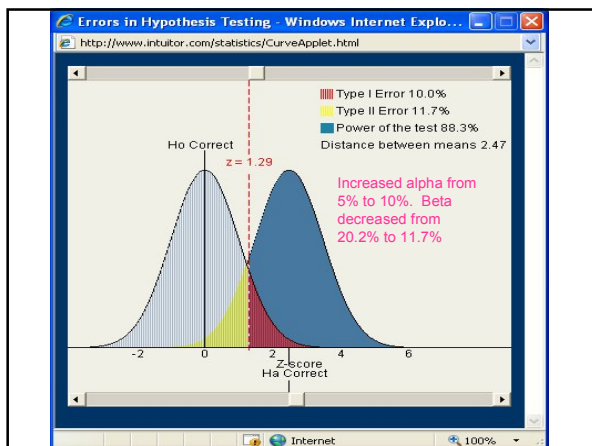


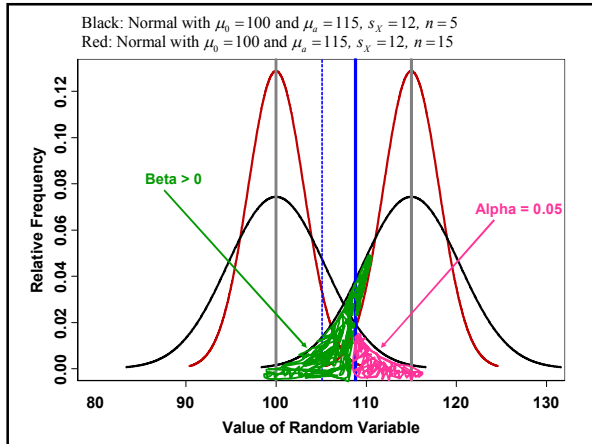


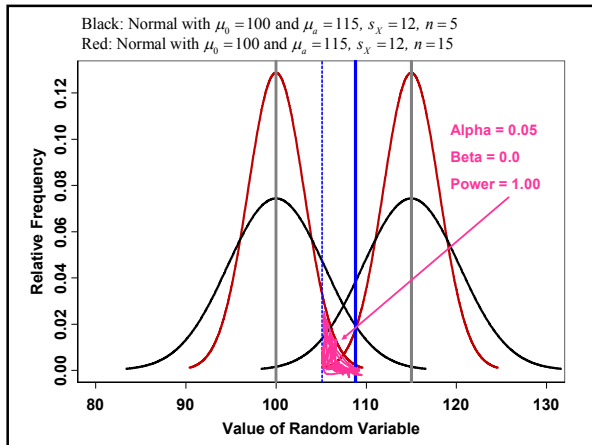
What does power depend on?

Three factors that will increase the power of a test:

- Increase α
- Increase n , the sample size
- Increase the δ distance between μ_0 and μ_a







Summary

- As alpha increases, power increases
- As n increases, power increases
- As the distance between the null and hypothesized values of the mean increases, power increases

Summary

- For a fixed n and alpha, the value of beta decreases and the power increases as the distance between the specified null value and the specified alternative value increases.
- For fixed n and values of the null and hypothesized mean, the value of beta increases and the power decreases as the value of alpha is decreased.
- For fixed alpha and values of the null and hypothesized mean, the value of beta decreases and the power increases as the sample size n is increased.

See applet at: <http://wise.cgu.edu/power/appletover.html>
