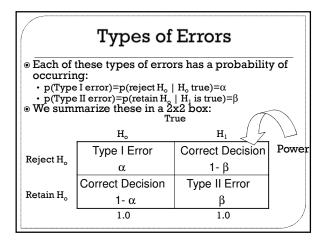
# Types of Error and Power

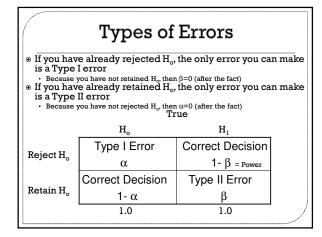
PSY 5101: Advanced Statistics for Psychological and Behavioral Research

### **Types of Errors**

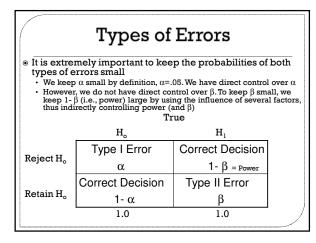
- Two hypotheses, two decisions, two types of error: this was one of the seven topics common to all inferential methods
- ${\scriptstyle \odot}$  The two hypotheses are  ${\rm H_o}$  and  ${\rm H_1},$  and the two decisions are to Reject  ${\rm H_o}$  and to Retain  ${\rm H_o}$
- Now we come to the errors that you can make in hypothesis testing:
  - A Type I error: to reject  $H_o$  when  $H_o$  is true
  - + A Type II error: to retain  $H_o$  when  $H_0$  is false ( $H_1$  is true)













Power
• Power = p(rejecting $H_0   H_1$ is true) = 1- $\beta$
<ul> <li>We keep β small and 1-β large indirectly by using the influence of several factors:         <ul> <li>effect size</li> <li>N</li> <li>σ<sup>2</sup></li> <li>α</li> </ul> </li> </ul>
• Use of appropriate type of hypotheses

#### **Power: Effect Size**

•Effect size, for  $z_{\overline{X}}$  is  $\gamma = \frac{(\mu - \mu_o)}{\sigma}$ , the difference between the true mean and the mean given in the H<sub>o</sub> divided by the population standard deviation

As effect size increases, power increases

### Power: Sample Size (N)

Sample size (N) is the factor that gives you the greatest control over power
You usually can choose N
N has a great influence on power

•As N increases, power increases

## $\textbf{Power:}\,\sigma^2$

 •σ<sup>2</sup> (population variance) offers you little direct control over power because it is difficult to influence

•As  $\sigma^2$  decreases, power increases

#### Power: $\alpha$

 α is the p(Type I error)
 α is usually set at .05 so it also offers you little control over power

• You can choose to use .01 or smaller but you will rarely use  $\alpha$  larger than .05

•As  $\alpha$  increases, power increases

### Power: Type of Hypotheses

 Directional hypotheses have greater power if you are correct in predicting direction...but virtually zero power if you are wrong

 Non-directional hypotheses have good power in either direction...but lower power than a directional hypothesis in the correct direction