Questions?

- Final
  - In class final on May 18th from 10:30 to 12:30
- Preliminary findings presentation
  - 04/24
- Paper review in class
  - Be ready to have a draft by May 1st
- Final presentation
  - 05/13

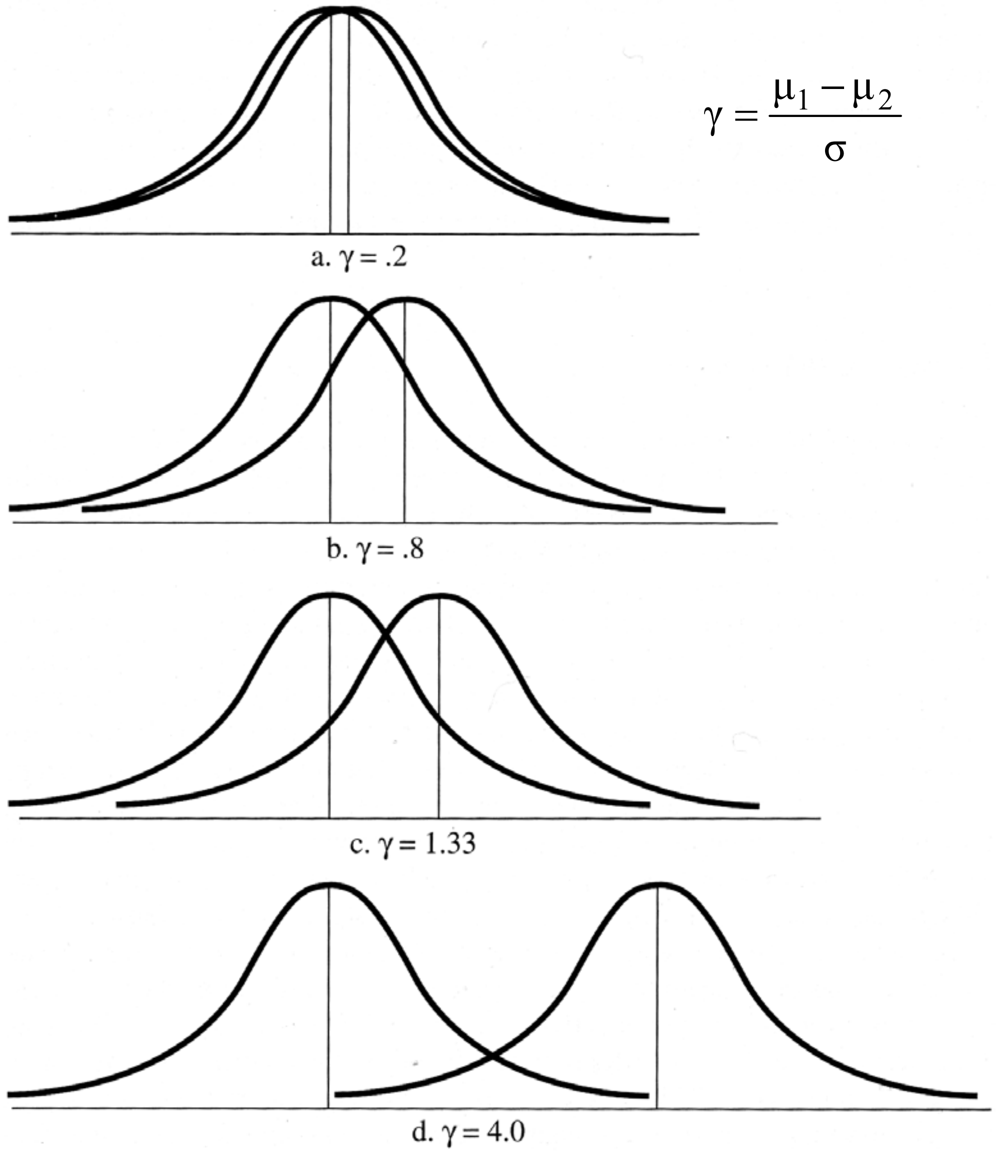
t-Test for two independent sample means

- Setting
  - Two different treatments: (pen versus mouse)
  - For each treatment you gathered from a random samples
    - *Mean*
    - *Standard deviation*
- Null hypothesis
  - The difference of the means follows a normal distribution
- t-Test

$$t = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{\sigma_1^{\ 2}}{N_1 - 1} + \frac{\sigma_2^{\ 2}}{N_2 - 1}}}, \quad \text{with} \begin{cases} \sigma_i = \sqrt{\dfrac{\sum_j (X_{i,j} - \bar{X}_i)^2}{N_i}} \\ df = N_1 + N_2 - 2 \end{cases}$$

t-test interpretation

$$\gamma = \frac{\mu_1 - \mu_2}{\sigma}$$



From Explaining Psychological Statistic (Cohen)

t-test assumptions

- Independent Random Sampling
- Normal Distribution
- Homogeneity of Variance (same variance for the 2 populations)

t-test example

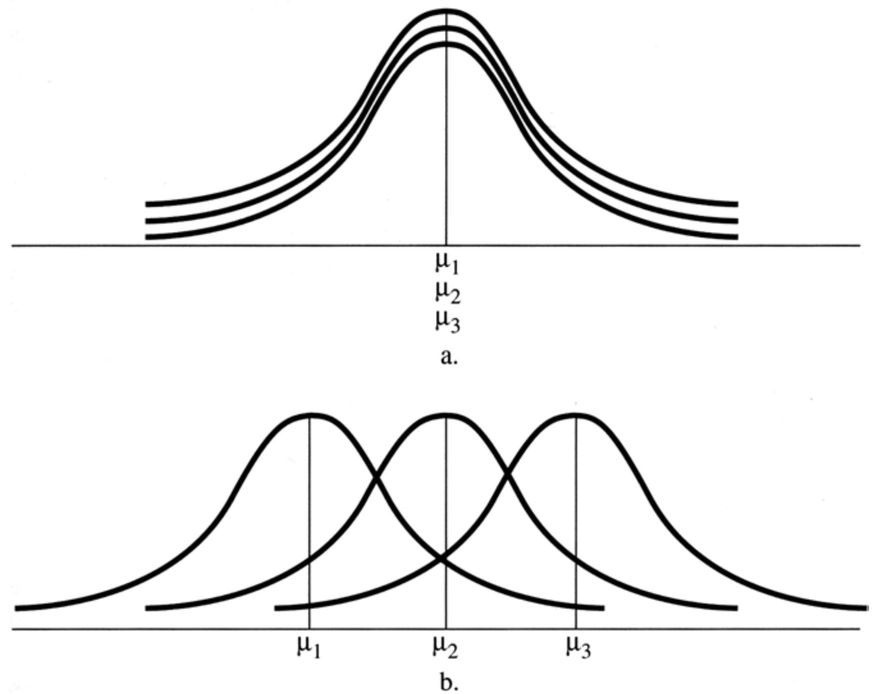
One-way Independent ANOVA

- Setting
  - *k* different treatments: (pen versus mouse, versus TrackPoint)
  - For each treatment you gathered from a random samples
    - *Mean*
    - *Standard deviation*
- Null hypothesis
  - The *F* ratio follows a *F* distribution

$$F = \frac{MS_{bg}}{MS_{wg}}, \quad \text{with} \begin{cases} MS_{bg} = \dfrac{SS_{bg}}{df_{bg}}, \quad SS_{bg} = \sum_{j=1}^{k} n_j (\overline{X}_j - \overline{X}_G)^2 \\ MS_{wg} = \dfrac{SS_{wg}}{df_{wg}}, \quad SS_{wg} = \sum (n_j) \sigma_j^2 \\ df_{bg} = k - 1 \\ df_{wg} = N - k \end{cases}$$

From Explaining Psychological Statistic (Cohen)

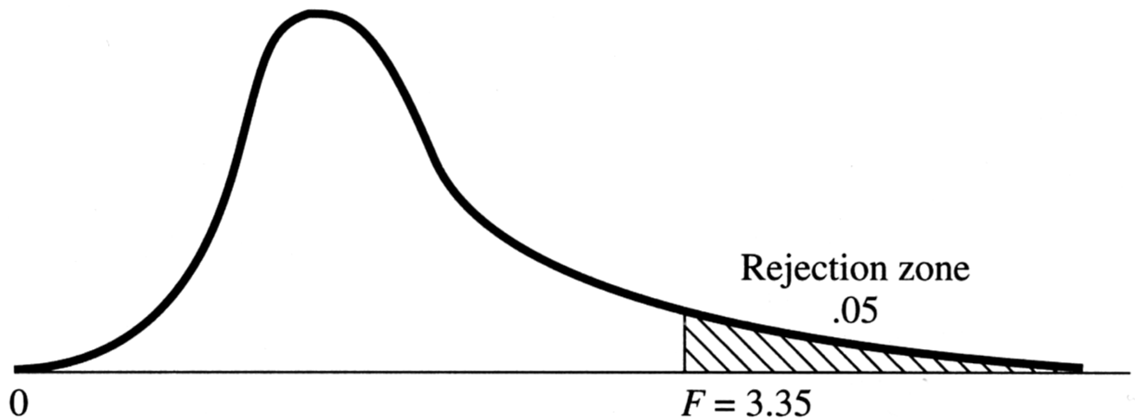
Interpretation



From Explaining Psychological Statistic (Cohen)

$$F = \frac{\text{treatment effect} + \text{error variance}}{\text{error variance}}$$

F distribution



From Explaining Psychological Statistic (Cohen)

Other way to computer *F*

$$F = \frac{MS_{bg}}{MS_{wg}}, \quad \text{with} \begin{cases} MS_{bg} = \dfrac{SS_{bg}}{df_{bg}}, \quad SS_{bg} = \displaystyle\sum_{j=1}^{k} \frac{T_j^2}{n_j} - \frac{T^2}{N} \\ MS_{wg} = \dfrac{SS_{wg}}{df_{wg}}, \quad SS_{wg} = \displaystyle\sum X^2 - \sum_{j=1}^{k} \frac{T_j^2}{n_j} \\ df_{bg} = k - 1 \\ df_{bw} = N - k \end{cases}$$

ANOVA assumptions

- Independent Random Sampling
- Normal Distributions
- Homogeneity of variance

ANOVA example

Reading for next class

- Quantitative analysis of scrolling techniques (Hinckley et al. CHI'02)
- Handout