Results

One-way subject design

Your decision	Reality: Population — No difference: H_0 is true	Reality: Population — Difference: H_1 is true
Sample — Difference	Type I Error: **Liberal**	No error
Sample — No difference	No error	Type II error: **Conservative**

Variability due to:

Signal: Treatment (IV)

Noise: "Chance": Individual Differences

Or repeated measures effect

(Interaction Subjects X I.V.)

t test

t ratio = (Signal & Noise) / Noise

critical t value

— sampling distribution

F test ($F=t^2$)

F ratio = (Signal & noise) / Noise

critical F value

— sampling distribution

Probability? / chance?

Between subject design

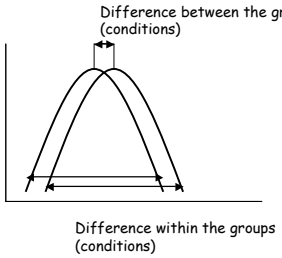
Individual differences

Within subject design

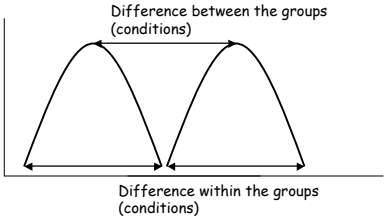
Repeated measures:

Interaction participants X IV

Is there a significant difference?



Is there a significant difference?



Hypotheses

Evaluated by statistical tests

H_0 ⇨ **Null Hypothesis**

No "difference" between Gr. A and B

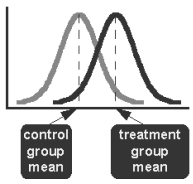
H_1 ⇨ **Alternate Hypothesis**

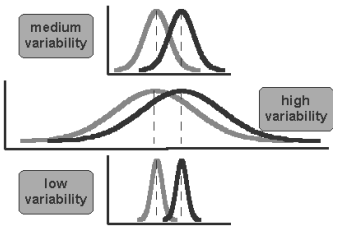
Difference between groups

- In one specific direction: → *One-tailed test*

  Gr. A > Gr. B or Gr. A < Gr. B
- In any direction → *Two-tailed test*

t test: comparing 2 groups





t test

$$\frac{\text{signal}}{\text{noise}} = \frac{\text{difference between group means}}{\text{variability of groups}}$$

$$= \frac{\bar{X}_T - \bar{X}_C}{SE(\bar{X}_T - \bar{X}_C)}$$

$$= \text{t-value}$$

$$SE(\bar{X}_T - \bar{X}_C) = \sqrt{\frac{var_1}{(n_1 - 1)} + \frac{var_2}{(n_2 - 1)}}$$

Standard Deviation

$$\sqrt{\frac{\Sigma(X - \bar{X})^2}{(n - 1)}}$$

where:

- X = each score
- $\bar{X}$ = the mean or average
- n = the number of values
- Σ means we sum across the values

$$t = \frac{\bar{X}_T - \bar{X}_C}{\sqrt{\frac{var_1}{(n_1 - 1)} + \frac{var_2}{(n_2 - 1)}}}$$

Variability due to:

Signal: Treatment (IV)

Noise: "Chance": Individual Differences

Or repeated measures effect

(interaction Subjects X IV)

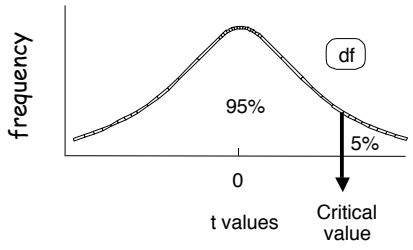
t test

t ratio = (Signal & Noise) / Noise

critical t value

— sampling distribution

t values from sampling distribution



Variability due to:

Signal: Treatment (IV)

Noise: "Chance": Individual Differences

Or repeated measures effect

(interaction subjects X IV)

t test

t ratio = (Signal & Noise) / Noise

critical t value

— sampling distribution

F test

F ratio = (Signal & noise) / Noise

critical F value

— sampling distribution

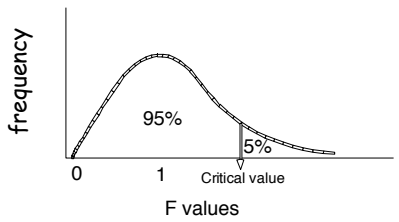
F test: a ratio of variance

Variance between groups (conditions)

$$F = \frac{s_1^2}{s_2^2}$$

Variance within groups (conditions)

F values from sampling distribution



Analysis of Variance

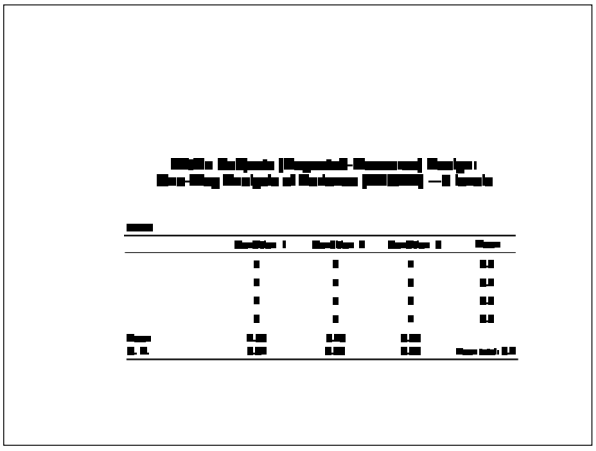
Equivalent to t test **(t^2=F)**

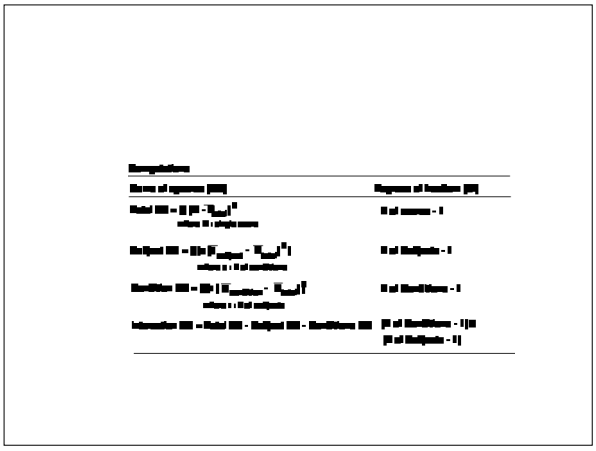
Assumptions
underlying the use of t test & F test

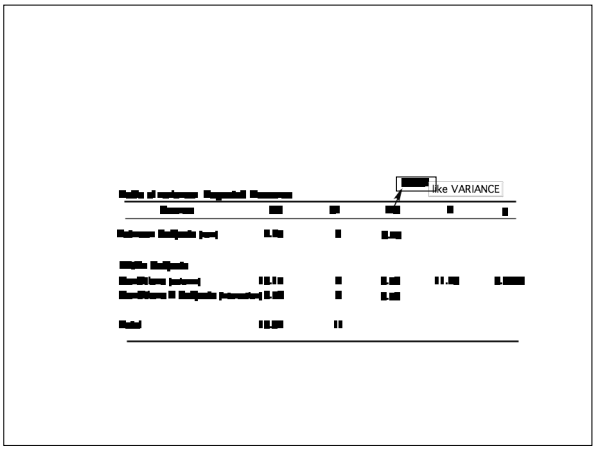
- Errors are independent
- Errors are identically distributed
  (homogeneity of variance)
- Errors are normally distributed

[redacted]

[redacted]






like VARIANCE