

Analysis of Variance (ANOVA)

Essentials of Statistics for the Behavioral Sciences

Eighth Edition by Frederick J. Gravetter and Larry B. Wallnau

Intro to ANOVA

- **Analysis of variance**
 - Used to evaluate mean differences between two or more treatments
 - Uses sample data as basis for drawing general conclusions about populations
- **Clear advantage over a t test:** it can be used to compare more than two treatments at the same time

Terms in ANOVA

- **Factor:** The independent (or quasi-independent – related to personal attributes such as age, gender, personal traits) variable that designates the groups being compared.
- **Level:** The individual conditions or values that make up a factor are called the levels of the factor.
- **Factorial design:** A study that combines two factors.



Statistical Hypotheses

$$H_0: \mu_1 = \mu_2 = \mu_3$$

The population means for the three conditions are all the same. In general, H_0 states that there is no treatment effect.

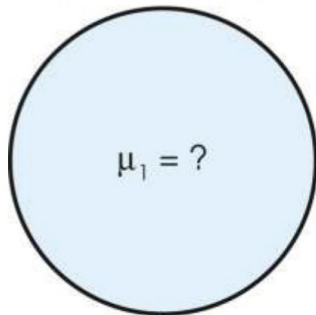
H_1 : There is at least one mean difference among the populations.

The treatment conditions are not all the same; that is, there is a real treatment effect.



Typical Situation for Using ANOVA

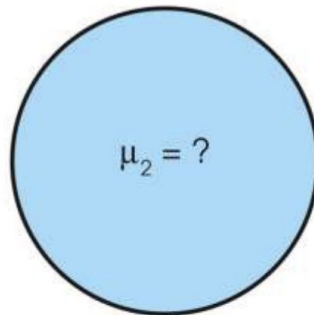
Population 1
(Treatment 1)



Sample 1

$n = 15$
 $M = 23.1$
 $SS = 114$

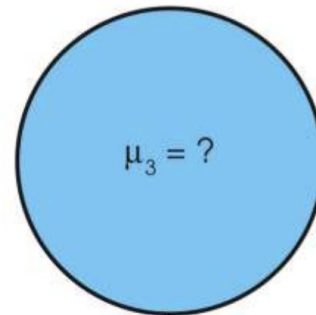
Population 2
(Treatment 2)



Sample 2

$n = 15$
 $M = 28.5$
 $SS = 130$

Population 3
(Treatment 3)



Sample 3

$n = 15$
 $M = 20.8$
 $SS = 101$

Test Statistic for ANOVA

$$F = \frac{\text{variance (differences) between sample means}}{\text{variance (differences) expected with no treatment effect}}$$



Test Statistic for ANOVA

Between-treatments variance

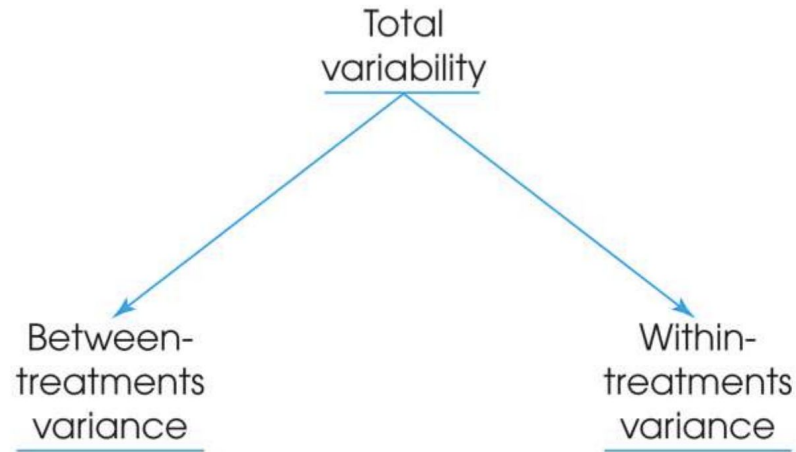


$$F = \frac{\text{differences including any treatment effects}}{\text{differences with no treatment effects}}$$



Within-treatments variance





Measures differences
caused by

1. Systematic treatment effects
2. Random, unsystematic factors

Measures differences
caused by

1. Random, unsystematic factors





Exercise



Calculating Effect Size & Post Hoc Test



Thank You