

MANOVA & MANCOVA.

1. Introduction.

The term **MANOVA** comes from Multiple Analysis Of Variance, and refers to a well established technique for comparing multivariate population means of several groups. This is done by essentially comparing the variance-covariance between variables to test the statistical significance of the mean differences. As opposed to ANOVA, MANOVA is used when there are two or more dependent variables and is used to; explore the effect independent variable(s) have the dependent variables, ascertain if there are any interactions among the dependent variables and among independent variables.

1.1. Assumptions.

- linear relationships among all pairs of dependent variables and all pairs of covariates.
- equality of error variances and covariances.
- normally distributed errors.

2. Types of MANOVA.

The three basic variations of MANOVA are:

- **Hotelling's T**: The analogue of the two group t-test situation i.e, one dichotomous independent variable, and multiple dependent variables.
- **One-Way MANOVA**: The analogue of the one-way ANOVA; i.e. one multi-level nominal independent variable, and multiple dependent variables.
- **Factorial MANOVA**: The analogue of the factorial ANOVA design i.e., multiple nominal independent variables, and multiple dependent variables.

2.1. **Examples of use.** We could use a one-way MANOVA to understand whether there were differences in the perceptions of attractiveness and intelligence of Statistics Postgraduates in St Andrews - the two **dependent** variables are "*perceptions of attractiveness*" and "*perceptions of intelligence*", whilst the **independent** variable is "Statistics Postgraduates in St Andrews", which has (*say*)three **independent** groups: "*Purely Statistics*", "*Part Statistics*" and "*Non Statistics*".

As in the case of a one-way ANOVA the one-way MANOVA cannot tell you which specific groups were significantly different from each other; it only tells you that at least two groups were different. As you are likely to have three, four, five plus groups in your study design, determining which of these groups differ from each other is important. This can be done using post-hoc analysis, as is done when using ANOVA's.

3. MANCOVA.

Multivariate analysis of covariance (MANCOVA) is an extension of analysis of covariance (ANCOVA) methods to cover cases where there is more than one dependent variable and where the control of the continuous independent variables is required.