

## Contrasts

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{A contrast is a linear functional of the sample. Contrasts are a central notion of ANOVA. They are more closely related to the research hypothesis rather than the statistical hypothesis.

{A contrast between the means is a functional of the means:

{Thus, a contrast is a function  $c : \mathbb{R}^t \rightarrow \mathbb{R}$ , where  $t$  is the number of groups. More precisely:

$$c(X) = \sum_{j=1}^t c_j \cdot \mu_j$$

where  $\mu_j$  is the  $j$ -th treatment mean. Additionally, we require that  $\sum_{j=1}^t c_j = 0$ . Thus, the total mean  $\mu = \bar{x}_{..}$  is not a contrast. Moreover, all contrasts are orthogonal to the mean. Hence, under the assumption of normality, contrasts are independent from the total mean.