

# Relative Efficiency of Experimental Designs

<http://marekrychlik.com/node/17>

Relative efficiency is used to compare different experimental designs with respect to the reduction of experimental error. Often, the completely randomized design is used as basis for comparison. Two designs may achieve the same size of the experimental error by varying the number of replications. A numerical measure of two experimental design was proposed by Fisher and it uses the concept of information. The amount of information about the true difference between two means given by an estimated difference between two means can be calculated from the formula:

$$I = \frac{f + 1}{f + 3} \cdot \frac{1}{s^2}$$

where  $s^2$  is the estimated experimental error variance with  $f$  degrees of freedom. If  $\sigma^2$  is known then

$$I = \frac{1}{\sigma^2}$$

The relative efficiency of two designs with information values  $I_1$  and  $I_2$  is simply the ratio:

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$$RE = \frac{I_1}{I_2}.$$