

Calculations for Variance Components of 2-Factor Crossed ANOVA Designs

In each case:

a = number of levels of Factor A

b = number of levels of Factor B

n = number of replicates per treatment level

A. Pure Model II

Variance Components:

$$S_e^2 = MS_e$$

$$S_A^2 = \frac{MS_A - MS_{A*B}}{bn}$$

$$S_B^2 = \frac{MS_B - MS_{A*B}}{an}$$

$$S_{A*B}^2 = \frac{MS_{A*B} - MS_e}{n}$$

$$\text{Total} = S_e^2 + S_{A*B}^2 + S_A^2 + S_B^2$$

Percent Variance Explained:

$$\text{Factor A: } \frac{S_A^2}{\text{Total}} \times 100\%$$

$$\text{Factor B: } \frac{S_B^2}{\text{Total}} \times 100\%$$

$$\text{Interaction: } \frac{S_{A*B}^2}{\text{Total}} \times 100\%$$

$$\text{Error: } \frac{S_e^2}{\text{Total}} \times 100\%$$

B. Mixed Model: Factor A Random and Factor B Fixed

Variance Components:

Note that only three variance components can be estimated.

$$S_e^2 = MS_e$$

$$S_A^2 = \frac{MS_A - MS_e}{bn}$$

$$S_{A*B}^2 = \frac{MS_{A*B} - MS_e}{n}$$

$$\text{Total} = S_e^2 + S_{A*B}^2 + S_A^2$$

Percent Variance Explained:

$$\text{Factor A: } \frac{S_A^2}{\text{Total}} \times 100\%$$

$$\text{Interaction: } \frac{S_{A*B}^2}{\text{Total}} \times 100\%$$

$$\text{Error: } \frac{S_e^2}{\text{Total}} \times 100\%$$

In the case of a mixed model where Factor A is fixed and Factor B is random, simply make the appropriate substitutions in the above formulae.