

## 12.2.1: Repeated Measures ANOVA Sum of Squares Formulas

In a Repeated Measures ANOVA, you don't calculate the Within-Groups (Error) Sum of Squares from a formula. Instead, you calculate the Within-Groups (Error) Sum of Squares by calculating the other Sums of Squares, then subtracting the Between Groups SS and Participants SS from the Total Ss. Unfortunately, that means that there's no computational check. ☹️

But in better news, that also means that you already know two of the three Sum of Squares formulas! (Well, three of the four formulas if you can the subtraction one...)

### Sum of Squares Refresher

#### Between Groups Sum of Squares

$$SS_B = \sum_{EachGroup} \left[ \left( \bar{X}_{group} - \bar{X}_T \right)^2 * (n_{group}) \right]$$

1. Subtract
2. Square
3. Multiply
4. Sum

#### Within Groups Sum of Squares

A refresher from a page ago!

$$SS_{WG} = SS_T - SS_{BG} - S_P$$

1. Calculate
2. Subtract

#### Total Sum of Squares

$$SS_T = \sum \left[ \left( X - \bar{X}_T \right)^2 \right]$$

1. Subtract
2. Square
3. Sum

### New Sum of Squares Formula: Participants

The newest formula has similarities to the prior sums of squares:

$$SS_P = \left[ \sum \frac{((\sum X_P)^2)}{k} \right] - \frac{((\sum X)^2)}{N}$$

In which  $\sum X_P$  means that you sum all of the scores for that particular participant. For example, if you had the average album sales for three participants (Ariana, Beyonce, and Carli) at three different times periods (pre-pandemic, pandemic, post-pandemic), you would add up all of Ariana's scores for all three time periods, square them, then divide by the number of time periods (3). Then, do the same thing for the other participants. You can see how this is a mean for each individual person. The big sigma at the beginning is tell you to add all of these individual participants' averages together.

What is being subtracted from the sum of each participants' average score is the basic sum of squares average for all of the scores. You add up all of the scores, square them, then divide by the number of scores. Easy-peasy!

1. Individual participants:
  1. Add
  2. Square
  3. Divide
2. Add all of the participants' means together.

3. Subtract the sum of squares for every score:

1. Add
2. Square
3. Divide

We will practice this later on mindset data. For now, let's just leave this here for now, and practice with the RM ANOVA Summary Table without these pesky Sum of Squares formulas!

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