

## Topic 10: Two-way factorial ANOVA

- Understand the terminology associated with factorial ANOVA

**Factorial ANOVA** refers to the use of multiple factors. It compares scores on a dependent variable across different groups, and uses different independent variables. For example, we may try to determine if scores on a happiness (DV) scale differ based on age (IV), and gender (IV).

**Factor** refers to an independent variable, for example, gender, or score on a scale, and **levels** refer to different rankings in an IV (for example, if age is the IV, the three 'levels' might be classed as young, middle-aged, and old; gender has two 'levels': male and female). In such an instance, the analysis could be called a 3 x 2 factorial ANOVA, because one ANOVA had three levels, and the other had two. It is more generally referred to as a **two-way** ANOVA, however, seeing as there are two factors in the design.

- Distinguish between main effects and interactions

With a two-way ANOVA, there are three possible effects: the **main effect** (the overall effect of one IV, not considering the other. Seeing as there are 2 IVs, there are 2 possible main effects). An **interaction effect** is when the effect of one factor on the DV is not the same at all levels of the other, for example, the effect of age on happiness might differ for males and females (age and gender are IVs; happiness is DV).

- Calculate a two-way ANOVA

Using the example of a researching investigating whether alcohol use is influenced by anxiety:

There are two factors with two levels (gender: male and female; anxiety: high and low). The DV is the number of alcohol drinks per week. This is a 2 x 2 ANOVA.

Calculate the Sums of Squares, use the *df* values to obtain Mean Squares, and then calculate F values for all three effects. Seeing as we have 2 variables, we need to calculate a Sums of Squares for each variable, AND the interaction.

- Step 1: Sums of Squares
  - $SS_{total}$ ,  $SS_A$ ,  $SS_B$ ,  $SS_{AB}$ ,  $SS_{error}$
- Step 2: degrees of freedom
  - $df_{total}$ ,  $df_A$ ,  $df_B$ ,  $df_{AB}$ ,  $df_{error}$
- Step 3: Mean squares
  - $MS_A$ ,  $MS_B$ ,  $MS_{AB}$ ,  $MS_{error}$
- Step 4: F values
  - $F_A$ ,  $F_B$ ,  $F_{AB}$

- Complete an ANOVA summary table for a two-way ANOVA

	<i>df</i>	Sum of Squares (SS)	Mean Squares (MS)	F	p
A (Gender)	1	0.34	0.34	0.34	
B (Anxiety)	1	12	12	12	
AB (interaction)	1	16.3	16.3	16.3	
Error	8	8	1		
Total	11	36.6			