



SPSS: MIXED ANOVA

THREE-WAY MIXED DESIGN ANOVA



THREE-WAY MIXED ANOVA

- Mixed design = between-subjects variable(s) and within-subjects variable(s)
- *Three IV's, each with **two or more** levels*

THINGS TO REMEMBER

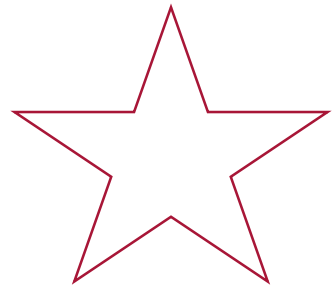
- Three-way ANOVA is used when you have **three IV's**, and each IV will contain two or more levels.
- Parametric test – relies on a number of assumptions relating to data
- A three-way ANOVA tests whether there are **interaction effects** between combinations of two and three IV's, as well as the **main effect** of each IV in isolation.
 - A significant interaction ($p < .05$) informs us whether the effect of one of our IVs on the DV is the same for all levels of your other IV – and vice versa
 - Significant interaction = simple main effects!!

ASSUMPTIONS AND REQUIREMENTS FOR DATA

1. The DV should be measured on a continuous scale – interval or ratio
2. The three IV's should each have two or more categorical, independent levels
3. Independence of observations:
 - a) Each measurement should be a distinct and independent entity
4. No significant outliers!
5. Normality: approximately normal distribution for each combination of the groups of the three IV's
6.
 - a) **Levene's Test (as with between-subjects ANOVA)** ($p > .05$)
 - b) **Mauchly's Test of Sphericity (as with within-subjects ANOVA)** ($p > .05$)
 - c) **Box's Test of Equality of Covariance Matrices (additional)** ($p > .001$)

STUDY EXAMPLE

- Exploring the effects of gender and subject of study on end of year grades across three years of a degree
- NOTE: we need...
 - Three **categorical** IV's:
 1. Gender (Male OR female) [between-subjects]
 2. Subject of study (Psychology OR Art) [between-subjects]
 3. Year of study (1, 2 AND 3) [within-subjects]
 - One **continuous** DV: end of year grades



RESULTS

$$F(df1, df2) = F\text{-value}, p < / > .05$$

Remember that you will have SEVEN of these!
One for the three-way interaction effect, three for each combination of two-way interactions, and three for each of the main effects.

RESULTS

Three-way interaction: $F(2, 32) = .40, p > .05 (= .68), \eta^2 = .02$

*Two-way interaction (gender*subject): $F(1, 16) = .15, p > .05 (= .71), \eta^2 = .009$*

*Two-way interaction (gender*year): $F(2, 32) = .21, p > .05 (= .81), \eta^2 = .01$*

*Two-way interaction (subject*year): $F(2, 32) = .21, p > .05 (= .81), \eta^2 = .01$*

Main effect of gender: $F(1, 16) = .04, p > .05 (= .85), \eta^2 = .002$

Main effect of subject: $F(1, 16) = 13.25, p = .002, \eta^2 = .45$

Main effect of year: $F(2, 32) = 17.02, p < .001 (= .), \eta^2 = .52$



INTERPRETING RESULTS

1. Interpret the three-way interaction first, followed by the two-way interactions and then the main effects
 - a) If any significant interaction effects, then caution needed with the interpretation of the main effects and simple main effects should be analysed.
2. If there are any significant main effects, ensure you use the descriptive statistics to provide information on the direction of the difference. If there is a significant main effect of your 3-level IV, then you need to assess additional comparisons

INTERPRETING RESULTS

A 2 x 2 x 3 mixed design ANOVA was conducted to explore the effect of gender (male/female), subject of study (psychology/art) and year of study (year 1/year 2/year 3) on end of year grades. The three-way interaction between gender, subject of study and year was non-significant, $F(2, 32) = .40$, $p = .68$, $\eta^2 = .02$. The two-way interactions between subject of study and gender ($F(1, 16) = .15$, $p = .71$, $\eta^2 = .009$), subject of study and year ($F(2, 32) = .21$, $p = .81$, $\eta^2 = .01$), and gender and year ($F(2, 32) = .21$, $p = .81$, $\eta^2 = .01$) also did not reach statistical significance.

INTERPRETING RESULTS

The main effect of gender was non-significant ($F(1, 16) = .04, p = .85, \eta^2 = .002$) indicating that there was no difference in overall grades between males and females. The main effect of subject of study was significant, $F(2, 32) = 13.25, p = .002$, and had a large effect size (partial eta squared = .45). This finding specifies that average end of year grades were significantly higher for students studying psychology ($M = 69.10$) than those studying art ($M = 54.43$). The main effect for year of study was also significant, $F(2, 32) = 17.02, p < .001$, indicating that there is a difference in end of year scores in accordance with the year that students were studying in.



Because this is significant, we need to assess multiple comparisons!



MULTIPLE COMPARISONS

If the main effect of your 3-level IV is significant, the information in the pairwise comparisons table (within-subjects IV) will allow us to determine where the significant difference lies across the three groups. If needed, you should report these with the associated mean scores (where necessary) and Sig. values.

INTERPRETING RESULTS

- Pairwise comparisons show that there was a significant difference between end of year grades at year 1 ($M = 59.65$, $SD = 11.79$) and year 3 ($M = 64.25$, $SD = 11.38$; $p < .001$), and between grades at the end of years 2 and 3 ($M = 61.40$, $SD = 10.95$; $M = 64.25$, $SD = 11.38$ respectively; $p = .008$).

Full results section for this analysis is available on Moodle for your full reference!