Exercise 7

Mixed-factorial ANOVA

Researchers at the Institut für Germanistik at the University of Oldenburg investigate the pronunciation of the /u/ in three different Saterfrisian words. F2 values are measured (they represent actually the front-back dimension in the mouth cavity). For each vowel F2 values are measured at three points: namely 20%, 50% and 80%. Are there differences between the three time points, and are the F2 values of the vowels in the three words significantly different?

Download the table three.sav from: http://www.let.rug.nl/~heeringa/statistics/stat03_2013/ and load the table in SPSS.

1. Give boxplots for each time point. What do the plots tell you?

2. Calculate the average F2 for each vowel.

3. Show boxplots for each of the three types of vowels (recorded in three different words). What would you expect?

4. We have three vowel types and three F2 measurements per vowel. Therefore, we have 9 groups. Check the normality by means of normal quantile plots and the Shapiro-Wilk test.

5. Perform the Mixed-factorial ANOVA test. 'Vowel' is the between-groups factor, and 'Formants' is the within-groups factor. Carry out the Levene's test, the Mauchly's test, and perform multiple (or pairwise) comparisons for 'Vowel' and 'Formant' with the Bonferroni correction. Create also an interaction plot Vowel × Formant, where the horizontal axis represents the formants, and each line represents one of the three vowel types.

6. Examine the results of the Levene's test. Do the 9 groups have same variances?

7. Examine the results of Mauchly's test. May we assume homogeneity of variances of pairwise differences between levels of the within-subjects factor 'Formant'?

8. Do you find a main effect over time in the formant measurements? Look in the table `Tests of Within-Subject Effects'. What is the effect size?

9. Is there a significant difference between the three vowel types? Look in the table `Tests of Between-Subject Effects'. What is the effect size?

10. What does the interaction plot show?

11. Is there an interaction between 'Vowel' and 'Formant'? Look in the table `Tests of Within-Subject Effects'. Report the effect size.

12. Between which pairs of F2 time point do you find significant differences? Look under '1. Formant' in the table `Pairwise Comparisons'.

13. Between which pairs of vowel types do you find significant differences? Look under '2. Vowel' in the table `Pairwise Comparisons'.