

## EXERCISE 15

## Mixed ANOVA: two-factor experiment

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### Before you start

Readers should study Chapter 10 carefully before proceeding with this Exercise.

### Effects of ambient hue and sound on vigilance

Colour	Participant	Signal		
		Horn	Whistle	Bell
Red	1	25	18	22
	2	22	16	21
	3	26	19	26
	4	23	21	20
	5	19	18	19
	6	27	23	27
Blue	7	19	12	23
	8	21	15	19
	9	23	14	24
	10	20	16	21
	11	17	16	20
	12	21	17	19

In an experiment investigating the effect of the colour of the ambient light upon the performance of a vigilance task, participants were asked to press a button when they thought they could discern a signal against a background of random noise. The experimenter expected that the detection of different kinds of sound would differ depending on the ambient colour. Three types of signal were used: a horn, a whistle and a bell. Each signal was presented 30 times in the course of a one-hour monitoring session, during which the participant sat in a cubicle lit by either red or blue light. The dependent variable was the number of correct presses of the button. For theoretical purposes, it was necessary to use different participants for the different colour conditions. It was considered that there would be advantages in testing each individual with all three kinds of signal. In this experiment, therefore, the factor of Colour was between subjects; whereas the other factor, Signal, was within subjects.

The results are shown in Table 1.

## Preparing the SPSS data set

Rearrange the data of Table 1 into a form suitable for entry into SPSS. In **Variable View**, after naming a variable *Case*, you will need to have a grouping variable *Colour* and three variables for the scores: *Horn*, *Whistle*, and *Bell*. The last three variables will be the three levels of the within-subjects factor *Signal*, which is not defined until the ANOVA command is actually being run. Follow the procedure described in Section 10.2.1. Save the data with a suitable file name.

## Exploring the data set

Draw boxplots as described in Section 10.2.2.

- **What do the plots tell us about the distributions? (Comment on the position of the median bar in the box.)**
- **Are there any markedly deviant scores, as shown by \* or O?**

## Running the two-factor mixed ANOVA

Run the ANOVA as described in Section 10.2.3, remembering to request **Descriptive Statistics**, a **Profile Plot** and **Bonferroni Pairwise Comparisons** for the factor *Signal* (see Chapter 9, Figure 11 for details of how to request **Bonferroni pairwise comparisons**). Name the **Measure Name** as *Recognition* in the **Define Factors** dialog box. Click the check boxes for **Descriptive statistics** and for **Estimates of effect size** in the **Options** dialog box.

## Output for the two-factor mixed ANOVA

When answering the bullet point relating to effect size, use the following ranges of partial eta squared ( $\eta_p^2$ ) for deciding whether its value is Small, Medium or Large: Small:  $.01 \leq \eta_p^2 < .06$ ; Medium:  $.06 \leq \eta_p^2 < .14$ ; Large:  $\eta_p^2 \geq .14$ . Note that these are the ranges of values given for omega squared in Table 5 on page 236. While omega squared corrects for positive bias, there are problems with that statistic in experiments of mixed factorial design and we must use eta squared as an equivalent measure of effect size.

The main features of the output are explained in Section 10.2.4. After tables listing the **Within-Subjects Factors** and **Between-Subjects Factors**, look at the table of **Descriptive Statistics** and the **Profile Plot**.

- **Can you discern any pattern in the means for each level of colour across the three signals?**

The next table, **Multivariate Tests**, can be deleted by highlighting its icon in the left-hand pane of **SPSS Viewer** and pressing the **Delete** key. Next, comes the table showing the results of **Mauchly's Test of Sphericity**, followed by the **Tests of Within-Subjects Effects**. If the Mauchly's Test is not significant, read the rows labelled **Sphericity Assumed** and delete the conservative test rows by double-clicking anywhere in the table, highlighting the material to be deleted and then pressing the **Delete** key. Delete the **Tests of Within-Subjects Contrasts** table.

- **For the Signal factor, write down the value of *F* and its associated *p*-value. Do the same with the interaction between Signal and Colour. What is the value of Partial Eta Squared and can it be described as a small, medium or large effect?**

- Next there is a table of Tests of Between-Subjects Effects. For the Colour factor, write down the value of  $F$  and its associated p-value. What is the value of Partial Eta Squared and can it be described as a small, medium or large effect?
- Does the profile plot show a pattern consistent with the results of the ANOVA?
- Has the experimenter's hypothesis been confirmed?

### **Finishing the session**

Close down SPSS and any other windows before logging out.