Introduction

The three-way repeated measures ANOVA is used to determine if there is a statistically significant interaction effect between three within-subjects factors on a continuous dependent variable (i.e., if a three-way interaction exists). As such, it extends the two-way repeated measures ANOVA, which is used to determine if such an interaction exists between just two within-subjects factors (i.e., rather than three within-subjects factors).

> **Note:** It is quite common for "within-subjects factors" to be called "independent variables", but we will continue to refer to them as "within-subjects factors" (or simply "factors") in this guide. Furthermore, it is worth noting that the three-way repeated measures ANOVA is also referred to more generally as a "factorial repeated measures ANOVA" or more specifically as a "three-way within-subjects ANOVA".

A three-way repeated measures ANOVA can be used in a number of situations. For example, you might be interested in the effect of two different types of ski goggle (i.e., blue-tinted or gold-tinted ski goggles) for improving ski performance (i.e., time to complete a ski run). However, you are concerned that the effect of the different lens colours on ski performance might be different depending on the snow condition (i.e., whether there has been recent snow fall or not), as well as whether it is overcast or sunny (i.e., current weather conditions). Indeed, you suspect that the effect of the type of lens colour on ski performance will depend on both the snow conditions and the current weather conditions. As such, you want to determine if a three-way interaction effect exists between lens colour, snow conditions and the current weather conditions (i.e., the three within-subjects factors) in explaining ski performance. A three-way repeated measures ANOVA can be used to examine whether such a three-way interaction exists.

If you know little about the three-way repeated measures ANOVA, you are most likely to benefit from reading about its main characteristics and basic requirements on page 3. However, if you already understand the main characteristics of the three-way repeated measures ANOVA, we would suggest starting with the example we use throughout this guide (the Example & Data Setup section on page 4). This also includes an SPSS Statistics data file you can download so that you can work through the example used in this guide (e.g., if you want to practice before carrying out the three-way repeated measures ANOVA on your own data). This leads on to the data setup process in SPSS Statistics, which we also cover on page 4.

If you have already set up your data correctly, you can jump to the Assumptions I section starting on page 5, where we explain the five assumptions of the three-way repeated measures ANOVA, including tests for two of the three assumptions you can carry out using SPSS Statistics: (a) testing for outliers using boxplots; and (b) testing for normality using the Shapiro-Wilk test of normality. You will discover that a lot of the time you spend analysing your data using a three-way repeated measures ANOVA is dedicated not only to determining whether your data meets or violates these assumptions, but making decisions about how to proceed if any of these assumptions are violated. Therefore, on page 6, the procedure to detect outliers and normality is set out, before we show you how to interpret the SPSS Statistics output from testing these two assumptions, as well as explaining how to deal with violations of these assumptions (pages 6 and 10).

After you have tested your data to check you can analyse it using a three-way repeated measures ANOVA, we guide you through the SPSS Statistics procedure required to carry out the three-way repeated measures ANOVA in the Procedure section on page 11. This also includes the procedure to run Mauchly's test of sphericity to test the assumption of sphericity, which we show you how to interpret in the Assumption II section on page 12.

When you reach the Interpreting Results section (pages 13 to 20), you'll be in a position to start interpreting your results. How far you need to work through this section will depend on your results since there are many potential follow-up tests that can be run if you have a statistically significant three-way interaction. Possible tests that you will need to consider include simple two-way interactions, simple simple main effects and simple simple comparisons (or possibly just two-way

interactions). Each of these tests require further procedures using SPSS Statistics, so we show you how to carry these out, as well as how to interpret and report the results, throughout this section. Finally, in the Reporting section on page 21 we show you how you can bring this all together into a single paragraph that explains your results.

If you get lost as you work through the guide, there is a Table of Contents on the next page, or simply use the article menu above to navigate to the different sections within the guide. Also, if you want to reference this guide or view the reference list, see the Referencingsection. Finally, we're constantly working to improve the content in the site, so if you find anything in the guide unclear or if there is anything else you would like to see covered, please contact us at support@laerd.com. We may be able to add a note or new section to the guide to make things clearer.