

11.1: Introduction to Repeated-Measures ANOVA

The **repeated-measures ANOVA** is used when you want to test whether the means of a single group are significantly different when measured at different exposures to the independent variable or waves of testing. A wave refers to a time point, usually connected to some kind of intervention or other change in an independent variable. Waves may also be called times, conditions, or treatments. Recall that ANOVA is short for analysis of variance because the formula examines and compares the proportions of variability attributed to different sources. If the means are distinct enough at the different waves of measurement, even after accounting for the fact that there is some variability around the mean for each wave of testing, the result will be significant.

Repeated-measures ANOVA is a bivariate technique. One variable is a qualitative grouping variable where data from a single sample are grouped based on different times, conditions, and/or exposures to the independent variable. The other is a comparison or focal quantitative variable. This quantitative variable is measured at each wave or condition using the same group of participants. The qualitative grouping variable is often referred to as a **factor**. Thus, factors refer to how the independent variables or conditions are grouped. Data from the sample in each of those conditions are compared.

Comparing ANOVAs

In repeated-measures ANOVA, the quantitative variable is measured in the same group of participants under different conditions of the qualitative variable. This is different from independent-groups ANOVA where data from different groups of participants are compared for each condition (see Chapter 10 to review independent-groups ANOVA).

There are a few reasons a repeated-measures ANOVA, and a corresponding research design, can be useful. First, repeated-measures ANOVA is similar to a dependent samples *t*-test but without the limitation of only being able to compare two groups (waves) of data (see Chapter 8 to review the dependent samples *t*-test). Second, repeating measures within a single group can reduce or eliminate cohort or pre-existing grouping effects that may occur when comparing several independent groups. Cohort and pre-existing grouping effects refer to when there are differences in the groups that may cause them to have different mean scores of the quantitative outcome variable that are not due to differences in the qualitative grouping (factor) variable. Another way of saying this is that the main issue that can arise when you put multiple, independent samples into different experimental conditions, is that you cannot always be sure whether differences observed in those groups are due to pre-existing differences in those groups or due to the different conditions they experienced as part of the study. Using the same group across conditions can be used to address this issue.

A **confound** or **confounding variable** refers to something that erroneously causes it to appear that the groups differed because of the study conditions when, in fact, the differences were not due to those conditions. When different participants are compared for each condition, pre existing differences among members of the different groups are possible confounds. To avoid this, therefore, some studies are designed to measure the same group multiple times under different conditions. These are known as a repeated-measures design studies. When the same group is being compared on the same quantitative outcome variable across three or more conditions, a repeated-measures ANOVA is the appropriate analysis. However, it should be noted that there are other possible issues with repeated-measures designs such as learning effects. The details about the benefits and limitations of research designs, however, is beyond the scope of this book so we will briefly differentiating between two aspects of research methods: 1. independent-groups designs vs. repeated-measures designs and 2. experimental vs. non-experimental designs because these have implications for how we analyze the data and whether we can make statements of cause-effect from the results of those analyses. However, further aspects of research methods are covered in detail in courses on Research Methods which are common in social and behavioral science programs.

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