Chapter 11: Repeated Measures Analysis of Variance (ANOVA)

I. Overview

a. Repeated-measures ANOVA is used when you have measures on the same variable at multiple time points. For example, measuring a sample of children's height at 5, 6, and 7 years of age.

b. Repeated-measures ANOVA normally involves one dependent variable measured on an interval scale and an independent variable of time, or trial (i.e., repeated measurements).
    i. Purpose is to determine whether scores on the dependent variable, on average, differ across the trials, or repeated measures.

c. One or more categorical independent variables can also be added to the model, creating a mixed-model ANOVA.

d. Covariates can also be included in the model.

II. Partitioning the Variance

a. Main effects of time, or trial.
    i. In the basic model, a researcher simply examines whether the average scores on the dependent variable differ across times of measurement, or trials.
        1. e.g., Does a sample of students reading test scores increase from 5^{th} to 6^{th} and to 7^{th} grade?
    ii. This is called the *within-subjects* effect.

b. Main effects of the independent group variable.
    i. If you are doing a mixed model ANOVA that includes a categorical independent variable, you can examine whether there is a main effect for the group variable.
        1. e.g., Do the reading test scores of Hispanic, Vietnamese, and Filipino immigrant students differ?
    ii. This is called the *between-subjects* effect.

c. Interaction between time and the independent group variable.
    i. With a mixed model ANOVA, you can examine whether there is an interaction between the time (or trial) variable and the categorical independent variable.
        1. E.g., Do the changes in the reading test scores of Hispanic, Vietnamese, and Filipino immigrant students from 5^{th} to 6^{th} and 6^{th} to 7^{th} grades occur at the same rates, or at different rates for different groups?
    ii. This is called the *interaction effect.*

d. Covariates
    i. Covariates can be included in the model to examine whether the main and interaction effects occur when controlling for some other variable, such as socioeconomic status.

III. Partial Effects, Simple Effects, and Effect Size

a. The partial (or controlled) effects are the same as they were for factorial ANOVA

i. Each effect in a repeated-measures ANOVA (i.e., main effects within-subjects and between-subjects, interaction effects) are all to be interpreted while controlling for all other effects in the model, including covariates.

b. Just as with factorial ANOVA, simple effects tests can determine whether differences between particular cells are statistically significant.
    i. E.g., Are the changes from 5^{th} to 6^{th} grade within the Hispanic sample statistically significant?

c. As with one-way and factorial ANOVA, effect size is measured using the eta-squared statistic.
    i. As with factorial ANOVA, the *partial* eta-squared statistic indicates the amount of variance in the dependent variable that is explained by the independent variable (or interaction or covariate) while controlling for all other effects in the model.

IV. Summary

a. Repeated-measures and mixed-model ANOVAs are very similar to factorial ANOVA discussed in Chapter 11.
    i. The main difference is that repeated-measures ANOVA introduces time, or trial, as a key independent variable.
    ii. Changes within individuals over time are examined with this method.

b. As with factorial ANOVA, in mixed-method ANOVAs researchers can examine both main effects and interaction effects.
    i. In this situation, the interaction is between a categorical independent variable and the time, or trial variable.
    ii. Allows researchers to examine whether changes within individual occur at the same rates or different rates depending on the group, or category, the individuals belong to.

c. The addition of a covariate in the ANOVA turns it into an ANCOVA and allows researchers to examine interaction and main effects while controlling for one or more additional variables.