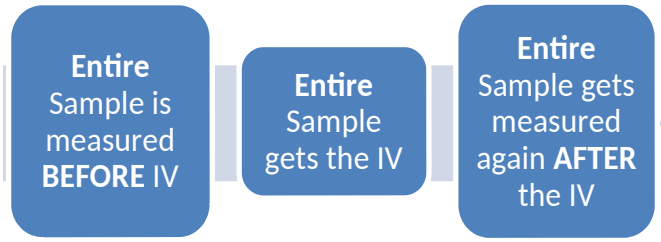
UNIT 5: Lecture 1, Part 2

Within-Subject Design and the Dependent-Measures t-test

The **within-subject research** design is also called the repeated measures design, or even the "before and after design." Unlike the between-subject design, covered in Lecture 1, Part I, of this unit, there is no random assignment in the within-subject design. The within-subject design is as follows:

Population
↓
Random Sample



(Measurement BEFORE) (Measurement AFTER)

What is happening in this design is that the researcher selects a random sample from the population. Then, rather than randomly assigning the sample to a control group and an experimental group (creating two groups with different participants), the research keeps the sample as ONE group (the sample remains together) throughout the entire process.

Let us consider a hypothesis using this design:

A researcher hypothesizes that a new antidepressant will have an effect on depression

If this were the case and the researcher wanted to use a within-subjects design, then the researcher would get a random sample of depressed people from the population of interest. The researcher would NOT randomly assign the sample to any groups. But rather the researcher would first measure every participant's level of depression, which is referred to, in the above diagram as the BEFORE measure. Then, the ENTIRE sample (everyone) would be given the antidepressant, for say, six months. After the six month period, the researcher would once again measure the level of depression in ALL the participants (the entire sample). Notice that the entire sample remains as one group, BEFORE, DURING, and AFTER the treatment as the diagram indicates above.

Importantly, notice that unlike the between-subjects design where each participant is measured only once, in the within-subject design, each participant is measured twice: before the IV and after the IV, resulting in TWO measures for each participant.

Once the researcher has the **before and after measure for each participant**, the researcher would compute a *difference score (D)* for each participant; that is, the researcher would, for each

participant, find the difference between that participant's before score and that same participant's after score. Then, the researcher would compute a mean of all the differences or D-scores, statistically represented as $\mathbf{D_m}$, and compare that difference to the difference expected "just by chance," which should remind you of the general hypothesis test formula which we previously covered a few times:

$$\textbf{ALL HYPOTHESIS TESTS} = \frac{D_m}{\textbf{Differences between means because of the IV}} = \frac{}{\textbf{Differences due to ERROR}} \frac{}{S_{md}}$$

In this case, $\mathbf{D_m}$, is the numerator of the t-test, which, again, you may remember represents the differences we believe are due to the IV, or in our hypothesis, due to the antidepressant. And we need to compare that difference to the differences we believe are there "just by chance," which is the ERROR, or denominator of all hypotheses tests, **Smd,** which is called the "estimated standard error."

When the research design is a within-subject design and the participants are measured 2 times, as is the case in that which we have discussed above, then the appropriate hypothesis test is the:

Dependent Measures t-test

The "simplified" formula, to facilitate the overall idea, is:

$$\mathbf{t} = \frac{\mathbf{D_m}}{\mathbf{S_{md}}}$$

You don't need to be concerned with all the details of the formulas because you will conduct the dependent measures t-test on SPSS. However, you should be familiar with the statistical notation and very familiar with the GENERAL structure (overall "formula") of all hypotheses tests.

RECAP

The focus here is a within-subjects design. In this design, the researcher gets a random sample from a population, but does not randomly assign the sample to groups. The sample remains together throughout the entire study. The researcher measures the DV on everyone in the sample BEFORE the IV, then everyone in the sample gets the IV, and then the researcher measures everyone in the sample AFTER the IV.

Generally speaking, the researcher then wants to know if there is a significant difference (better than chance probability) that the IV did, indeed, have an effect. In our example, the researcher wants to know if there is a significant difference between the measures of depression BEFORE the participants took the antidepressant and the measures of depression AFTER the participants

took the antidepressant. The appropriate hypothesis test for this “difference” comparison is called the DEPENDENT –MEASURES t-test (SPSS calls it the “paired samples” t-test). Please refer to the VideoLecture to learn how to conduct the 4 step hypothesis test process for the Dependent-Measures t-test.