TOPIC 40A WITHIN-SUBJECTS EXPERIMENTAL DESIGNS

In Topic 37 we were introduced to the most well-known true experimental design—the classic form, as it were—**randomized control group designs**. These designs are often referred to as **between-groups designs** because the focus is on comparison of the effects of the independent variable on the dependent variable for each group. And random assignment allows us to overcome all the major threats to internal validity.

Another form of true experimental design is the **within-subjects design** (also known as a **repeated-measures design**), where subjects are used *as their own control*. This can be shown in the following diagram:

Design 9

$X_0O \quad X_1O$

Note that we use X_0 and X_1 here to represent *two different treatments*, not a treatment versus a non-treatment control (which was design 4 on page 95: O X O). In other words, X_0 must be an actual "treatment," with its own distinct experimental procedure, not just the absence of any treatment.

For example, suppose we want to test two different methods of teaching, lectures vs. small-group discussions. Using one sample of research participants, we first give them a 45-minute prepared lecture (X_0) and measure what they learn. Then we give them a 45-minute class in which we divide them up for small-group discussions (X_1) and again measure the effects. If the learning following X_1 is greater than the learning at the end of X_0, it seems we can conclude that X_1 is superior.

The participants in Design 9 are, in effect, serving as both the "control" participants when they receive X_0 and the "experimental" participants when they receive X_1. This is a major advantage because, unlike the randomized designs, where we must *assume* that the groups are comparable, in the within-subjects design the experimental and control groups *are identical because they are the same individuals*.

Because the participants in both groups are identical, Design 9 overcomes the *selection* threat to validity we covered in Topic 39. However, it is still vulnerable to *history*, *maturation*, *testing*, and *statistical regression*. Because X_1 occurs after X_0, any changes to X_1 could occur simply because time has passed, or because of new events, or repeated testing, or extreme scores just settling back to average.

And Design 9 is also vulnerable to another similar threat to internal validity: **sequence effects**. The experience of first going through X_0 could itself influence how participants respond to X_1. But perhaps the greater improvement simply occurred because the X_0 lectures had "prepped" the subjects for the small-group discussions. This is often referred to as a **practice effect**.

Or conversely, suppose the results for X_1 were noticeably worse than for X_0. Now we might conclude that X_0 was superior. But perhaps the experience with X_0 had simply worn the students out. This is often referred to as a **fatigue effect**.

All these threats can easily be handled by **counter-balancing**.

Design 10

$R \quad X_0O \quad X_1O$
$R \quad X_1O \quad X_0O$

In this superior design, both X_0 and X_1 occur first half the time and second half the time, and this overcomes all the threats to internal validity.

Because we do not need a separate group of participants for a control group (subjects are their own control), we can conduct our experiment with fewer participants. And while counter-balancing can create more work for the experimenter, within-subject designs are very common in psychological research.