MORE ABOUT EXPERIMENTS

Unit 2: Producing Data

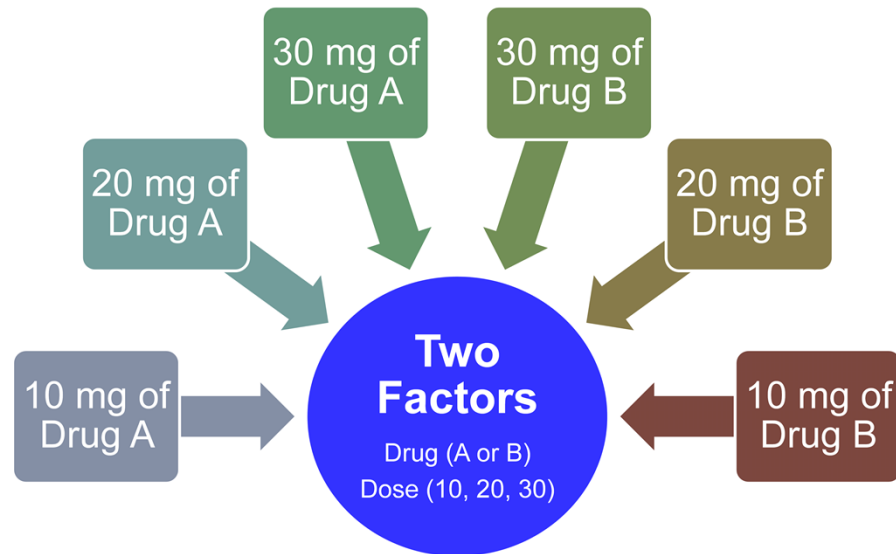UF UNIVERSITY of FLORIDA

Our goal in this section is to explain a few more concepts about experiments. Don't be concerned with the details.

We already mentioned an example with two explanatory variables or factors – the case of two drugs at three doses.

In such a case, there would be 6 total treatments – one for each combination of the two drugs and three doses.

When assigning subjects, we would need to randomly assign subjects to one of the six treatments.

In other words, we would NOT randomly assign individuals to the drug and dose separately.
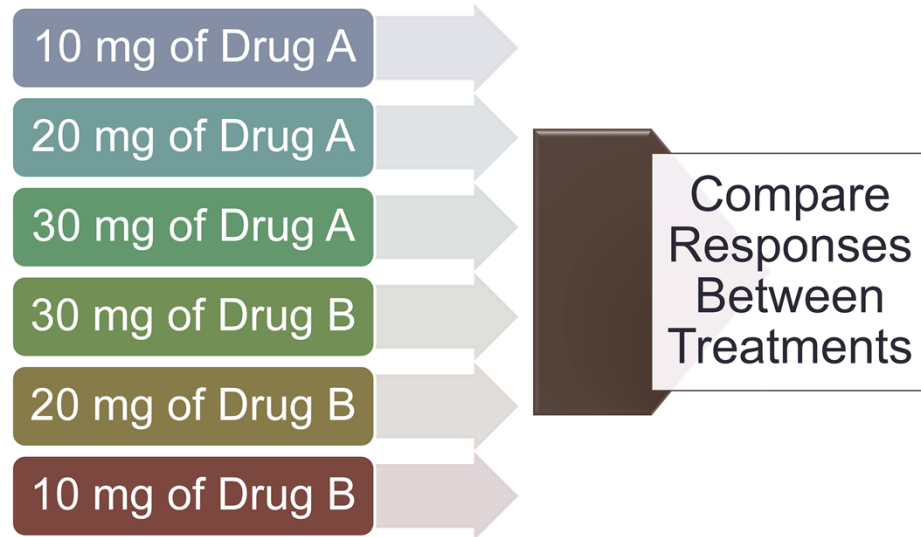
When the experiment is complete, we would compare the responses between the 6 treatments.

There are methods for investigating the effect of Drug and Dose as well as their interaction.

Although we won't discuss the concept of interaction formally in this class, I will mention here that the concept of statistical interaction (sometimes called effect modification) is important to understand if you plan to conduct formal research using statistical methods.

In general, an interaction exists if the effect of one variable – say dose – is different for the levels of the other variable – in this case, drug.
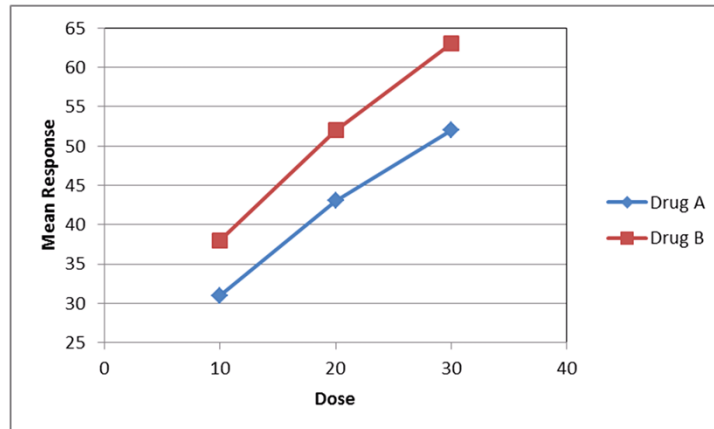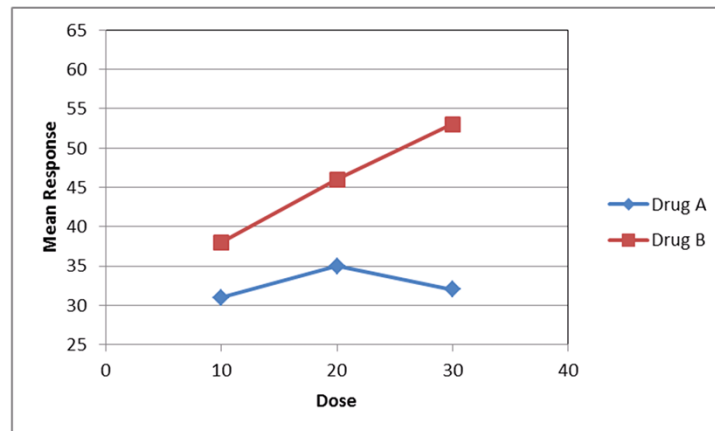
This graph displays the mean response for individuals in each treatment. Let's assume that larger values are a more favorable outcome.

In this case, Drug B is always better than Drug A by about the same amount and the higher the dose, the higher the mean response – regardless of drug.

Here, drug and dose do not interact.

In this graph, however, Drug A doesn't seem to have much effect regardless of dose but Drug B shows an increasing mean response with increasing dose.

In this case there is an interaction between drug and dose. The effect of dose is different for the two drugs.

Studying differences in the effect of one factor for levels of another factor is a primary use of two-way ANOVA. We will learn one-way ANOVA in this class and, if you go on to regression, you will learn more about interactions.
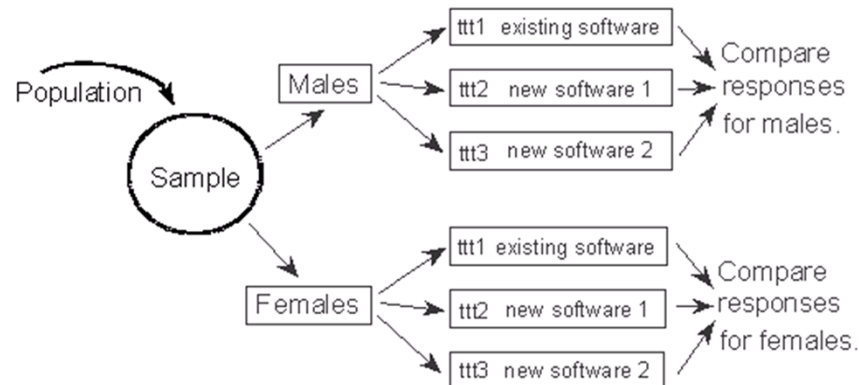
In some cases, an experiment's design may be enhanced by relaxing the requirement of total randomization and **blocking** the subjects first, dividing them into groups of individuals who are similar with respect to an outside variable that may be important in the relationship being studied.

The result of proper blocking is increased precision in our estimate of the treatment effect.

In this image, we are blocking the population by gender into males and females. We won't talk any more about general block designs but we will spend some time this semester talking about one particular block design where each individual or matched individuals form the blocks.

This is called a matched pairs design.
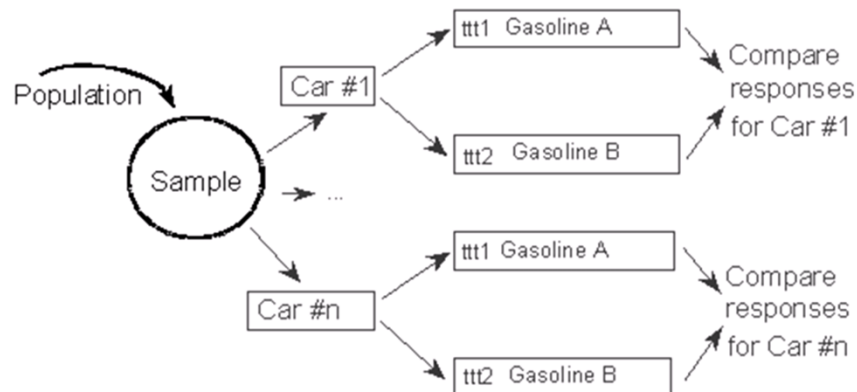
In a matched pairs design, each individual or two individuals who are similar in many important respects are used for the experiment.

If it is the same individual, then this individual receives both treatments in some reasonable manner given the scenario under study. For example, if you are studying two drugs, there may be a washout period between the two treatments and the order of the treatments may also be randomly chosen so that some subjects take Drug A first and others Drug B.

In the example on this slide, we have individual cars and each car is driving a certain number of miles using each of the two gasoline formulations under study.

Then, we compare the responses for each car and determine if overall one formulation seems superior to the other.

Before-and-after studies are also a common type of matched pairs design.

We will discuss this method later in the semester so it is important to consider and understand this situation carefully.

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Here we have introduced you to a few more complex concepts associated with experiments. There is much more to learn in this area if you ever plan to conduct an experiment yourself and entire classes exist just covering the concept of the design of experiments in ways which minimize the use of resources and maximize the chances of detecting differences of importance to the researcher.