This tutorial examines one type of experimental design called completely randomized design. In completely randomized design, the researcher's assignment of experimental units to the control and the treatment groups is, as the title suggests, completely random. Now, one advantage to this is it's very easy, and it's very quick to do.

One potential method would be taking your group of experimental units, assigning the numbers, and then having the odds be in the treatment group and the evens be in the control group. However, a disadvantage to this is you could end up with a disproportionate number of one type of people in the control group, and one type of people in the treatment group. Let's look at how that would happen.

If we're testing a new drug and we think that the drug might have different effects on men than on women, we would want to make sure that there is a fairly even number of men and women in the treatment group and in the control group. We'd hope for something that looked like this. Each of the groups of the treatment and the control has a pretty proportionate number of men and women to the original population.

However, doing completely randomized design, sometimes you don't end up with this ideal situation. It could end up looking like this. In the treatment group, there's a disproportionate number of females. In the control group, there's a disproportionate number of males.

If the drug does, in fact, affect men and women differently, we wouldn't be able to see the true effect of the treatment, because gender will be masking some of that. So while completely randomized design's quick and easy, there is the potential to get unrepresentative groups in the treatment and control, and have some confounding of variables. Other types of experimental design help to control this better. We look at those in other tutorials.

In this first example, a company's to test three kinds of fertilizer to determine which one is best. The company has enrolled the help of several farmers. We'll look at one. First let's decide if what the farmer wants to do is completely randomized or not. The farmer hears that one of the treatments, one of the fertilizers, is better.

So he wants to put the better one right here, because this is the chunk of land that's closest to his house. He sees it the most often. He wants to know how it's doing. He also thinks that one of the fertilizers is less damaging, so he wants to try that one out here, in the chunk of land that's by the river, because he wants to make sure that the river isn't damaged. And then the last treatment he

hasn't really heard anything about, so he's going to put it on the part of his land over here.

This design is very obviously not completely randomized. The farmer's exerting a lot of control about where the different treatments get put down, and in turn, he's biasing the effects. Let's look at another version where it is completely randomized.

In order to be completely randomized, the farmer has to be making no decisions at all by himself, and using random chance to make the determinations as to which treatment goes where. First he would start by overlaying a grid onto his field to divide it into areas that are of equal size. I've done this very roughly, but you can then get the idea.

He could then go through block by block to decide which treatment to give. One easy way of doing it is you could say, he has a die. Treatment A would be applied he you rolled and got a 1 or 2. Treatment B could be applied if he got a 3 or a 4. And you can probably guess this, but Treatment C would be applied if he got a 5 or a 6.

Because a dice roll is random, he has an equal chance of getting a 1 as he does a 4, so Treatment A, B, and C would each have an equal chance of getting applied to each spot. Because he's randomizing decisions about which treatment goes where, he would be doing a completely randomized design. This has been your tutorial on completely randomized design.