

## 9.4: Knowing what you want to find out

When you conduct a design with more than one IV, you get more means to look at. As a result, there are more kinds of questions that you can ask of the data. Sometimes it turns out that the questions that you can ask, are not the ones that you want to ask, or have an interest in asking. Because you ran the design with more than one IV, you have the opportunity to ask these kinds of extra questions.

What kinds of new things are we talking about? Let's keep going with our distraction effect experiment. We have the first IV where we manipulated distraction. So, we could find the overall means in spot-the difference for the distraction vs. no-distraction conditions (that's two means). The second IV was reward. We could find the overall means in spot-the-difference performance for the reward vs. no-reward conditions (that's two more means). We could do what we already did, and look at the means for each combination, that is the mean for distraction/reward, distraction/no-reward, no-distraction/reward, and no-distraction/no-reward (that's four more means, if you're counting). There's even more. We could look at the mean distraction effect (the difference between distraction and no-distraction) for the reward condition, and the mean distraction effect for the no-reward condition (that's two more). I hope you see here that there are a lot of means to look. And they are all different means. Let's look at all of them together in one graph with four panels.

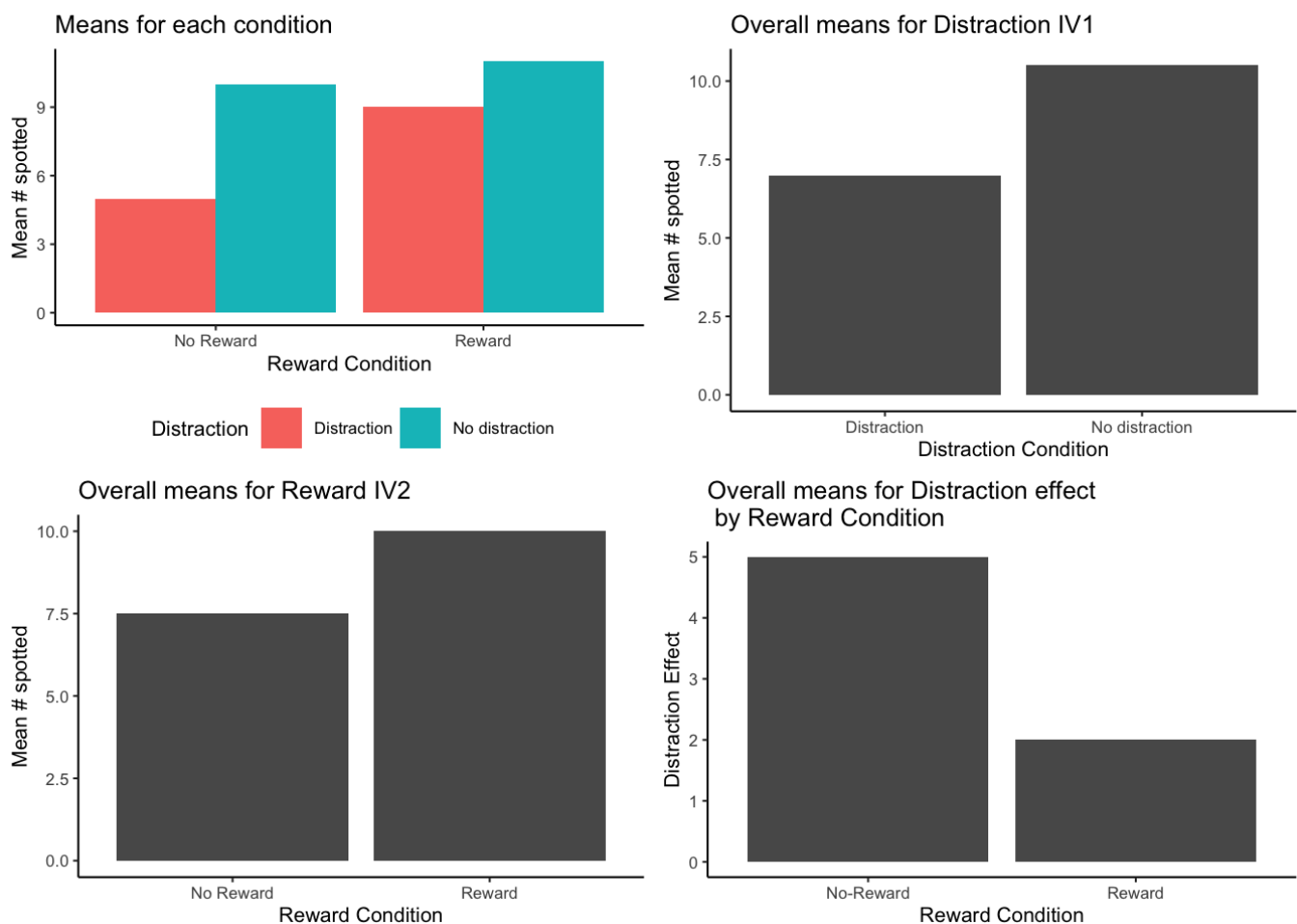


Figure 9.4.1: Each panel shows the mean for different effects in the design.

The purpose of showing all of these means is to orient you to your problem. If you conduct a 2x2 design (and this is the most simple factorial that you can conduct), you will get all of these means. You need to know what you want to know from the means. That is, you need to be able to connect the research question to the specific means you are interested in analyzing.

For example, in our example, the research question was whether reward would change the size of the distraction effect. The top left panel gives us some info about this question. We can see all of the condition means, and we can visually see that the distraction

effect was larger in the No-reward compared to the reward condition. But, to “see” this, we need to do some visual subtraction. You need to look at the difference between the red and aqua bars for each of the reward and no-reward conditions.

Does the top right panel tell us about whether reward changed the size of the distraction effect? NO, it just shows that there was an overall distraction effect (this is called the **main effect** of distraction). **Main effects** are any differences between the levels of one independent variable.

Does the bottom left panel tell us about whether reward changed the size of the distraction effect? NO! it just shows that there was an overall reward effect, called the main effect of reward. People who were rewarded spotted a few more differences than the people who weren't, but this doesn't tell us if they were any less distracted.

Finally, how about the bottom right panel. Does this tell us about whether the reward changed the size of the distraction effect? YES! Notice, the y-axis is different for this panel. The y-axis here is labelled “Distraction Effect”. You are looking at two difference scores. The distraction effect in the no-reward condition ( $10 - 5 = 5$ ), and the distraction effect in the Reward condition ( $11 - 9 = 2$ ). These two bars are different as a function of reward. So, it looks like reward did produce a difference between the distraction effects! This was the whole point of the fake study. It is these means that were most important for answering the question of the study. As a very last point, this panel contains what we call an **interaction**. We explain this in the next section.

*Pro tip: Make sure you know what you want to know from your means before you run the study, otherwise you will just have way too many means, and you won't know what they mean.*

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