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Demo: Understanding p-Values and t Ratios

In this video, we use the p-value animator to explore the relationship between the p-value and the t ratio for a one-sample t test using the file Diameter Test.jmp.

First, we conduct a one-sample t test for Diameter. To do this, we use the Distribution platform from the Analyze menu. We select Diameter as the Y, Column and click OK.

Then we select Test Mean from the red triangle for the analysis.

We'll test the null hypothesis that the mean diameter is 16.15 mm against the alternative hypothesis that the mean is not 16.15.

PValue Animation is an option under the red triangle for Test Mean. We'll select this option to run the animator.

The curve is centered at the hypothesized value, and the solid black line is drawn at the observed sample mean.

For this example, the sample mean is 16.1406, and the hypothesized mean is 16.15. The t ratio measures the difference between the sample mean and the hypothesized value.

The t ratio for this test is -1.397. The sample mean is 1.397 standard errors below the hypothesized mean.

You can use the grabber at the top of the curve to explore how the t ratio and the p-value change as you change the difference between the two means.

If we drag the hypothesized mean to the right, we increase the distance. Notice that the t ratio increases and the p-value gets smaller the further the hypothesized mean is from the sample mean.

Now, we'll drag the hypothesized value close to the sample mean. As the hypothesized mean approaches the sample mean, you can see that the t ratio approaches 0 and the p-value approaches 1.

We'll continue to drag the hypothesized value to the left, below the sample mean. Notice that the t ratio is now positive, because the sample mean is greater than the hypothesized value. As we drag the hypothesized value farther to the left, the t ratio increases and the p-value approaches zero.

This animation illustrates the essence of test statistics, like the t ratio. A test statistic measures how extreme your results are relative to the null hypothesis. If you have a large test statistic, relatively speaking, you have a lot of evidence against the null hypothesis. If you have a small test statistic, your sample results are consistent with the null hypothesis.

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