



## Independent Samples T-test

### 1. Intro and Data Setup

- a. If you've watched our video that explains the concept of an independent samples t-test, you may recall that an independent-samples t-test helps you figure out when you really do have one group of people in the data who are acting like apples, and a different group of people in the data who are acting like oranges. Or if the groups are acting like apples of different shades (and so really versions of the same thing).
- b. In this example, we are going to take a look at average Overall Rating of the Festival by binary Gender, using two groups for gender – female and male. We want to determine if females and males rated the festival very differently, acting like apples and oranges, or not so differently, acting more like apples of different shades.
- c. The Overall Rating question asked festival attendees, “How would you rate today's event overall?” Festival goers could choose an answer on a 5-point scale from Poor to Excellent. Here, Gender is the predictor variable – we want to know if Gender predicts differences in Overall Rating. Overall Rating is our outcome variable – it is the variable that we want to learn more about.
- d. The EvalFest Database for SPSS.sav file contains the data we will use to conduct the independent samples t-test. The column marked Gender contains the Gender data. The column marked OverallCode contains the Overall Festival Rating data, which has been transformed from a string, or text, variable into a numeric variable.

### 2. Conducting the independent samples t-test

- a. To conduct an independent samples t-test using SPSS, Click on Analyze, scroll down to Compare Means, and choose Independent-Samples T Test.
- b. Click on OverallCode and move it to the Test Variable(s) box. This indicates to SPSS that this is your outcome variable.
- c. Click Gender and move it to the Grouping Variable box. This lets SPSS know that this is your predictor variable.
- d. You will have to Define the Groups in your predictor variable. Click on Define Groups...
- e. Type 'Male' in the Group 1 box and 'Female' in the Group 2 box. Note that you have to use the same spelling and capitalization for each category as it appears in your database. That is, if Male is capitalized in your data, it must be capitalized here.
  - i. If your data are numeric, you would type the appropriate number in

- each box.
- ii. Note that you could switch the groups. That is, you could indicate that Females are Group 1 and Males are Group 2. The signs on the values of  $t$  and the mean difference would change, but you would get the same  $p$ -value for the independent samples  $t$ -test.
  - f. Click Continue and Click OK.
3. Interpretation of the Independent Samples T-test Output
- a. SPSS will populate the Output window with the results. SPSS provides the value of  $t$ , the degrees of freedom, and two  $p$ -values, among other things.
  - b. The  $t$ -test uses the average Festival rating for each group, and the variation in those ratings, to figure out if there are differences in the ratings of Male and Females (acting like apples and oranges), or if the Festival ratings of Males and Females are pretty similar (acting like apples of different shades).
  - c. You're most interested in the  $p$ -value, but which one? SPSS provides a  $p$ -value for the comparison of 2 groups that have approximately equal variances (or standard deviations), and a  $p$ -value for the comparison of 2 groups that have very unequal variances (or standard deviations). If you have forgotten what a standard deviation is, please revisit the Data Analysis: Exploring Your Data section of the EvalFest website.
  - d. It is helpful to compare the standard deviations of the 2 groups to determine which  $p$ -value to use. As we see here, our standard deviations are fairly similar in value, and thus we will use the  $p$ -value associated with Equal Variances Assumed. In many cases, like we see here, the two  $p$ -values are equal or very close in value. Therefore, this is often not a concern.
  - e. If you've watched the conceptual video, you may recall that the  $p$ -value is a measure of the risk you take in making a decision based on your data. If the  $p$ -value is less than .05, that means there is less than 5% chance that the results are based on something other than the data. Thinking about this another way, there is a 1 minus the  $p$ -value chance that you DO have differences in ratings between Males and Females, and they are acting like apples and oranges.
  - f. In more statistical terms, you use the  $p$ -value to determine if the mean of the outcome variable is statistically significantly different between the groups in the predictor variable.
  - g. For this scenario, we can see that our  $p$  value is .000. This is the lowest value that SPSS provides as a  $p$ -value. While the  $p$ -value is unlikely equal to 0, this is our indication that it is very small, or less than .05. That means that we have a statistically significant difference in the average festival ratings provided by female and male attendees.
  - h. Keep in mind that, just because a result is statistically significant, just because you found a  $p$ -value of less than .05, you still have to decide whether or not the result has *practical implications* for your program. Looking at the mean ratings for Males and Females, we see that Females had a higher mean rating than Males, at 4.44 vs. 4.33. This is a difference of 0.11 points on a 5-point scale, or a 2.2% difference in average rating. Is this difference meaningful for your program? Maybe, or maybe not – this is something you will have to decide.

- i. So now what? How do you think about interpreting these results? Remember that these ratings were made on a five-point scale, where 1 was Poor and 5 was Excellent. Both of our average ratings were above 4.0, and so somewhere between Very Good and Excellent on the scale. If you have statistical significance and the results are meaningful for your program, you want to think about the kinds of ratings you have overall and the group differences.
- j. So, to interpret these results, we might say something like: Ratings for the Festival were quite positive. There was a statistically significant difference in how males and females rated the event. Males rated the Festival between Very Good and Excellent, on average, with a rating of 4.33. Female ratings were also in the Very Good to Excellent range, but were statistically significantly higher, and thus even closer to the top of the scale at 4.44.
- k. The default independent samples t-test in SPSS is a two-tailed test. That is, we were looking for significant differences in either direction – females greater than males or vice versa. Once we found a statistically significant difference, we then went back to the mean for females and the mean for males to determine which was significantly greater.
- l. If you want to conduct a one-tail, less than test (in this scenario, you believe that the mean overall rating for males is statistically significantly less than the mean overall rating for females), you would divide the two-tailed p-value by 2
- m. If you want to conduct a one-tail, greater than test (in this scenario, you believe that the mean overall rating for males is statistically significantly greater than the mean overall rating for females), you would divide the two-tailed p-value by 2 and subtract this from 1.
- n. Determining whether to use the two-tailed p-value, one-tailed p-value, or 1 minus the one-tailed p-value depends on the question you are trying to answer.



UNC  
MOREHEAD PLANETARIUM  
AND SCIENCE CENTER



karen peterman  
CONSULTING

