Chapter 19: Categorical outcomes: chi-square and loglinear analysis

Labcoat Leni's Real Research

The impact of sexualized images on women's self-evaluations

Problem

Daniels, E., A. (2012). *Journal of Applied Developmental Psychology*, *33*, 79–90.

Women (and increasingly men) are constantly bombared with images of 'idealized' women in the media and there is a growing concern about how these images affect our perceptions of ourselves. Daniels (2012) conducted an interesting study in which she showed young women images of successful female athletes (e.g., Anna Kournikova) that were either images of them playing sport (performance athlete images) or images of them posing in bathing suits (sexualized images). Participants completed a short writing exercise after viewing these types of images. Each participant saw only one type of image, but several examples. Daniels then coded these written exercises and identified themes, one of which was whether women commented on their own appearance or attractiveness. Daniels hypothesized that women who viewed the sexualized images (*n* = 140) would self-objectify (i.e., this theme would be present in what they wrote) more than those who viewed the performance athlete pictures (*n* = 117, despite what the participants section of the paper implies). These are the frequencies:

	Theme Present	Theme Absent	Total
Performance athletes	20	97	117
Sexualized athletes	56	84	140

Labcoat Leni wants you to enter these data in SPSS and test Daniel's hypothesis that there is an association between the type of image viewed, and whether or not the women commented on their own appearance/attractiveness in their writing exercise (**Daniels (2012).sav**).

Solution

Because the frequency data have been entered into SPSS, we must tell the computer that the variable **Self_Evaluation** represents the number of cases that fell into a particular combination of categories. To do this, access the *Weight Cases* dialog box by selecting Data ⚓ Weight Cases…. Select ◉ Weight cases by and then drag the variable in which the number of cases is specified (in this case **Self_Evaluation**) to the box labelled *Frequency variable* (or click on ➡). This process tells the computer that it should weight each category combination by the

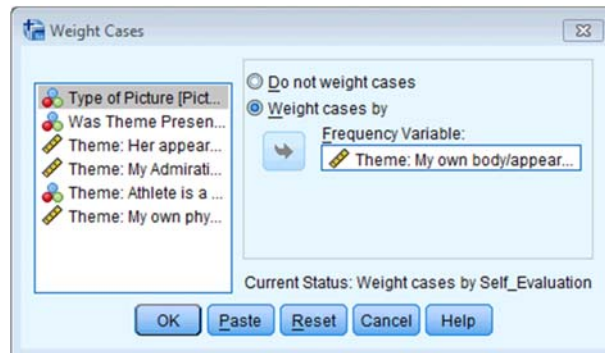number in the column labelled **Self_Evaluation**. Your completed dialog box should look like Figure Figure 1.

Figure 1

Next, select Analyze Descriptive Statistics ▸ Crosstabs…. First, drag one of the variables of interest from the variable list to the box labelled *Row(s)* (or select it and click on ▸). For this example, I selected **Type of Picture** to be the rows of the table. Next, drag the other variable of interest (**Was Theme Present or Absent in what participant wrote**) to the box labelled *Column(s)* (or select it and click on ▸). If you click on Statistics… a dialog box appears in which you can specify various statistical tests. Select the chi-square test, the contingency coefficient, phi and lambda and then click on Continue. If you click on Cells… a dialog box appears in which you can specify the type of data displayed in the crosstabulation table. It is important that you ask for expected counts because this is how we check the assumptions about the expected frequencies. It is also useful to have a look at the row, column and total percentages because these values are usually more easily interpreted than the actual frequencies and provide some idea of the origin of any significant effects. There are two other options that are useful for breaking down a significant effect (should we get one): (1) we can select a *z*-test to compare cell counts across columns of the contingency table (by checking ✔ Compare column proportions), and if we do we should use a Bonferroni correction (check ✔ Adjust p-values (Bonferroni method)); and (2) select standardized residuals. Once these options have been selected, click on Continue to return to the main dialog box. From here you can click on Exact… to compute Fisher's exact test if your sample is small or if your expected frequencies are too low. Select the *Exact* test option; we don't really need it for these data, but it will be a useful way to see how it is used. Click on Continue to return to the main dialog box and then click on OK to run the analysis (your completed dialog boxes should look like those in Figure Figure 2).

Figure 2
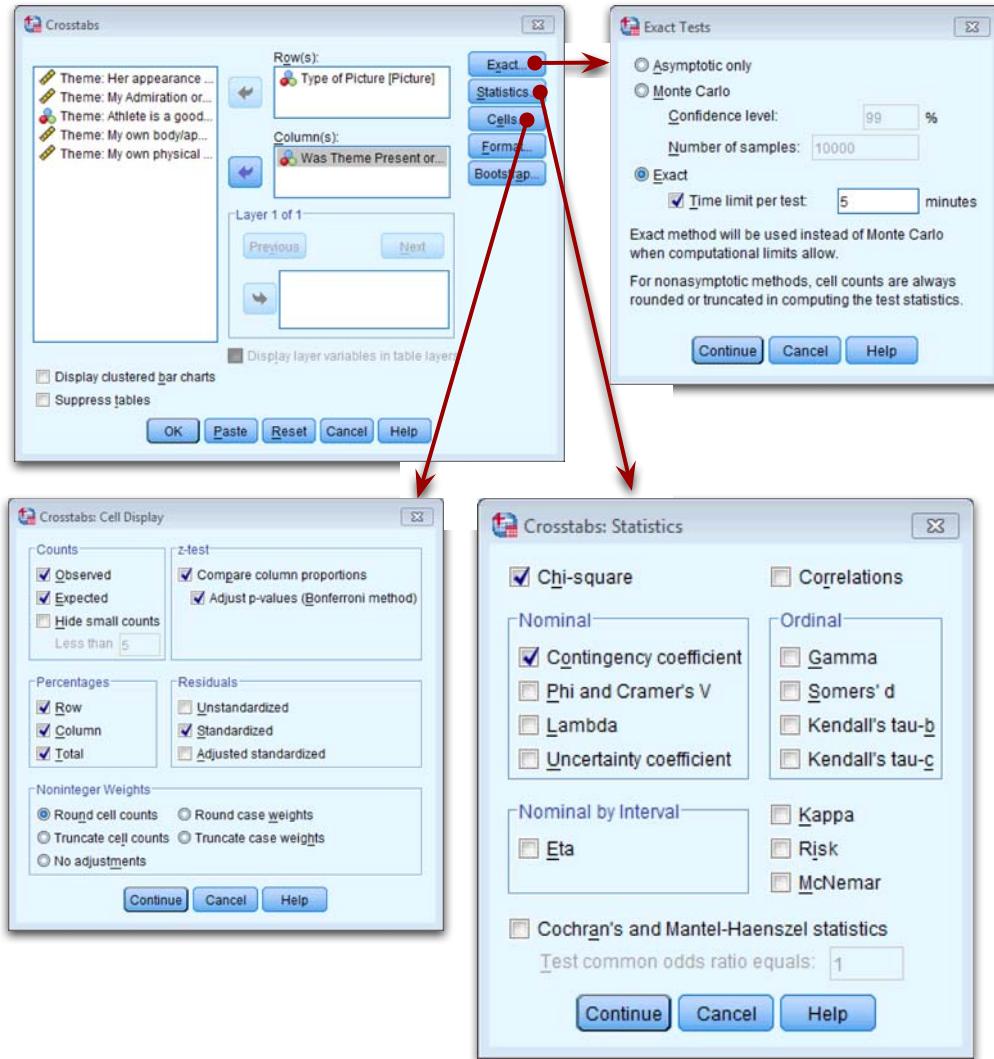
Output

Type of Picture * Was Theme Present or Absent in what participant wrote? Crosstabulation[1]

			Was Theme Present or Absent in what participant wrote?		
			Absent	Present	Total
Type of Picture	Performance Athletes	Count	97a	20b	117
		Expected Count	82.4	34.6	117.0
		% within Type of Picture	82.9%	17.1%	100.0%
		% within Was Theme Present or Absent in what participant wrote?	53.6%	26.3%	45.5%
		Std. Residual	1.6	-2.5	
	Sexualized Athletes	Count	84a	56b	140
		Expected Count	98.6	41.4	140.0
		% within Type of Picture	60.0%	40.0%	100.0%
		% within Was Theme Present or Absent in what participant wrote?	46.4%	73.7%	54.5%
		Std. Residual	-1.5	2.3	
Total		Count	181	76	257
		Expected Count	181.0	76.0	257.0
		% within Type of Picture	70.4%	29.6%	100.0%
		% within Was Theme Present or Absent in what participant wrote?	100.0%	100.0%	100.0%

Each subscript letter denotes a subset of Was Theme Present or Absent in what participant wrote? categories whose column proportions do not differ significantly from each other at the .05 level.

1. Type of Theme = Self–evaluation

Output 1

First, let's check that the expected frequencies assumption has been met. We have a 2×2 table, so all expected frequencies need to be greater than 5. If you look at the expected counts in the contingency table, we see that the smallest expected count is 34.6 (for women who saw pictures of performance athletes and did self-evaluate). This value exceeds 5 and so the assumption has been met.

The other thing to note about this table is that because we selected *Compare column proportions* our counts have subscript letters. For example, in the row labelled *Performance Athletes* the count of 97 has a subscript letter *a* and the count of 20 has a subscript letter *b*. These subscripts tell us the results of the *z*-test that we asked for: columns with different subscripts have significantly different column proportions. We need to look within rows of the table. So, for *Performance Athletes* the columns have different subscripts as I just explained, which means that proportions within the column variable (i.e., *Was the theme present or absent in what they wrote?*) are significantly different. The *z*-test compares the *proportion* of the total frequency of the first column that falls into the first row against the *proportion* of the total frequency of the second column that falls into the first row. So, of all the women who did self-evaluate (theme present), 26.3% saw pictures of performance athletes, and of all the women who didn't self-evaluate (theme absent), 53.6% saw pictures of performance athletes. The different subscripts tell us that these proportions are significantly different. Put another way, the proportion of women who self-evaluated after seeing pictures of performance athletes was significantly less than the proportion who didn't self-evaluate after seeing pictures of performance athletes.

If we move on to the row labelled *Sexualized Athletes*, the count of 84 has a subscript letter *a* and the count of 56 has a subscript letter *b*; as before, the fact they have different letters tells us that the column proportions are significantly different. The proportion of

women who self-evaluated after seeing sexualized pictures of female athletes (73.7%) was significantly greater than the proportion who didn't self-evaluate after seeing sexualized pictures of female athletes (46.4%).

As we saw earlier, Pearson's chi-square test examines whether there is an association between two categorical variables (in this case the type of picture and whether the women self-evaluated or not). The value of the chi-square statistic is 16.057. This value is highly significant ($p < .001$), indicating that the type of picture used had a significant effect on whether women self-evaluated.

Underneath the chi-square table there are several footnotes relating to the assumption that expected counts should be greater than 5. If you forgot to check this assumption yourself, SPSS kindly gives a summary of the number of expected counts below 5. In this case, there were no expected frequencies less than 5, so we know that the chi-square statistic should be accurate.

Chi-Square Tests[a]

	Value	df	Asymp. Sig. (2–sided)	Exact Sig. (2–sided)	Exact Sig. (1–sided)
Pearson Chi-Square	16.057[b]	1	.000		
Continuity Correction[c]	14.976	1	.000		
Likelihood Ratio	16.629	1	.000		
Fisher's Exact Test				.000	.000
Linear–by–Linear Association	15.994	1	.000		
N of Valid Cases	257				

a. Type of Theme = Self–evaluation

b. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 34.60.

c. Computed only for a 2x2 table

Output 2

The highly significant result indicates that there is an association between the type of picture and whether women self-evaluated or not. In other words, the pattern of responses (i.e., the proportion of women who self-evaluated to the proportion who did not) in the two picture conditions is significantly different.

Below is an excerpt from Daniels's (2012) conclusions:

> *My body/looks.* Hypothesis 3 predicted that participants in the sexualized athlete and sexualized model conditions would self-objectify more than participants in the performance athlete condition. As expected, participants who saw the sexualized athletes (40.0%) made more *self-evaluation* statements than did participants who saw the performance athletes (17.1%), χ^2 (1, n = 257) = 16.06, $p < .001$. Cramer's V = .25. The planned chi-square analysis to inves-