sis of covariance, ANCOVA

Labcoat Leni's Real Research

Space invaders

Problem

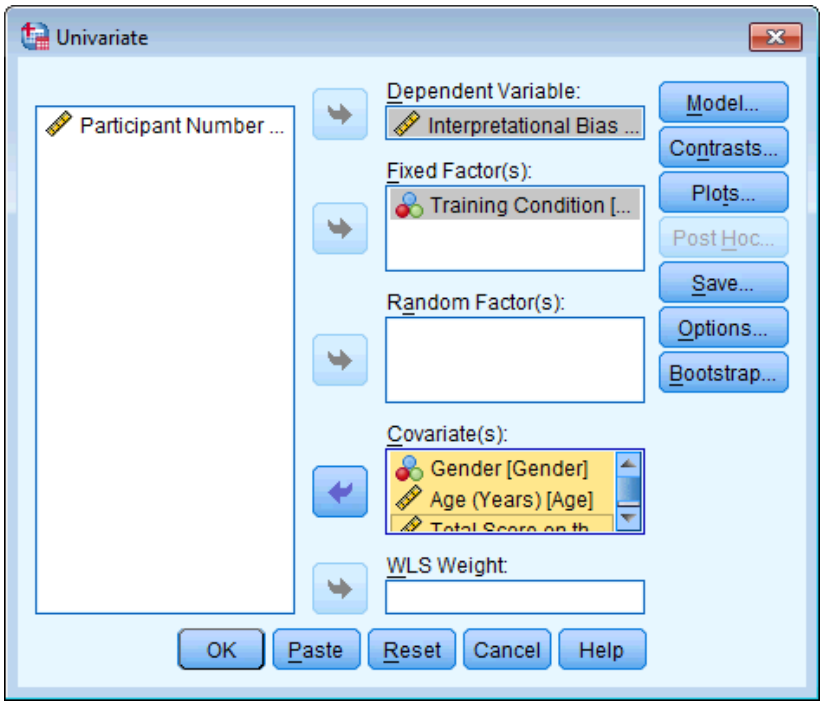
Muris, P., et al. (2008). *Child Psychiatry and Human Development*, *39*, 469–480.

Anxious people tend to interpret ambiguous information in a negative way. For example, being highly anxious myself, if I overheard a student saying 'Andy Field's lectures are really *different*' I would assume that 'different' meant rubbish, but it could also mean 'refreshing' or 'innovative'. In an ingenious study Peter Muris and his colleagues addressed how these interpretational biases develop in children. Children imagined that they were astronauts who had discovered a new planet. Although the planet was similar to Earth, some things were different. They were given some scenarios about their time on the planet (e.g., 'On the street, you encounter a spaceman. He has a toy handgun and he fires at you …') and the child had to decide whether a positive ('You laugh: it is a water pistol and the weather is fine anyway') or negative ('Oops, this hurts! The pistol produces a red beam which burns your skin!') outcome occurred. After each response the child was told whether their choice was correct. Half of the children were *always* told that the negative interpretation was correct, and the reminder were told that the positive interpretation was correct.

Over 30 scenarios children were trained to interpret their experiences on the planet as negative or positive. Muris et al. then measured interpretational biases in everyday life to see whether the training had created a bias to interpret things negatively. In doing so, they could ascertain whether children learn interpretational biases through feedback (e.g., from parents).

The data from this study are in the file **Muris et al (2008).sav**. The independent variable is **Training** (positive or negative) and the outcome was the child's interpretational bias score (**Interpretational_Bias**) – a high score reflects a tendency to interpret situations negatively. It is important to factor in the **Age** and **Gender** of the child and also their natural anxiety level (which they measured with a standard questionnaire of child anxiety called the **SCARED**) because these things affect interpretational biases also. Labcoat Leni wants you to carry out a one-way ANCOVA on these data to see whether **Training** significantly affected children's **Interpretational_Bias** using **Age**, **Gender** and **SCARED** as covariates. What can you conclude?

s the main dialog box by selecting Analyze
lect **Interpretational_Bias** and drag this variable to the box labelled *Dependent Variable* or click on . Select **Training** (i.e., the type of training that the child had) and drag it to the box labelled *Fixed Factor(s)*, and then select **Gender**, **Age** and **SCARED** (by holding down *Ctrl* while you click on these variables) and drag these variables to the box labelled *Covariate(s)*. The finished dialog box should look like this:



In the chapter we looked at how to select contrasts, but because our main predictor variable (the type of training) has only two levels (positive or negative) we don't need contrasts: the main effect of this variable can only reflect differences between the two types of training. The main output is as follows:

's Test of Equality of Error Variances[a]

tational Bias Score

df2	Sig.
68	.299

that the error variance of the dependent variable is equal

a. Design: Intercept + Gender + Age + SCARED + Training

Tests of Between-Subjects Effects

Dependent Variable:Interpretational Bias Score

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	69270.900[a]	4	17317.725	10.506	.000
Intercept	6068.235	1	6068.235	3.681	.059
Gender	11083.252	1	11083.252	6.724	.012
Age	2643.436	1	2643.436	1.604	.210
SCARED	26400.360	1	26400.360	16.016	.000
Training	22129.485	1	22129.485	13.425	.001
Error	107146.585	65	1648.409		
Total	1289250.000	70			
Corrected Total	176417.486	69			

a. R Squared = .393 (Adjusted R Squared = .355)

Training Condition

Dependent Variable:Interpretational Bias Score

Training Condition	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Negative Training	144.617[a]	7.009	130.619	158.616
Positive Training	108.584[a]	6.809	94.984	122.183

a. Covariates appearing in the model are evaluated at the following values: Gender = 1.51, Age (Years) = 10.03, Total Score on the Screen for Child Anxiety and Related Disorders (SCARED) = 17.70.

First, notice that Levene's test is non-significant, $F(1, 68) = 1.09$, $p > .05$, which tells us that the variance in interpretational bias scores was fairly similar in the two training groups. In other words, the assumption of homogeneity of variance has been met.

In the main table, we can see that even after partialling out the effects of age, gender and natural anxiety, the training had a significant effect on the subsequent bias score, $F(1, 65) = 13.43$. The means in the table tell us that interpretational biases were stronger (higher) after negative training. This result is as expected. It seems then that giving children feedback that tells them to interpret ambiguous situations negatively does induce an interpretational bias that persists into everyday situations, which is an important step towards understanding how these biases develop.

In terms of the covariates, age did not have a significant influence on the acquisition of interpretational biases. However, anxiety and gender did. If we look at the parameter estimates table, we can use the beta values to interpret these effects. For anxiety (**SCARED**), $b = 2.01$, which reflects a positive relationship. Therefore, as anxiety increases, the interpretational bias increases also (this is what you would expect, because anxious children would be more likely to naturally interpret ambiguous situations in a negative way). If you draw a scatterplot of the relationship between **SCARED** and **Interpretational_Bias** you'll see a very nice positive relationship. For **Gender**, $b = 26.12$, which again is positive, but to interpret this we need to know how the children were coded in the data editor. Boys were coded as 1 and girls as 2. Therefore, as a child 'changes' (not literally) from a boy to a girl, their

…her words, girls show a stronger natural tendency to …ively. This is consistent with the anxiety literature, which … have anxiety disorders.

One important thing to remember is that although anxiety and gender naturally affected whether children interpreted ambiguous situations negatively, the training (the experiences on the alien planet) had an effect above and beyond these natural tendencies (in other words, the effects of training cannot be explained by gender of natural anxiety levels in the sample).

Have a look at the original article to see how Muris et al. reported the results of this analysis – this can help you to see how you can report your own data from an ANCOVA. (One bit of good practice that you should note is that they report effect sizes from their analysis – as you will see from the book chapter, this is an excellent thing to do.)

Parameter Estimates

Dependent Variable:Interpretational Bias Score

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	106.492	64.341	1.655	.103	-22.007	234.991
Gender	26.121	10.074	2.593	.012	6.002	46.239
Age	-7.278	5.747	-1.266	.210	-18.756	4.200
SCARED	2.007	.502	4.002	.000	1.005	3.009
[Training=1]	36.034	9.835	3.664	.001	16.393	55.675
[Training=2]	0[a]	.	.	.	.	.

a. This parameter is set to zero because it is redundant.