SAS Programs and Output for Alternative Experimentals Designs. Section 13-8 in Howell (2010)

In Statistical Methods for Psychology (7th ed.) I discuss various alternative experimental designs involving random effects and nested variables. This document contains the printout from SAS for each of those designs, as well as links to data and SAS code.

Some may complain that I did not use SAS Proc Mixed, but that would lead us into a different world, and I didn't think that you were eager to go there right now. Proc Mixed does have some major advantages. For example it does not require complete data and it can handle alternative covariance matrices, but neither of those is an issue for the designs used here. It is also very much more difficult to set up and interpret.

SAS Output for Various Models.
The Variable Names Change, But Not the Data

These analyses

- **A crossed design with a standard fixed model analysis of variance**
- **A crossed design with one random factor**
- **A nested design with Therapist nested within Gender**

The relevant data can be found at

- www.uvm.edu\~dhowell\methods7\DataFiles\EysenckFixedRandom.dat
- www.uvm.edu\~dhowell\methods7\DataFiles\CaseLetter.dat
- www.uvm.edu\~dhowell\methods7\DataFiles\GenderTherapist.dat

The SAS code can be found at

- www.uvm.edu\~dhowell\methods7\Supplements\All13-8.sas .

SAS GLM does not handle random factors well when it comes to deriving error terms. So I have indicated that there are places where the main analysis table should be ignored and the correct analysis is given after that. (SAS probably would not agree with my characterization of their procedures.)

Standard Fixed Model 14:21 Friday, March 5, 2010 1

The GLM Procedure

Class Level Information

Class	Levels	Values
Condition	5	1 2 3 4 5
Age	2	1 2

Number of Observations Read	100
Number of Observations Used	100

The GLM Procedure

Dependent Variable: Recall

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	1945.490000	216.165556	26.93	<.0001
Error	90	722.300000	8.025556		
Corrected Total	99	2667.790000			

R-Square	Coeff Var	Root MSE	Recall Mean
0.729252	24.40087	2.832941	11.61000

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Age	1	240.250000	240.250000	29.94	<.0001
Condition	4	1514.940000	378.735000	47.19	<.0001
Condition*Age	4	190.300000	47.575000	5.93	0.0003

Crossed Design with Random Factor

Ignore the first part of this printout because it tests the wrong hypotheses.

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The GLM Procedure

Class Level Information

Class	Levels	Values
Subj	100	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100
Case	2	1 2
Letter	5	1 2 3 4 5

Number of Observations Read	101
Number of Observations Used	100

The GLM Procedure

Dependent Variable: ResponseTime

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	99	2667.790000	26.947374	.	.
Error	0	0.000000	.		
Corrected Total	99	2667.790000			

R-Square	Coeff Var	Root MSE	ResponseTime Mean
1.000000	.	.	11.61000

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Case	1	240.250000	240.250000	.	.
Letter	4	1514.940000	378.735000	.	.
Case*Letter	4	190.300000	47.575000	.	.
Case*Letter(Subj)	90	722.300000	8.025556	.	.

Source	Type III Expected Mean Square
Case	Var(Error) + 10 Var(Case*Letter) + Q(Case,Case*Letter(Subj))
Letter	Var(Error) + 10 Var(Case*Letter) + 20 Var(Letter) + Q(Case*Letter(Subj))
Case*Letter	Var(Error) + 10 Var(Case*Letter) + Q(Case*Letter(Subj))
Case*Letter(Subj)	Var(Error) + Q(Case*Letter(Subj))

The following are the correct tests

The GLM Procedure

Dependent Variable: ResponseTime

Tests of Hypotheses Using the Type III MS for Case*Letter as an Error Term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Case	1	240.2500000	240.2500000	5.05	0.0879

Tests of Hypotheses Using the Type III MS for Case*Letter(Subj) as an Error Term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Letter	4	1514.940000	378.735000	47.19	<.0001
Case*Letter	4	190.300000	47.575000	5.93	0.0003

The GLM Procedure

Class Level Information

Class	Levels	Values
Gender	2	1 2
Therapist	10	1 2 3 4 5 6 7 8 9 10

Number of Observations Read	101
Number of Observations Used	100

Ignore this analysis and look at the next one

The GLM Procedure

Dependent Variable: Effect

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	1945.490000	216.165556	26.93	<.0001
Error	90	722.300000	8.025556		
Corrected Total	99	2667.790000			

R-Square	Coeff Var	Root MSE	Effect Mean
0.729252	24.40087	2.832941	11.61000

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Gender	1	240.250000	240.250000	29.94	<.0001
Therapist(Gender)	8	1705.240000	213.155000	26.56	<.0001

The GLM Procedure

Source	Type III Expected Mean Square
Gender	Var(Error) + 10 Var(Therapist(Gender)) + Q(Gender)
Therapist(Gender)	Var(Error) + 10 Var(Therapist(Gender))

Correct Analysis

Tests of Hypotheses for Mixed Model Analysis of Variance

Dependent Variable: Effect

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Gender	1	240.250000	240.250000	1.13	0.3194

Error	8	1705.240000	213.155000	

Error: MS(Therapist(Gender))

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Therapist(Gender)	8	1705.240000	213.155000	26.56	<.0001
Error: MS(Error)	90	722.300000	8.025556		