

Keylog analyses

Example (1)

- Simple experiment on the difference between anecdotic and statistical evidence

Random crossed effects

Anecdotic

Saskia: I always was somewhat chubby. After my pregnancy I had more than enough. I had gained another 10 kilo. Thanks to *SLIM FAST* I lost 25 kilo in about 2 months.



Statistical

Success percentage: 90%
Clinical research from the prestigious *New York University, School of Medicine* shows a success percentage of 90% for *SLIM FAST*. More than any other product *SLIM FAST* almost garantees a durable loss of weight

Example (1)

- Data
 - 2 conditions (anecdotic vs statistical)
 - Subjects read 5 texts in each condition

Subjects	Texts 1-5	Texts 6-10
Even	Statistical	Anecdotic
Uneven	Anecdotic	Statistical

Example (2)

- Data: Emlar1.sav

Subject	Statistical			Anecdotic		
	Txt 1	Txt 2	..	Txt 6	..	Txt 10
1	8	13	..	15	..	14
2	12	9	..	11	..	12
3						
..						

Descriptives

	mean	st.dev.
Anecdotic	12,3	2,9
Statistical	10,6	2,5

Example (1)

- Standard: ANOVA for RM

Source	SS	df	MS	F	p
Condition	66.6	1	66.6	9.7	.02
Text	166.3	4	41.6	11.6	<.001
Condition * Text	23.6	4	5.9	1.9	.14

- Conclusion
- Correct conclusion?

Work through example (1)

- Variance is based on differences between individuals
- So, in fact the question is answered:
If we were to take another sample of 8 (!) individuals the same 10 texts is it likely to show differences between conditions

Conclusions

- Ignored the structure of the data!
- Looking at the experiment:
 - Sample of individuals -> S^2 (subjects)
 - Sample of texts -> S^2 (texts)
- So we need to estimate those variances

Example (1) ctd.

- Open Emlar2.sav
- The same data in different format
 - Responses in a vector instead of matrix

Example (1) ctd.

Subject	Condition	Text	Score
1	1	1	8
1	1	2	13
1	..	..	..
1	2	6	15
1	2	..	..
1	2	10	14
2	1	1	12

Emlar2.sav

Example (1) ctd.

- We still have to answer the question: Is a distinction between the two conditions warranted ?

Example (1) ctd.

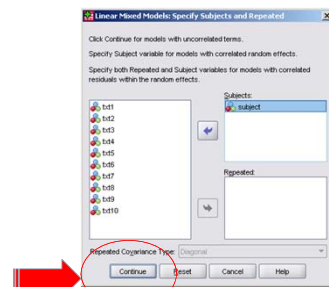
- The research question is:

If we were to repeat the same experiment with another sample of subjects AND another sample of texts ..

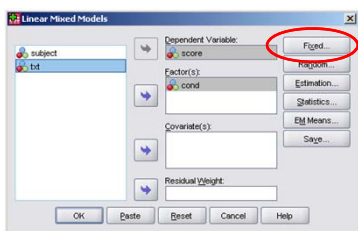
- So, we have to estimate S^2_{subjects} AND S^2_{texts}

Example (1) ctd.

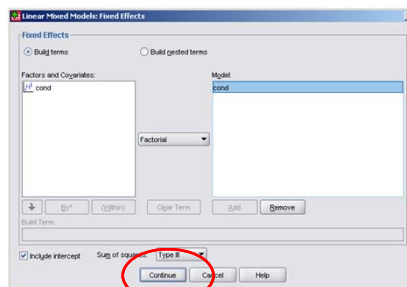
- Go to Analyze -> mixed models -> linear



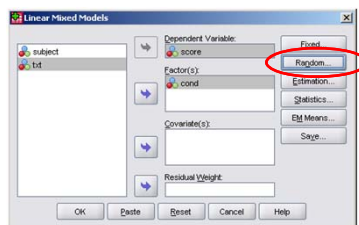
Example (1) ctd.



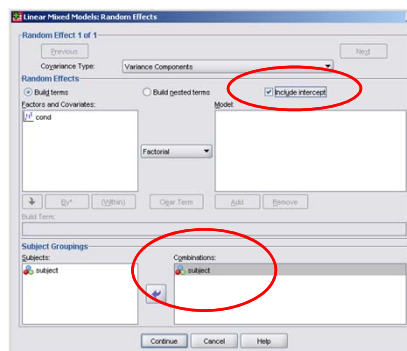
Example (2) ctd.



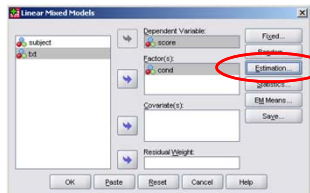
Example (2) ctd.



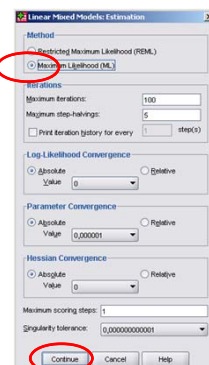
Example (2) ctd.



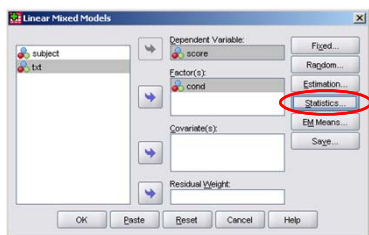
Example (2) ctd.



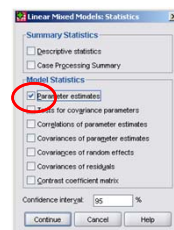
Example (2) ctd.



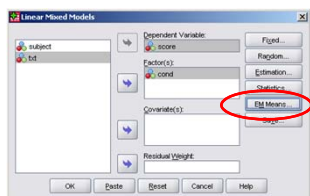
Example (2) ctd.



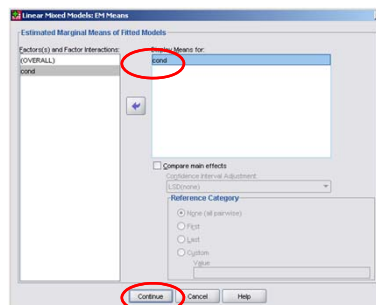
Example (2) ctd.



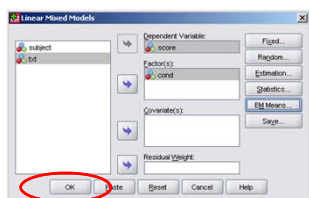
Example (2) ctd.



Example (2) ctd.



Example (2) ctd.



Output Example (2)

Model Dimension^b

		Number of Levels	Covariance Structure	Number of Parameters	Subject Variables
Fixed Effects	Intercept	1	Variance Components	1	subject
	cond	2		1	
Random Effects	Intercept	1		1	
Residual				1	
Total		4		4	

b. Dependent Variable: score.

Output Example (2)

Information Criteria^a

-2 Log Likelihood	461,281
Akaike's Information Criterion (AIC)	469,281
Hurvich and Tsai's Criterion (AICC)	469,711
Bozdogan's Criterion (CAIC)	483,621
Schwarz's Bayesian Criterion (BIC)	479,621

The information criteria are displayed in smaller-is-better forms.

a. Dependent Variable: score.

Output Example (2)

Type III Tests of Fixed Effects^a

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	10,064	652,208	,000
cond	1	88,187	12,957	,001

a. Dependent Variable: score.

Output Example (2)

Estimates of Fixed Effects^b

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	12,275	,508	16,650	24,172	,000	11,202	13,348
[cond=1]	-1,740	,484	88,187	-3,600	,001	-2,701	-,780
[cond=2]	A	0	.	.	.	.	.

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

b. Dependent Variable: score.

Output Example (2)

Estimates of Covariance Parameters^a

Parameter	Estimate	Std. Error
Residual	5,719	,862
Intercept [subject = subject]	Variance 1,410	,893

a. Dependent Variable: score.

Output Example (2)

cond ^a					
cond	Mean	Std. Error	df	95% Confidence Interval	
				Lower Bound	Upper Bound
1 Statistical evidence	10,535,508		16,650	9,461	11,608
2 Anecdotic evidence	12,275,508		16,650	11,202	13,348

a. Dependent Variable: score.

Example (2) ctd.

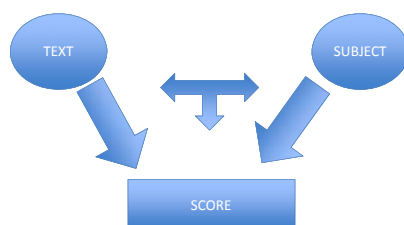
- Effect condition is significant:
 - $F(1, 88.1) = 12.9; p = 0.001;$
- Or:
 - $\beta / se = -1.740 / 0.484 = 3.595$
 - $p [z_{3.595}] = 0.001$

Example (2) ctd.

- In example:
 - Observations nested within subjects
- However:
 - Observations nested within subjects AND
 - Observations nested within texts

Example (2) ctd.

- So, we need:
 - S^2 (texts)
 - S^2 (subjects)
 - S^2 (residuals)
- So, our variance estimates might be a bit too low (i.e. biased)



Example (2) perfected

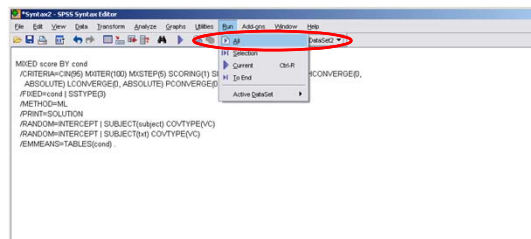
- This cannot be done in a standard way
- We need to 'fool' spss
- Go analyze -> mixed models -> linear
- Continue and Paste

Example (2) perfected

`/RANDOM=INTERCEPT | SUBJECT(txt) COVTYPE(VC)`

Example (2) perfected

■ After adding the red line



Example (2) perfected

Model Dimension^b

		Number of Levels	Covariance Structure	Number of Parameters	Subject Variables
Fixed Effects	Intercept	1	Variance Components	1	subject
	cond	2		1	
Random Effects	Intercept ^a	1	Variance Components	1	txt
	Intercept ^a	1		1	
Residual				1	
Total		5		5	

Example (2) perfected

Information Criteria^a

-2 Log Likelihood	440,874
Akaike's Information Criterion (AIC)	450,874
Hurvich and Tsai's Criterion (AICC)	451,527
Bozdogan's Criterion (CAIC)	468,799
Schwarz's Bayesian Criterion (BIC)	463,799

a. Dependent Variable: score.

Example (2) perfected

Type III Tests of Fixed Effects^a

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	15,694	324,416	,000
cond	1	9,779	3,604	,088

a. Dependent Variable: score.

Example (2) perfected

Estimates of Fixed Effects^b

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	12,287	,789	15,019	15,563	,000	10,604	13,969
[cond=1]	-1,794	,945	9,779	-1,898	,088	-3,907	,318
[cond=2]	0	0	.	.	.	.	.

Example (2) perfected

Estimates of Covariance Parameters^a

Parameter		Estimate	Std. Error
Residual		3,727	,594
Intercept [subject = subject]	Variance	1,764	,971
Intercept [subject = txt]	Variance	1,852	1,012

a. Dependent Variable: score.

Example (2) perfected

cond^a

cond	Mean	Std. Error	df	95% Confidence Interval	
				Lower Bound	Upper Bound
1 Statistical evidence	10,492	,789	15,019	8,810	12,175
2 Anecdotic evidence	12,287	,789	15,019	10,605	13,970

a. Dependent Variable: score.

- Is model 2 better than model 1

- -2LL test

	-2LL	Comparison		
		Chi2	df	p
Model 1	461,3			
Model 2	440,9	20,4	1	<0,0001

- Is model 2 better than model 1?
- YES, $S^2 \text{ text} = 1,85$ (S.E. = 1,01)
- $z(S^2 \text{ text}) = 1,83$; $p = 0,03$ (one-sided)

Example (1) perfected

- Conclusion?

	Mean	S ² error	S ² individual	S ² text
Anecdotic	12,3	3,7	1,8	1,9
Statistical	10,5			