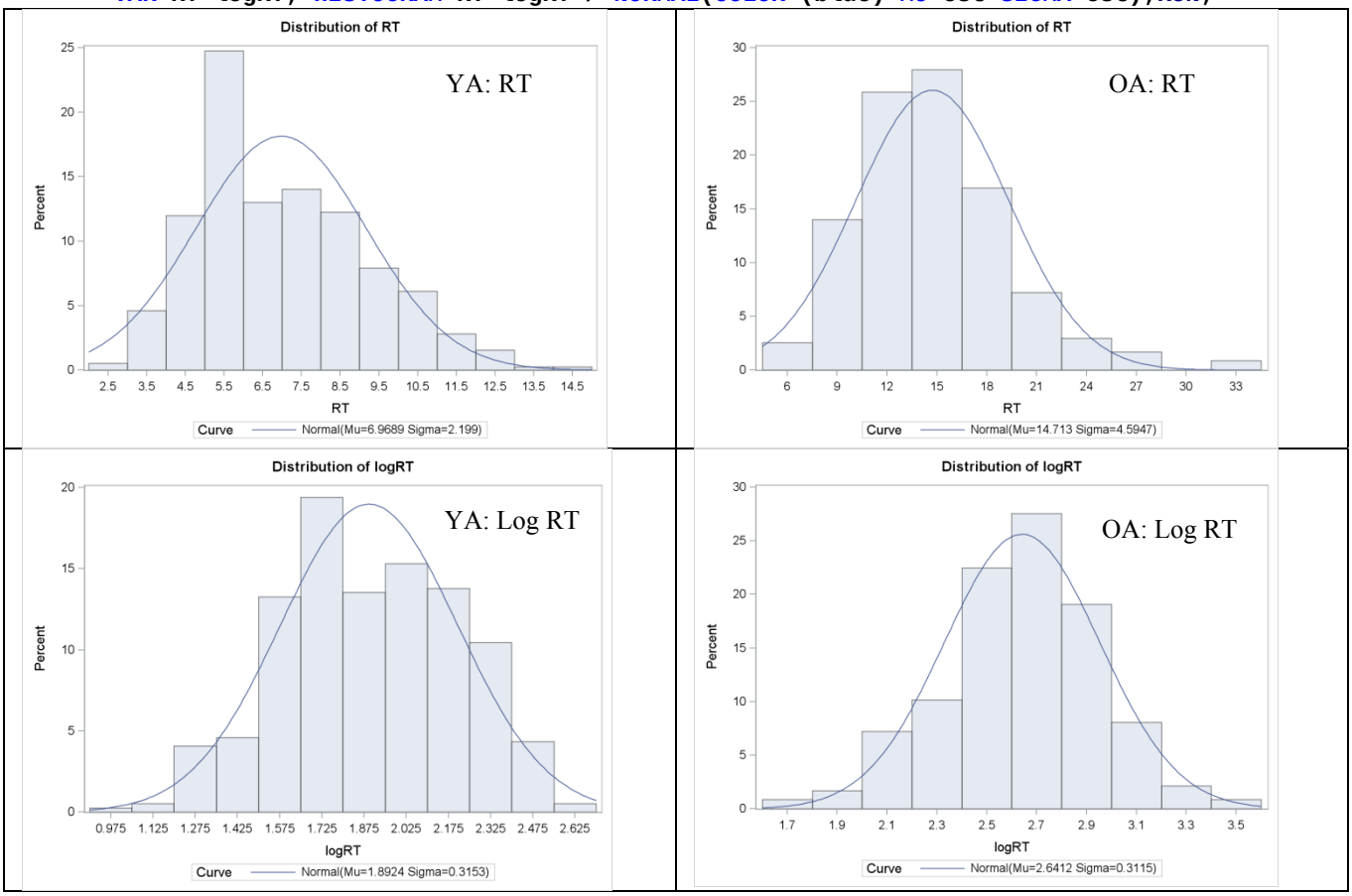
Multivariate Models for Repeated Measures Response Times in Older and Younger Adults

These data were collected as part of my masters' thesis, and are unpublished in this form (to see the way I'd prefer to have analyzed the data, see Hoffman & Rovine, 2007 *Behavior Research Methods*). The outcome was the log-transformed mean per condition of response time to detect changes in driving scenes that were either of low/high meaningfulness to driving or low/high visual salience (i.e., a 2x2 repeated measures design). Participants included 98 younger adults (years of age M=19.7, SD = 2.3, range= 18–32) and 60 older adults (years of age M = 75.9, SD = 5.4, range = 63–86). The older adults may show differential heterogeneity with respect to both their mean and variability, so stay tuned to see how our multivariate models will reflect this…

SAS Syntax and Output for Data Manipulation:

```
* Stack data into multivariate;
DATA work.example_stacked; SET work.example;
       DV="00-LM-LS"; RT=RT11; Mean=0; Sal=0; OUTPUT; * Low  meaning, low  salience;
       DV="01-LM-HS"; RT=RT12; Mean=0; Sal=1; OUTPUT; * Low  meaning, high salience;
       DV="10-HM-LS"; RT=RT21; Mean=1; Sal=0; OUTPUT; * High meaning, low  salience;
       DV="11-HM-HS"; RT=RT22; Mean=1; Sal=1; OUTPUT; * High meaning, high salience; RUN;
* Prepare data for analysis;
DATA work.example_stacked; SET work.example_stacked;
* Log RT to improve residual normality;
  logRT=LOG(RT);
* Create piecewise effects of age;
       IF agegroup=0 THEN DO; old=0; yrs65=0;      END;
  ELSE IF agegroup=1 THEN DO; old=1; yrs65=age-65; END;
* Select complete cases;
  IF NMISS(old,yrs65,rt)>0 THEN DELETE; RUN;
TITLE "Descriptive Info for RT";
PROC UNIVARIATE DATA=example_stacked; BY agegroup; FORMAT agegroup fagegroup.;
       VAR RT logRT; HISTOGRAM RT logRT / NORMAL(COLOR=(blue) MU=est SIGMA=est);RUN;
```

```
* Also created formats to use for
condition and age group variables;
PROC FORMAT;
VALUE fcondition
       0="Low" 1="High";
VALUE fagegroup
       0="Younger" 1="Older";
RUN;
```



Empty Multivariate Model Predicting Log RT (using Multivariate Normal Distribution and Identity Link after log-transforming): This model predicts the RT in condition *c* for person *p* →

$$RT_{pc} = \beta_0 + \beta_1 Meaning_{pc} + \beta_2 Salience_{pc} + \beta_3 Meaning_{pc} * Salience_{pc} + e_{pc}$$

Is unstructured really necessary, or would a simpler covariance structure be ok? Each model starts with:

```
TITLE "Empty Model RT Differences from Meaning by Salience";
PROC MIXED DATA=example_stacked NAMELEN=50 COVTEST NOPROFILE IC METHOD=ML;
       CLASS DV mean sal;
       FORMAT mean fcondition. sal fcondition.;
       MODEL logRT = mean|sal / SOLUTION DDFM=KR;
       LSMEANS mean*sal;
```

Then selects a different covariance structure for the multivariate outcomes using REPEATED:

```
REPEATED DV / R RCORR TYPE=UN  SUBJECT=subnum; RUN; * Unstructured;
REPEATED DV / R RCORR TYPE=CSH SUBJECT=subnum; RUN; * Compound Symmetry Heterogeneous;
REPEATED DV / R RCORR TYPE=CS  SUBJECT=subnum; RUN; * Compound Symmetry (Homogeneous);
```

Unstructured:

Estimated R Matrix for Subject 1				
Row	Col1	Col2	Col3	Col4
1	0.1354	0.1292	0.1189	0.1240
2	0.1292	0.2365	0.1653	0.1636
3	0.1189	0.1653	0.2262	0.1652
4	0.1240	0.1636	0.1652	0.2034

Estimated R Correlation Matrix for Subject 1				
Row	Col1	Col2	Col3	Col4
1	1.0000	0.7219	0.6795	0.7476
2	0.7219	1.0000	0.7146	0.7460
3	0.6795	0.7146	1.0000	0.7701
4	0.7476	0.7460	0.7701	1.0000

Information Criteria						
Neg2LogLike	Parms	AIC	AICC	HQIC	BIC	CAIC
316.7	14	344.7	345.4	362.1	387.5	401.5

Covariance Parameter Estimates					
Cov Parm	Subject	Estimate	Standard Error	Z Value	Pr Z
UN(1,1)	SUBNUM	0.1354	0.01528	8.86	<.0001
UN(2,1)	SUBNUM	0.1292	0.01761	7.33	<.0001
UN(2,2)	SUBNUM	0.2365	0.02670	8.86	<.0001
UN(3,1)	SUBNUM	0.1189	0.01688	7.04	<.0001
UN(3,2)	SUBNUM	0.1653	0.02269	7.28	<.0001
UN(3,3)	SUBNUM	0.2262	0.02553	8.86	<.0001
UN(4,1)	SUBNUM	0.1240	0.01653	7.50	<.0001
UN(4,2)	SUBNUM	0.1636	0.02184	7.49	<.0001
UN(4,3)	SUBNUM	0.1652	0.02161	7.65	<.0001
UN(4,4)	SUBNUM	0.2034	0.02296	8.86	<.0001

Compound Symmetry Heterogeneous:

Estimated R Matrix for Subject 1				
Row	Col1	Col2	Col3	Col4
1	0.1375	0.1319	0.1294	0.1204
2	0.1319	0.2372	0.1699	0.1582
3	0.1294	0.1699	0.2284	0.1552
4	0.1204	0.1582	0.1552	0.1979

Estimated R Correlation Matrix for Subject 1				
Row	Col1	Col2	Col3	Col4
1	1.0000	0.7301	0.7301	0.7301
2	0.7301	1.0000	0.7301	0.7301
3	0.7301	0.7301	1.0000	0.7301
4	0.7301	0.7301	0.7301	1.0000

Information Criteria						
Neg2LogLike	Parms	AIC	AICC	HQIC	BIC	CAIC
323.8	9	341.8	342.1	353.0	369.3	378.3

Is the difference in fit significant? What does it mean?

Covariance Parameter Estimates					
Cov Parm	Subject	Estimate	Standard Error	Z Value	Pr Z
Var(1)	SUBNUM	0.1375	0.01546	8.89	<.0001
Var(2)	SUBNUM	0.2372	0.02659	8.92	<.0001
Var(3)	SUBNUM	0.2284	0.02564	8.91	<.0001
Var(4)	SUBNUM	0.1979	0.02201	8.99	<.0001
CSH	SUBNUM	0.7301	0.02805	26.03	<.0001

Compound Symmetry:

Estimated R Matrix for Subject 1				
Row	Col1	Col2	Col3	Col4
1	0.2004	0.1444	0.1444	0.1444
2	0.1444	0.2004	0.1444	0.1444
3	0.1444	0.1444	0.2004	0.1444
4	0.1444	0.1444	0.1444	0.2004

Information Criteria						
Neg2LogLike	Parms	AIC	AICC	HQIC	BIC	CAIC
352.9	6	364.9	365.1	372.4	383.3	389.3

Is the difference in fit significant? What does it mean?

Estimated R Correlation Matrix for Subject 1				
Row	Col1	Col2	Col3	Col4
1	1.0000	0.7205	0.7205	0.7205
2	0.7205	1.0000	0.7205	0.7205
3	0.7205	0.7205	1.0000	0.7205
4	0.7205	0.7205	0.7205	1.0000

Covariance Parameter Estimates					
Cov Parm	Subject	Estimate	Standard Error	Z Value	Pr Z
Variance	SUBNUM	0.05600	0.003649	15.35	<.0001
CS	SUBNUM	0.1444	0.01790	8.07	<.0001

Here's the rest of the output for CSH:

Class Level Information		
Class	Levels	Values
DV	4	00-LM-LS 01-LM-HS 10-HM-LS 11-HM-HS
Mean	2	High Low
Sal	2	High Low

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Mean	1	450	54.08	<.0001
Sal	1	440	274.81	<.0001
Mean*Sal	1	393	3.97	0.0471

Solution for Fixed Effects							
Effect	Mean	Sal	Estimate	Standard Error	DF	t Value	Pr > |t|
Intercept			2.4176	0.02959	158	81.70	<.0001
Mean	High		-0.1760	0.02616	280	-6.73	<.0001
Mean	Low		0	.	.	.	.
Sal		High	-0.3501	0.02663	274	-13.14	<.0001
Sal		Low	0	.	.	.	.
Mean*Sal	High	High	0.07677	0.03854	393	1.99	0.0471
Mean*Sal	High	Low	0	.	.	.	.
Mean*Sal	Low	High	0	.	.	.	.
Mean*Sal	Low	Low	0	.	.	.	.

Least Squares Means							
Effect	Mean	Sal	Estimate	Standard Error	DF	t Value	Pr > |t|
Mean*Sal	High	High	1.9683	0.03550	162	55.44	<.0001
Mean*Sal	High	Low	2.2416	0.03814	159	58.78	<.0001
Mean*Sal	Low	High	2.0676	0.03887	159	53.19	<.0001
Mean*Sal	Low	Low	2.4176	0.02959	158	81.70	<.0001

Adding main effects and interactions of age group to predict mean RT in condition *c* for person *p* →

$$RT_{pc} = \beta_0 + \beta_1 Meaning_{pc} + \beta_2 Salience_{pc} + \beta_3 Meaning_{pc} * Salience_{pc} + \beta_4 AgeGroup_p + \beta_5 Meaning_{pc} * AgeGroup_p + \beta_6 Salience_{pc} * AgeGroup_p + \beta_7 Meaning_{pc} * Salience_{pc} * AgeGroup_p + e_{pc}$$

```
TITLE "Multivariate Model including Effects of Age Group on Mean RT";
PROC MIXED DATA=example_stacked NAMELEN=50 COVTEST NOPROFILE IC METHOD=ML;
       CLASS DV mean sal;
       FORMAT mean fcondition. sal fcondition.;
       MODEL logRT = mean|sal|old / SOLUTION DDFM=KR;
       REPEATED DV / R RCORR TYPE=CSH SUBJECT=subnum;
       LSMEANS mean*sal / AT (old)=(0) SLICE=mean SLICE=sal; * For YA;
       LSMEANS mean*sal / AT (old)=(1) SLICE=mean SLICE=sal; * For OA;  RUN;
```

Note that the predictor for age group, old, is not on the CLASS statement.

Estimated R Matrix for Subject 1

Row	Col1	Col2	Col3	Col4
1	0.05101	0.01313	0.01244	0.01147
2	0.01313	0.08161	0.01574	0.01451
3	0.01244	0.01574	0.07336	0.01376
4	0.01147	0.01451	0.01376	0.06235

Covariance Parameter Estimates

Cov Parm	Subject	Estimate	Standard Error	Z Value	Pr Z
Var(1)	SUBNUM	0.05101	0.005729	8.90	<.0001
Var(2)	SUBNUM	0.08161	0.009154	8.92	<.0001
Var(3)	SUBNUM	0.07336	0.008292	8.85	<.0001
Var(4)	SUBNUM	0.06235	0.006909	9.02	<.0001
CSH	SUBNUM	0.2034	0.04183	4.86	<.0001

Estimated R Correlation Matrix for Subject 1

Row	Col1	Col2	Col3	Col4
1	1.0000	0.2034	0.2034	0.2034
2	0.2034	1.0000	0.2034	0.2034
3	0.2034	0.2034	1.0000	0.2034
4	0.2034	0.2034	0.2034	1.0000

Information Criteria

Neg2LogLike	Parms	AIC	AICC	HQIC	BIC	CAIC
43.4	13	69.4	70.0	85.6	109.2	122.2

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
Mean	1	462	52.50	<.0001
Sal	1	462	216.93	<.0001
Mean*Sal	1	464	13.39	0.0003
old	1	157	768.04	<.0001
old*Mean	1	462	4.86	0.0279
old*Sal	1	462	5.16	0.0236
old*Mean*Sal	1	464	10.86	0.0011

Tests of Effect Slices

Effect	Mean	Sal	old	SUBNUM	Num DF	Den DF	F Value	Pr > F
Mean*Sal	High		0.00	120.27	1	273	60.52	<.0001
Mean*Sal	Low		0.00	120.27	1	263	170.25	<.0001
Mean*Sal		High	0.00	120.27	1	269	5.94	0.0154
Mean*Sal		**Low**	**0.00**	**120.27**	**1**	**272**	**64.00**	**<.0001**
Mean*Sal	High		1.00	120.27	1	273	48.36	<.0001
Mean*Sal	Low		1.00	120.27	1	263	26.21	<.0001
Mean*Sal		High	1.00	120.27	1	269	8.07	0.0048
Mean*Sal		**Low**	**1.00**	**120.27**	**1**	**272**	**1.20**	**0.2744**

Least Squares Means

Effect	Mean	Sal	old	SUBNUM	Estimate	Standard Error	DF	t Value	Pr > |t|
Mean*Sal	High	High	0.00	120.27	1.6785	0.02522	163	66.54	<.0001
Mean*Sal	High	Low	0.00	120.27	**1.9370**	0.02736	157	70.80	<.0001
Mean*Sal	Low	High	0.00	120.27	1.7620	0.02886	159	61.06	<.0001
Mean*Sal	Low	Low	0.00	120.27	**2.1919**	0.02281	159	96.08	<.0001
Mean*Sal	High	High	1.00	120.27	2.4497	0.03251	163	75.36	<.0001
Mean*Sal	High	Low	1.00	120.27	**2.7475**	0.03526	157	77.92	<.0001
Mean*Sal	Low	High	1.00	120.27	2.5751	0.03719	159	69.24	<.0001
Mean*Sal	Low	Low	1.00	120.27	**2.7925**	0.02940	159	94.97	<.0001

So it appears the two-way interaction of meaning by salience differs between younger and older adults.

One way to interpret this effect is that if salience is low, there is a meaning effect for younger adults, but not for older adults.

But that's not the end of the story…

Right now we are assuming the same amount of residual variability in both groups, but the older adults may be more heterogeneous than the younger adults. Let's see by allowing the R matrix to differ by age group:

```
TITLE "Multivariate Model including Effects of Age Group on Residual Variance";
PROC MIXED DATA=example_stacked NAMELEN=50 COVTEST NOPROFILE IC METHOD=ML;
       CLASS DV mean sal agegroup;
       FORMAT mean fcondition. sal fcondition. agegroup fagegroup.;
       MODEL logRT = mean|sal|old / SOLUTION DDFM=KR;
       REPEATED DV / R=1,99 RCORR=1,99 TYPE=CSH SUBJECT=subnum GROUP=agegroup;
       LSMEANS mean*sal / AT (old)=(0) SLICE=mean SLICE=sal;
       LSMEANS mean*sal / AT (old)=(1) SLICE=mean SLICE=sal;
RUN;
```

Younger Adults on Left:

Estimated R Matrix for Subject 1

Row	Col1	Col2	Col3	Col4
1	0.03900	0.005190	0.005185	0.004765
2	0.005190	0.07146	0.007018	0.006450
3	0.005185	0.007018	0.07131	0.006443
4	0.004765	0.006450	0.006443	0.06024

Estimated R Correlation Matrix for Subject 1

Row	Col1	Col2	Col3	Col4
1	1.0000	0.09832	0.09832	0.09832
2	0.09832	1.0000	0.09832	0.09832
3	0.09832	0.09832	1.0000	0.09832
4	0.09832	0.09832	0.09832	1.0000

Older Adults on Right:

Estimated R Matrix for Subject 99

Row	Col1	Col2	Col3	Col4
1	0.07027	0.02785	0.02452	0.02285
2	0.02785	0.09865	0.02905	0.02707
3	0.02452	0.02905	0.07648	0.02383
4	0.02285	0.02707	0.02383	0.06641

Estimated R Correlation Matrix for Subject 99

Row	Col1	Col2	Col3	Col4
1	1.0000	0.3344	0.3344	0.3344
2	0.3344	1.0000	0.3344	0.3344
3	0.3344	0.3344	1.0000	0.3344
4	0.3344	0.3344	0.3344	1.0000

Covariance Parameter Estimates

Cov Parm	Subject	Group	Estimate	Standard Error	Z Value	Pr Z
Var(1)	SUBNUM	AGEGROUP Older	**0.07027**	0.01273	5.52	<.0001
Var(2)	SUBNUM	AGEGROUP Older	**0.09865**	0.01799	5.48	<.0001
Var(3)	SUBNUM	AGEGROUP Older	0.07648	0.01411	5.42	<.0001
Var(4)	SUBNUM	AGEGROUP Older	0.06641	0.01194	5.56	<.0001
CSH	SUBNUM	AGEGROUP Older	**0.3344**	0.07091	4.72	<.0001
Var(1)	SUBNUM	AGEGROUP Younger	**0.03900**	0.005589	6.98	<.0001
Var(2)	SUBNUM	AGEGROUP Younger	**0.07146**	0.01018	7.02	<.0001
Var(3)	SUBNUM	AGEGROUP Younger	0.07131	0.01020	6.99	<.0001
Var(4)	SUBNUM	AGEGROUP Younger	0.06024	0.008521	7.07	<.0001
CSH	SUBNUM	AGEGROUP Younger	**0.09832**	0.04824	2.04	0.0416

Eye-balling this table, it appears the older adults have more unexplained variability in the low meaning conditions (Var 1 and Var2) as well as more residual correlation across conditions.

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
Mean	1	284	51.38	<.0001
Sal	1	284	212.61	<.0001
Mean*Sal	1	287	13.15	0.0003
old	1	94.8	654.60	<.0001
old*Mean	1	372	4.90	0.0275
old*Sal	1	372	5.21	0.0230
old*Mean*Sal	1	372	10.96	0.0010

Information Criteria

Neg2LogLike	Parms	AIC	AICC	HQIC	BIC	CAIC
30.4	18	66.4	67.5	88.7	121.4	139.4

Is the difference in fit significant? What does it mean?

We are also assuming that age doesn't matter beyond just which group you are in. Let's test this:

$$RT_{pc} = \beta_0 + \beta_1 Meaning_{pc} + \beta_2 Salience_{pc} + \beta_3 Meaning_{pc} * Salience_{pc} + \beta_4 AgeGroup_p + \beta_5 Meaning_{pc} * AgeGroup_p + \beta_6 Salience_{pc} * AgeGroup_p + \beta_7 Meaning_{pc} * Salience_{pc} * AgeGroup_p + \beta_8 Years65_p + \beta_9 Meaning_{pc} * Years65_p + \beta_{10} Salience_{pc} * Years65_p + \beta_{11} Meaning_{pc} * Salience_{pc} * Years65_p + e_{pc}$$

```
TITLE "Multivariate Model with Mean Age Slope Three-Way Interaction for Older Age Group";
PROC MIXED DATA=example_stacked NAMELEN=50 NOPROFILE METHOD=ML;
       CLASS DV mean sal agegroup;
       FORMAT mean fcondition. sal fcondition. agegroup fagegroup.;
       MODEL logRT = mean|sal|old old*yrs65|mean|sal / SOLUTION DDFM=KR;
       REPEATED DV / R RCORR TYPE=CSH SUBJECT=subnum GROUP=agegroup; RUN;
```

Is the difference in fit significant? What does it mean?

Information Criteria

Neg2LogLike	Parms	AIC	AICC	HQIC	BIC	CAIC
16.1	22	60.1	61.8	87.4	127.4	149.4

Solution for Fixed Effects

Effect	Mean	Sal	Estimate	Standard Error	DF	t Value	Pr > |t|
Intercept			2.1919	0.01995	97.4	109.87	<.0001
Mean	High		-0.2549	0.03194	161	-7.98	<.0001
Mean	Low		0	.	.	.	.
Sal		High	-0.4299	0.03196	159	-13.45	<.0001
Sal		Low	0	.	.	.	.
Mean*Sal	High	High	0.1714	0.04728	287	3.63	0.0003
Mean*Sal	High	Low	0	.	.	.	.
Mean*Sal	Low	High	0	.	.	.	.
Mean*Sal	Low	Low	0	.	.	.	.
old			0.5155	0.07964	69.9	6.47	<.0001
old*Mean	High		0.1447	0.09910	131	1.46	0.1468
old*Mean	Low		0	.	.	.	.
old*Sal		High	0.03752	0.1031	126	0.36	0.7165
old*Sal		Low	0	.	.	.	.
old*Mean*Sal	High	High	-0.1043	0.1420	220	-0.73	0.4632
old*Mean*Sal	High	Low	0	.	.	.	.
old*Mean*Sal	Low	High	0	.	.	.	.
old*Mean*Sal	Low	Low	0	.	.	.	.
old*yrs65			0.007829	0.006376	61.6	1.23	0.2242
old*yrs65*Mean	High		0.006010	0.007758	106	0.77	0.4403
old*yrs65*Mean	Low		0	.	.	.	.
old*yrs65*Sal		High	0.01611	0.008103	104	1.99	0.0494
old*yrs65*Sal		Low	0	.	.	.	.
old*yrs65*Mean*Sal	High	High	-0.01358	0.01107	176	-1.23	0.2217
old*yrs65*Mean*Sal	High	Low	0	.	.	.	.
old*yrs65*Mean*Sal	Low	High	0	.	.	.	.
old*yrs65*Mean*Sal	Low	Low	0	.	.	.	.

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
Mean	1	284	51.38	<.0001
Sal	1	284	212.61	<.0001
Mean*Sal	1	287	13.15	0.0003
old	1	67.3	111.58	<.0001
old*Mean	1	220	1.70	0.1937
old*Sal	1	220	0.04	0.8364
old*Mean*Sal	1	220	0.54	0.4632
old*yrs65	1	58.9	12.44	0.0008
old*yrs65*Mean	1	175	0.02	0.8882
old*yrs65*Sal	1	176	2.84	0.0935
old*yrs65*Mean*Sal	1	176	1.50	0.2217

By not including years over 65 as a main effect, it applies only to the old=1 group as intended.

This is also why I left the predictor for old off the CLASS statement—I didn't want SAS to marginalize across age groups in evaluating the marginal effects of meaning and salience. As it stands now, they apply only to younger adults, and the interactions with old and old*yrs65 then tell us if they differ based on age.

Based on these results, it looks like we can simplify a little bit… after removing the nonsignificant three-way old*yrs65*meaning*salience interaction, the main effects of meaning and salience did not differ by years over 65, so the final model contains just a main effect for years over 65, as shown next.

$$RT_{pc} = \beta_0 + \beta_1 Meaning_{pc} + \beta_2 Salience_{pc} + \beta_3 Meaning_{pc} * Salience_{pc} + \beta_4 AgeGroup_p + \beta_5 Meaning_{pc} * AgeGroup_p + \beta_6 Salience_{pc} * AgeGroup_p + \beta_7 Meaning_{pc} * Salience_{pc} * AgeGroup_p + \beta_8 Years65_p + e_{pc}$$

```
TITLE "Multivariate Model including Mean Age Slope Main Effect for Older Age Group";
PROC MIXED DATA=example_stacked NAMELEN=50 COVTEST NOPROFILE IC METHOD=ML;
       CLASS DV mean sal agegroup;
       FORMAT mean fcondition. sal fcondition. agegroup fagegroup.;
       MODEL logRT = mean|sal|old old*yrs65 / SOLUTION DDFM=KR;
       REPEATED DV / R RCORR TYPE=CSH SUBJECT=subnum GROUP=agegroup;
       LSMEANS mean*sal / AT (old yrs65)=(0  0) SLICE=mean SLICE=sal; * For YA;
       LSMEANS mean*sal / AT (old yrs65)=(1  0) SLICE=mean SLICE=sal; * For age 65;
       LSMEANS mean*sal / AT (old yrs65)=(1 10) SLICE=mean SLICE=sal; * For age 75; RUN;
```

Is the difference in fit significant? What does it mean?

Information Criteria						
Neg2LogLike	Parms	AIC	AICC	HQIC	BIC	CAIC
20.1	19	58.1	59.4	81.7	116.2	135.2

Solution for Fixed Effects							
Effect	Mean	Sal	Estimate	Standard Error	DF	t Value	Pr > |t|
Intercept			2.1919	0.01995	97.4	109.87	<.0001
Mean	High		-0.2549	0.03194	161	-7.98	<.0001
Mean	Low		0	.	.	.	.
Sal		High	-0.4299	0.03196	159	-13.45	<.0001
Sal		Low	0	.	.	.	.
Mean*Sal	High	High	0.1714	0.04728	287	3.63	0.0003
Mean*Sal	High	Low	0	.	.	.	.
Mean*Sal	Low	High	0	.	.	.	.
Mean*Sal	Low	Low	0	.	.	.	.
old			0.4390	0.06271	98.7	7.00	<.0001
old*Mean	High		0.2099	0.05245	216	4.00	<.0001
old*Mean	Low		0	.	.	.	.
old*Sal		High	0.2125	0.05425	206	3.92	0.0001
old*Sal		Low	0	.	.	.	.
old*Mean*Sal	High	High	-0.2518	0.07598	376	-3.31	0.0010
old*Mean*Sal	High	Low	0	.	.	.	.
old*Mean*Sal	Low	High	0	.	.	.	.
old*Mean*Sal	Low	Low	0	.	.	.	.
old*yrs65			0.01488	0.004472	59.8	3.33	0.0015

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Mean	1	284	51.38	<.0001
Sal	1	284	212.61	<.0001
Mean*Sal	1	287	13.15	0.0003
old	1	68.5	111.08	<.0001
old*Mean	1	374	4.90	0.0275
old*Sal	1	375	5.21	0.0230
old*Mean*Sal	1	376	10.99	0.0010
old*yrs65	1	59.8	11.06	0.0015

Least Squares Means						
Effect	Mean	Sal	old	yrs65	Estimate	Standard Error
Mean*Sal	High	High	0.00	0.00	1.6785	0.02479
Mean*Sal	High	Low	0.00	0.00	1.9370	0.02697
Mean*Sal	Low	High	0.00	0.00	1.7620	0.02700
Mean*Sal	Low	Low	0.00	0.00	2.1919	0.01995
Mean*Sal	High	High	1.00	0.00	2.2881	0.05803
Mean*Sal	High	Low	1.00	0.00	2.5859	0.05965
Mean*Sal	Low	High	1.00	0.00	2.4135	0.06175
Mean*Sal	Low	Low	1.00	0.00	2.6309	0.05945
Mean*Sal	High	High	1.00	10.00	2.4369	0.03196
Mean*Sal	High	Low	1.00	10.00	2.7347	0.03481
Mean*Sal	Low	High	1.00	10.00	2.5623	0.03830
Mean*Sal	Low	Low	1.00	10.00	2.7797	0.03447

Tests of Effect Slices								
Effect	Mean	Sal	old	yrs65	Num DF	Den DF	F Value	Pr > F
Mean*Sal	High		0.00	0.00	1	166	55.20	<.0001
Mean*Sal	Low		0.00	0.00	1	159	180.96	<.0001
Mean*Sal		High	0.00	0.00	1	165	5.75	0.0176
Mean*Sal		Low	0.00	0.00	1	161	63.71	<.0001
Mean*Sal	High		1.00	0.00	1	105	55.05	<.0001
Mean*Sal	Low		1.00	0.00	1	104	24.60	<.0001
Mean*Sal		High	1.00	0.00	1	101	8.71	0.0039
Mean*Sal		Low	1.00	0.00	1	105	1.17	0.2821
Mean*Sal	High		1.00	10.00	1	105	55.05	<.0001
Mean*Sal	Low		1.00	10.00	1	104	24.60	<.0001
Mean*Sal		High	1.00	10.00	1	101	8.71	0.0039
Mean*Sal		Low	1.00	10.00	1	105	1.17	0.2821

As shown in the least squares means, all of the predicted means for someone age 65 vs. 75 differ by exactly $0.1488 = 10*\beta_8$ for the effect of years > 65.

As shown in the tests of effect slices, the tests are identical for 65-year-olds and 75-year-olds because the effects of meaning and salience do not differ by years over 65 in the final model, just by age group.