***Revisiting the Ramus data***

* Up to this point we’ve mainly consider simple random intercept models and time as a class variable.
* But really, what is the best model for the data?
  + We could try time as continuous.
  + We could try other covariance structures for **V** (combinatinos of **G** and **R**).
* Since there are 4 time points, **R***i* will be a 4×4 matrix. What are some structures we could use for it?

Compound symmetric (CS). If we do this, then we don’t need to include a random intercept, since the RI model with simple R is equivalent to the model without random effects and CS defined for R (easy to show).

Unstructured (UN). Most flexible and often the best for relatively few time points, but does it allow use more parameters than necessary?

First-order autoregressive [AR(1)]

Note that if time points are unequally spaced, a more general version can be used, called spatial power (SAS), or continuous AR(1) (R).

We could also try a random intercept plus an AR(1) structure. What does V look like for that?

For the Ramus data, here are the results of fitting different models. Model (4) provided the best AIC; model (7) reduced to (4) since the between-subject variance was estimated to be 0.

**Model of time Random effects Structure for R matrix AIC**

1. class random int. for boy Simple (Independent) 272.6
2. continuous (linear) random int. for boy Simple (Independent) 271.2
3. continuous (linear) none CS 271.2
4. continuous (linear) none AR(1) 239.1
5. continuous (linear) none UN 245.2
6. continuous (linear) random int. and slope for boy Simple (Independent) 271.4
7. continuous (linear) random int. for boy AR(1) 239.1\*

\*Subject variance estimated to be 0, associated parameter dropped; no penalty assessed in AIC.

\*repeated AR(1) for subject;

**proc** **mixed** data=long.ramus\_uni;

class boy;

model height = age / solution;

repeated / subject=boy type=ar(**1**);**run**;

Dimensions

Covariance Parameters 2

Columns in X 2

Columns in Z 0

Subjects 20

Max Obs Per Subject 4

Covariance Parameter Estimates

Cov Parm Subject Estimate

AR(1) boy 0.9542

Residual 6.8783

Fit Statistics

-2 Res Log Likelihood 235.1

AIC (smaller is better) 239.1

Solution for Fixed Effects

Effect Estimate SE DF t Value Pr >|t|

Intercept 33.7502 1.8415 19 18.33 <.0001

age 1.8633 0.2002 59 9.31 <.0001