Steps in model building

1. Define the dependent variable Y; define the levels of the data (subscripts ij and so on).

2. Include a constant in the model and define the coefficient of the constant (the intercept) to be random at all levels.

3. Estimate the model; this is the empty model (a variance-components model), to be used to estimate the variance at the different levels and as a point of reference for the other models.

4. Which explanatory variables belong in the model at level 1? Take care of categorical variables, i.e. construct dummy variables if needed. Consider centering of explanatory variables.

5. Enter the explanatory variables into the model, each with a fixed coefficient. Explanatory variables may be entered all as one set, or sequentially in subsets of one or more variables. The latter requires a rationale for distinguishing subsets of variables and a rationale for the particular sequence.

6. Estimate the models, look at significance, size and direction of individual parameters, look at the change in variances at all levels, and, maybe, compare nested models by the difference in deviances.

7. Check residuals of the final model. Consider, on prior grounds or from checking the data or the residuals, whether relationships are linear and additive. Consider possible nonlinearities or interaction effects. If needed include nonlinear relationships of interaction effects (between level-1 predictors) into the model and re-estimate.

8. Which explanatory variables belong in the model at level 2? Consider level-2 variables as well as aggregated level-1 predictors (e.g. group means). Level-2 predictors serve to explain intercept variance.

9. Estimate the models, look at significance, size and direction of individual parameters, look at the change in variances at all levels, and, maybe, compare nested models by the difference in deviances.

10. Do any of the *level-1 predictors* need a random slope? When adding a random slope, make sure (1) that the predictor still has a fixed parameter attached, and (2) that the random component is given for level 2 only.

11. Add cross-level interactions to explain slope variance.