Vocabulary Fun

▶ The varying coefficients are sometimes called random effects, since they are associated with distributional statements like $\alpha_j = N(\mathbf{Z}_j\gamma, \sigma_\alpha^2)$.

▶ The term fixed effects is more nebulous with different meanings from different authors:

   ▷ coefficients that are constant across individuals (most common definition)

   ▷ nuisance coefficients that are uninteresting but included

   ▷ coefficients in population models

   ▷ realized random variables

   ▷ MLE values assuming infinite group-level variance

  (see the discussion in G&H, p.245).

▶ Sometimes these models labeled as mixed effects models.

▶ Prescription: use multilevel models or hierarchical models with appropriate descriptor or detailed specification.

Vocabulary Overview

► For the data matrices, X_i for individual i in cluster j, and $\mathbf{Z}_j$ for cluster j, there are five canonical models that we will look at:

"Completely Pooled" $\qquad\qquad\qquad\qquad\qquad\quad$ $y_i = \beta_0 + \beta_1 \mathbf{X}_i + \gamma \mathbf{Z} + e_i$

"Fixed Effect" $\qquad\qquad\qquad\qquad\qquad\qquad\quad$ $y_i = \beta_{j0[i]} + \beta_1 \mathbf{X}_i + e_i$

"Random Effect" $\qquad\qquad\qquad\qquad\qquad\qquad$ $y_i = \beta_{j0[i]} + \beta_1 \mathbf{X}_i + \gamma \mathbf{Z}_j + e_i$

"Random Intercept and Random Slope" $\quad$ $y_i = \beta_{j0[i]} + \beta_{j1[i]} \mathbf{X}_i + e_i$

"Completely Unpooled' $\qquad\qquad\qquad\qquad\quad$ $y_{j[i]} = \beta_{j0} + (\beta_{j1} \mathbf{X}_{j[i]} + \gamma \mathbf{Z}_j) + e_{j[i]}$

► This is produced by replacing the previous γ coefficient names with common regression-style language.

► "Fixed" and "random" can differ in definition by literature (Kreft and De Leeuw 1988, Section 1.3.3, Gelman 2005), and better notation is "random intercepts" for "fixed effect," and "varying-intercept, varying-slope" for "random intercept and random slope."

► Best to conceptualize these specifications as members of a larger multilevel family where indices are *turned-on* or *turned-off* systematically depending on the hierarchical purpose.