Week 8 Special Cases of Random Effects
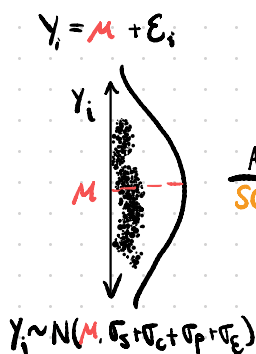
HIERARCHICAL MODELS

Some random effects are nested within others
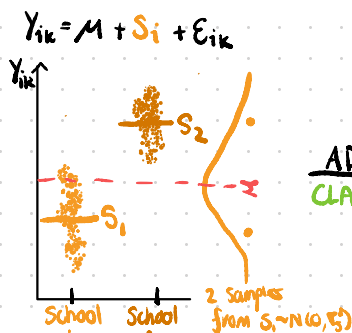
$$Y_{ikjl} = \underset{\substack{\text{Fixed} \\ \text{Global} \\ \text{Mean}}}{\mu} + \underset{\substack{\text{Random} \\ \text{School}}}{S_i} + \underset{\substack{\text{Random} \\ \text{Class}}}{C_{ik}} + \underset{\substack{\text{Random} \\ \text{Pupil}}}{P_{ikj}} + \underset{\substack{\text{Random} \\ \text{Error}}}{\varepsilon_{ikjl}}$$

Each of these are nested within the previous term

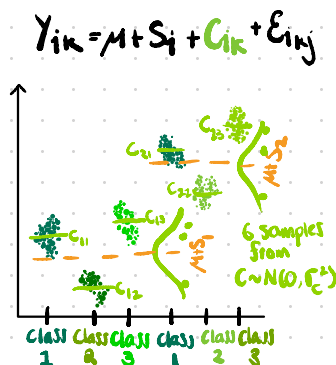The drawing is very similar to our basic case from week 7 (last week). I'm going to build it up with each random effect.

$Y_i = \mu + \varepsilon_i$

$Y_{ik} = \mu + S_i + \varepsilon_{ik}$

$Y_{ik} = \mu + S_i + C_{ik} + \varepsilon_{ikj}$

$\xrightarrow{\text{ADD} \atop \text{SCHOOL}}$

$\xrightarrow{\text{ADD} \atop \text{CLASS}}$

$Y_i \sim N(\mu, \sigma_S + \sigma_c + \sigma_p + \sigma_E)$

2 Samples from $S_i \sim N(0, \sigma_S)$

6 samples from $C \sim N(0, \sigma_c^2)$

School 1   School 2

Class 1 Class 2 Class 3 Class 1 Class 2 Class 3

Until we get to...

With nested distributions

① $S_i \sim N(0, \sigma_S)$

② $C_{ik} \sim N(0, \sigma_c)$

③ $P_{ikj} \sim N(0, \sigma_P)$

④ $\varepsilon_{ijkl} \sim N(0, \sigma_E)$

School 1   School 2