

The simplest form of the standard 3-stage hierarchical model in the context of MEP size modeling can be described as follows. Let there be  $N_P$  exchange sequences  $\{(x_i^j, y_i^j)_{i=1}^{n_j} \mid j = 1, 2 \dots N_P\}$  of MEP size  $y_i^j$  recorded at stimulus intensity  $x_i^j$  from  $j^{th}$  participant, for a total of  $N_P$  participants.

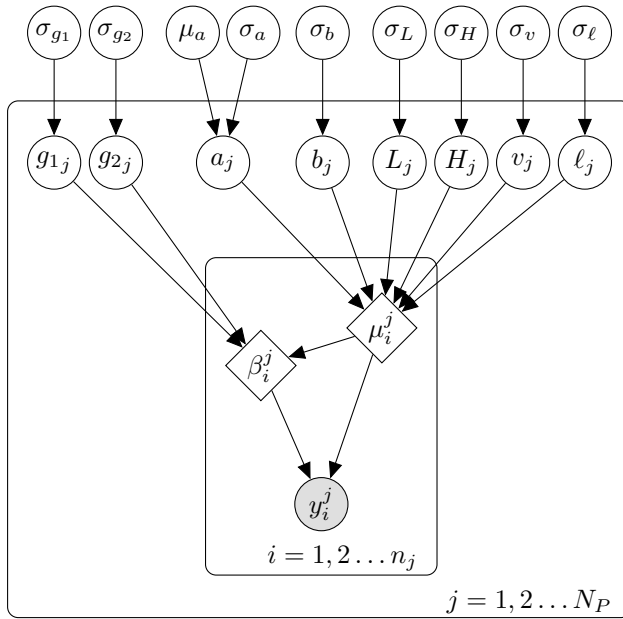
The first stage of hierarchy is the *participant-level* and specifies parametric model  $P(y_i^j \mid x_i^j, \theta_j)$  for each of the  $N_P$  sequences and models the MEP size  $y_i^j$  as a function of stimulus intensity  $x_i^j$  and participant specific parameters  $\theta_j$ . In the second stage,  $\theta_1, \theta_2 \dots \theta_P$  are assumed to be exchangeable and generated from a common distribution  $P(\theta_j \mid \gamma)$  with hyper-parameters  $\gamma$ . In the third stage, the hyper-parameters  $\gamma$  are assumed to be unknown and are assigned a non-informative prior density  $P(\gamma)$ .

$$y_i^j \mid x_i^j, \theta_j, \gamma \sim P(y_i^j \mid x_i^j, \theta_j, \gamma) \quad (4.3.1)$$

$$\theta_j \mid \gamma \sim P(\theta_j \mid \gamma) \quad (4.3.2)$$

$$\gamma \sim P(\gamma) \quad (4.3.3)$$

Figure 4.3.1 shows the graphical representation of the basic hierarchical model implemented by hbmeep (Section 5.1) for recruitment-curve fitting



$$y_i^j \mid x_i^j, \Omega_1^j \sim \mathcal{G}(\mu_i^j \cdot \beta_i^j, \beta_i^j)$$

$$\mu_i^j = \mathcal{F}(x_i^j \mid \Omega_1^j) \quad \beta_i^j = g_{1j} + \frac{\mu_i^j}{g_{2j}}$$

$$a_j \sim \mathcal{TN}(\mu_a, \sigma_a)$$

$$\theta_j \sim \mathcal{HN}(\sigma_{\theta_j}) \quad \forall \theta_j \in \Omega \setminus \{a_j\}$$

$$\mu_a \sim \mathcal{TN}(50, 20) \quad \sigma_a \sim \mathcal{HN}(30)$$

$$\sigma_{\sigma_L} \sim \mathcal{HN}(.05) \quad \sigma_{\theta} \sim \mathcal{HN}(5) \quad \forall \theta \in \Omega_2$$

$$\Omega_1^j = \{a_j, b_j, v_j, L_j, \ell_j, H_j, g_{1j}, g_{2j}\}$$

$$\Omega_2 = \{\sigma_L, \sigma_H, \sigma_v, \sigma_\ell, \sigma_{g_1}, \sigma_{g_2}\}$$