group level

$$\mu^k \sim \text{Normal}(XXX)$$
$$\sigma^k \sim \text{Uniform}(XXX)$$
$$\omega \sim \text{Beta}(1.1, 10.9)$$
$$\kappa \sim \text{Gamma}(0.01, 0.01)$$
$$\mu^\alpha \sim \text{Uniform}(0, 1000)$$
$$\sigma^\alpha \sim \text{Uniform}(0, 1000)$$

participant level

$$k_p \sim \text{Normal}(\mu^k, \sigma^k)$$
$$\epsilon_p \sim \text{Beta}_{(0,0.5)}(\omega(\kappa - 2) + 1, (1 - \omega)(\kappa - 2) + 1)$$
$$\alpha_p \sim \text{Normal}_{(0,+\infty)}(\mu^\alpha, \sigma^\alpha)$$

trial level

$$V_{pt}^A = \frac{A_{pt}}{1 + k_p D_{pt}^A}$$
$$V_{pt}^B = \frac{B_{pt}}{1 + k_p D_{pt}^B}$$
$$P_{pt} = \epsilon_p + (1 - 2.\epsilon_p).\Phi\left(\frac{V_{pt}^B - V_{pt}^A}{\alpha_p}\right)$$
$$R_{pt} \sim \text{Bernoulli}(P_{pt})$$