# Methods

| | |
|---|---|
| Agent Movement Onset Time Mean | $\mu_a$ |
| Agent Movement Onset Time Uncertainty | $\sigma_a$ |
| Reaction Time Mean | $\mu_{rt}$ |
| Reaction Time Uncertainty | $\sigma_{rt}$ |
| Movement Time Mean | $\mu_{mt}$ |
| Movement Time Uncertainty | $\sigma_{mt}$ |
| Neuromechanical Delay Mean | $\mu_{nmd}$ |
| Neuromechanical Delay Uncertainty | $\sigma_{nmd}$ |
| Stopping Time Uncertainty | $\sigma_\tau$ |
| Switch Time Mean | $\mu_{switch}$ |
| Switch Time Uncertainty | $\sigma_{switch}$ |

**Table 1.** Inputs to the model

| | |
|---|---|
| Reaction Time | $\mathcal{N}(\mu_{rt}, \sigma_{rt})$ |
| Movement Time | $\mathcal{N}(\mu_{mt}, \sigma_{mt})$ |
| Neuromechanical Delay | $\mathcal{N}(\mu_{nmd}, \sigma_{nmd})$ |
| Switch Time | $\mathcal{N}(\mu_{switch}, \sigma_{switch})$ |
| Agent Movement Onset Time | $\mathcal{N}(\mu_A, \sigma_A)$ |
| Stopping Time Uncertainty | $\sigma_\tau$ |

**Table 2.** Inputs to the model

$$f_X(x;\mu,\sigma) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}(\frac{x-\mu}{\sigma})^2} \tag{1}$$

$$P(u \leq X \leq v) = \int_u^v f_X(x;\mu,\sigma)dt \tag{2}$$

$$X \sim \mathcal{N}(\mu,\sigma) \tag{3}$$

$$\mu_A = \mathbb{E}[A] = \int_{-\infty}^{\infty} a \cdot f_A(a)dx \tag{4}$$

$$A \sim \mathcal{N}(\mu_A, \sigma_A) \tag{5}$$

$$T \sim \mathcal{N}(\tau, \sigma_\tau) \tag{6}$$

$$\mathbb{1}_{a \in S} = \begin{cases} 1, & \text{if } a \in S \\ 0, & \text{if } a \notin S \end{cases} \tag{7}$$

*where* $S = \{a \mid a < t;\ a, t \in \mathbb{R}\}$

$$\mu_{A_{react}} = \frac{\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} a \cdot p(a) \cdot p(t) \cdot \mathbb{1}_{a \in S} \; dxdt}{P(A < T)} \tag{8}$$

$$\sigma^2_{A_{react}} = \frac{\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} (a - \mu_{A_{react}})^2 \cdot p(a) \cdot p(t_j) \cdot \mathbb{1}_{a \in S} \; dx \; dt}{P(A < T)} \tag{9}$$

$$\mu_{mo_{react}} = \mu_{A_{react}} + \mu_{rt} \tag{10}$$

$$\sigma_{mo_{react}} = \sqrt{\sigma^2_{A_{react}} + \sigma^2_{rt}} \tag{11}$$

$$\mu_{mo_{guess}} = \tau + \mu_{nmd} + \mu_{switch} \tag{12}$$

$$\sigma_{mo_{guess}} = \sqrt{\sigma^2_{\tau} + \sigma^2_{nmd} + \sigma^2_{switch}} \tag{13}$$

$$R_{win} = 1 \tag{14}$$

$$R_{indecision} = 0 \tag{15}$$

$$R_{incorrect} = 0 \tag{16}$$

$$\begin{aligned} P(React) &= P(A < T) \\ &= P(A - T < 0) \\ &= P(Z < 0) \\ \text{where } Z &\sim \mathcal{N}(\mu_z, \sigma_z) \\ \mu_z &= \mu_A - \mu_\tau \\ \sigma_z &= \sqrt{\sigma^2_A + \sigma^2_T} \end{aligned} \tag{17}$$

$$P(G) = 1 - P(React) \tag{18}$$

$$\mu_{reach_{react}} = \mu_{mo_{react}} + \mu_{mt} \tag{19}$$

$$\sigma_{reach_{react}} = \sqrt{\sigma^2_{mo_{react}} + \sigma^2_{mt}} \tag{20}$$

$$\mu_{reach_{guess}} = \mu_{mo_{guess}} + \mu_{mt} \tag{21}$$

$$\sigma_{reach_{guess}} = \sqrt{\sigma^2_{mo_{guess}} + \sigma^2_{mt}} \tag{22}$$

$$\begin{aligned} P(Reach|React) &= P(X_{reach_{react}} < 1500) \\ \text{where } X_{reach_{react}} &\sim \mathcal{N}(\mu_{reach_{react}}, \sigma_{reach_{react}}) \end{aligned} \tag{23}$$

$$P(Reach|Guess) = P(X_{reach_{guess}} < 1500) \tag{24}$$
$$\text{where } X_{reach_{guess}} \sim \mathcal{N}(\mu_{reach_{guess}}, \sigma_{reach_{guess}})$$

$$P(Correct|React) = 1.0 \tag{25}$$
$$P(Correct|Guess) = 0.5 \tag{26}$$

$$P(Win|React) = P(Reach|React) \cdot P(Correct|React) \tag{27}$$
$$P(Win|Guess) = P(Reach|Guess) \cdot P(Correct|Guess) \tag{28}$$
$$P(Win) = P(React) \cdot P(Win|React) + P(Guess) \cdot P(Win|Guess) \tag{29}$$

$$P(Incorrect|React) = P(Reach|React) \cdot (1 - P(Correct|React)) \tag{30}$$
$$P(Incorrect|Guess) = P(Reach|Guess) \cdot (1 - P(Correct|Guess)) \tag{31}$$
$$P(Incorrect) = P(React) \cdot P(Incorrect|React) + P(Guess) \cdot P(Incorrect|Guess) \tag{32}$$

$$P(Indecision|React) = 1 - P(Reach|React) \tag{33}$$
$$P(Indecision|Guess) = 1 - P(Reach|Guess) \tag{34}$$
$$P(Indecision) = P(React) \cdot P(Indecision|React) + P(Guess) \cdot P(Indecision|Guess) \tag{35}$$

$$R_{win} = 1 \tag{36}$$
$$R_{indecision} = 0 \tag{37}$$
$$R_{incorrect} = 0 \tag{38}$$

$$\mathbb{E}[R] = P(Win) \cdot R_{Win} + P(Incorrect) \cdot R_{Incorrect} + P(Indecision) \cdot R_{Indecision} \tag{39}$$

$$\tau = \underset{\tau \in [0,2000]}{argmax}(\mathbb{E}[R]) \tag{40}$$