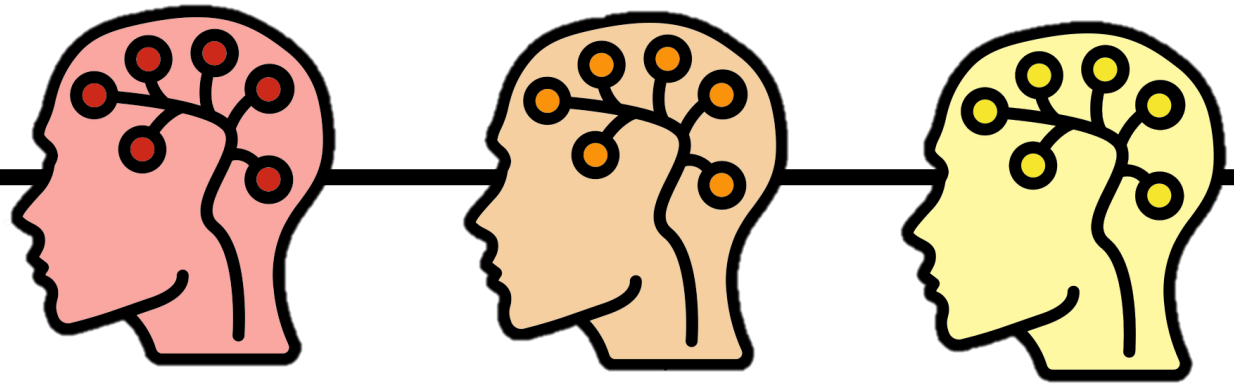
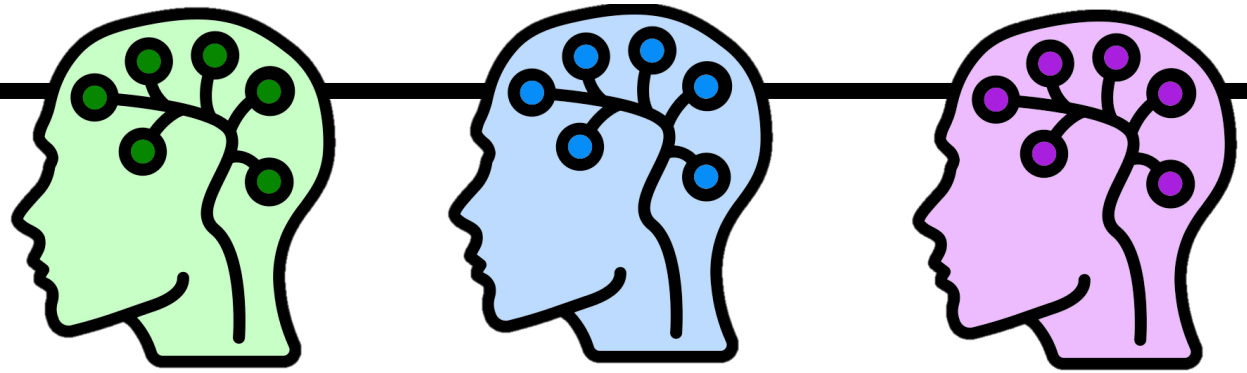
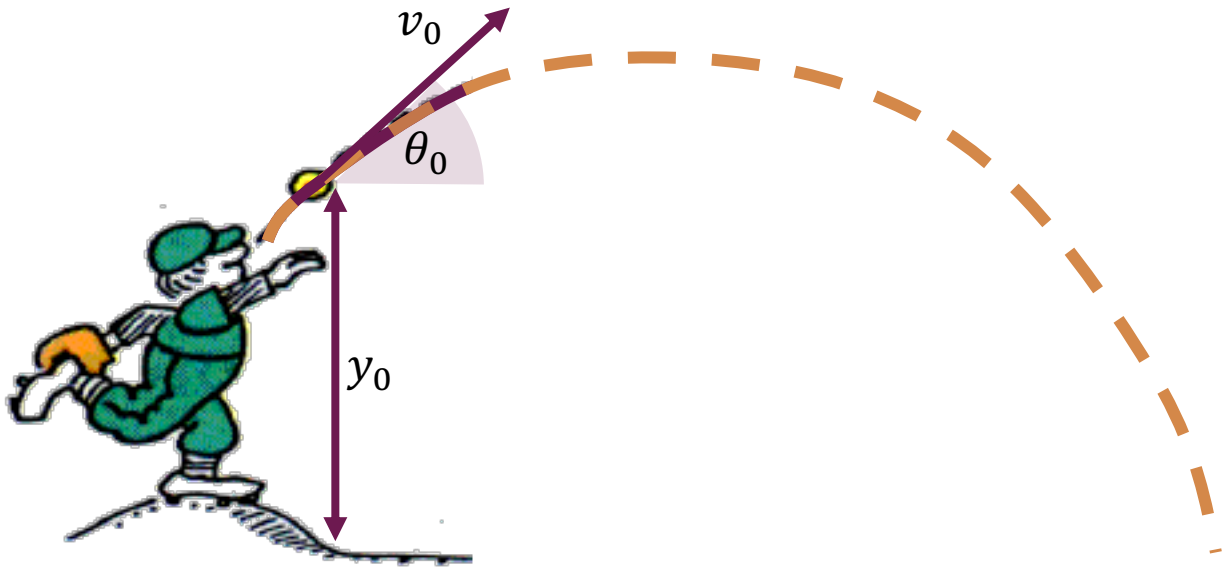


Modelling worskshop



What is computational modelling?



DATA

$Initial\ height\ (y_0)$

$Initial\ angle(\theta_0)$

$Initial\ speed(v_0)$

MODELS

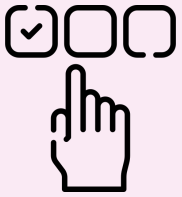
Observable variables → **Future data**

$$x_t = v_0 cos\theta_0 \cdot t$$

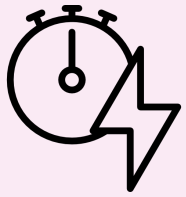
$$y_t = v_0 sin\theta_0 \cdot t - \frac{1}{2} g t^2$$

What is computational modelling? (in psychology)

DATA



choices



Reaction times

Eye movements

Neural data

MODELS

$$Q \leftarrow Q + \alpha(R - Q)$$

$$p_i = \frac{e^{\beta Q}}{\sum_{j=1}^{N} e^{\beta Q_j}}$$

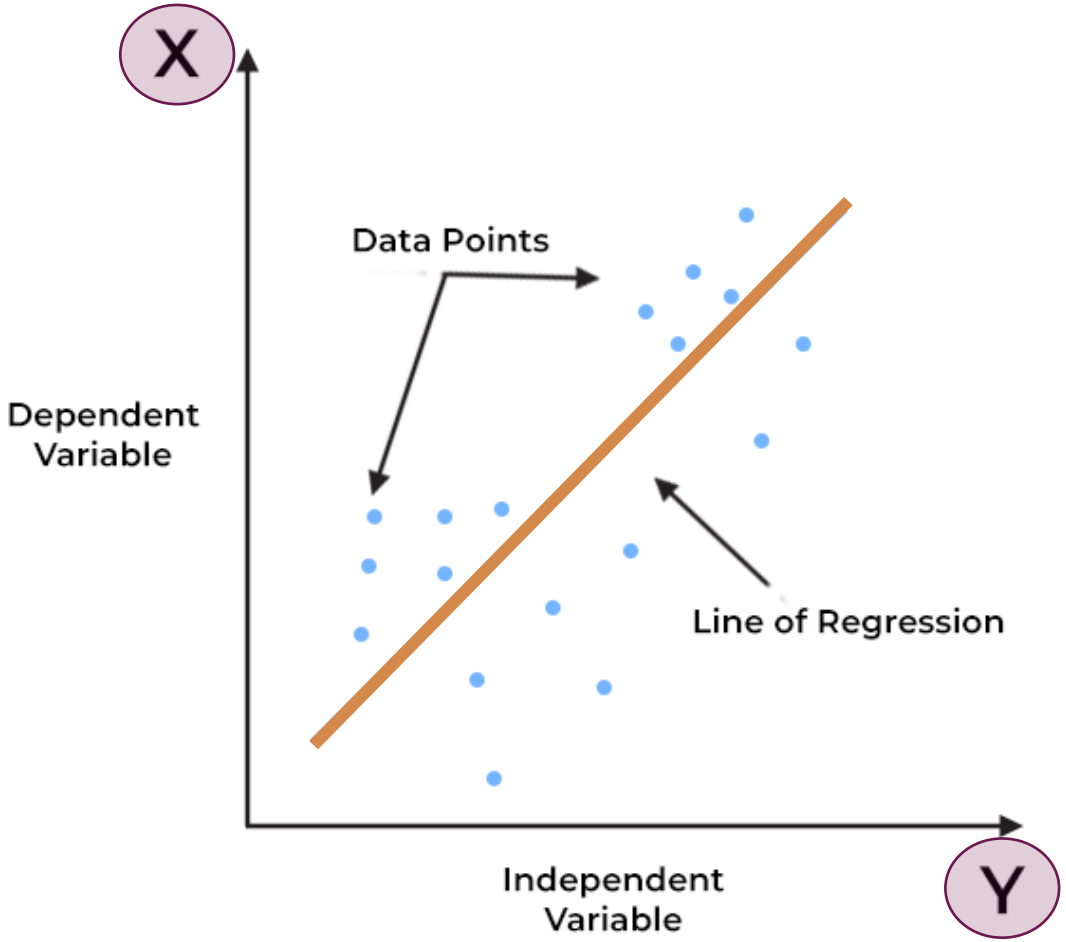
$$dx(t) = vdt + \sigma dW(t)$$

Observable variables

Stimuli
Outcomes
Past history
Time

→ **Future data**

You have probably done modelling before



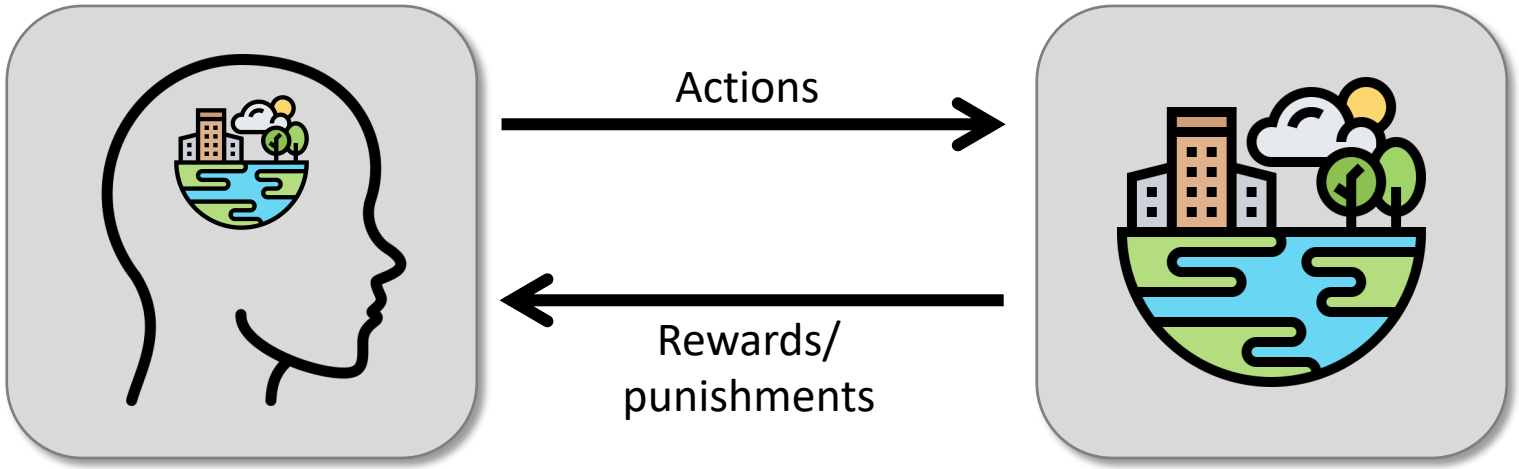
DATA

Dependent and
independent variables

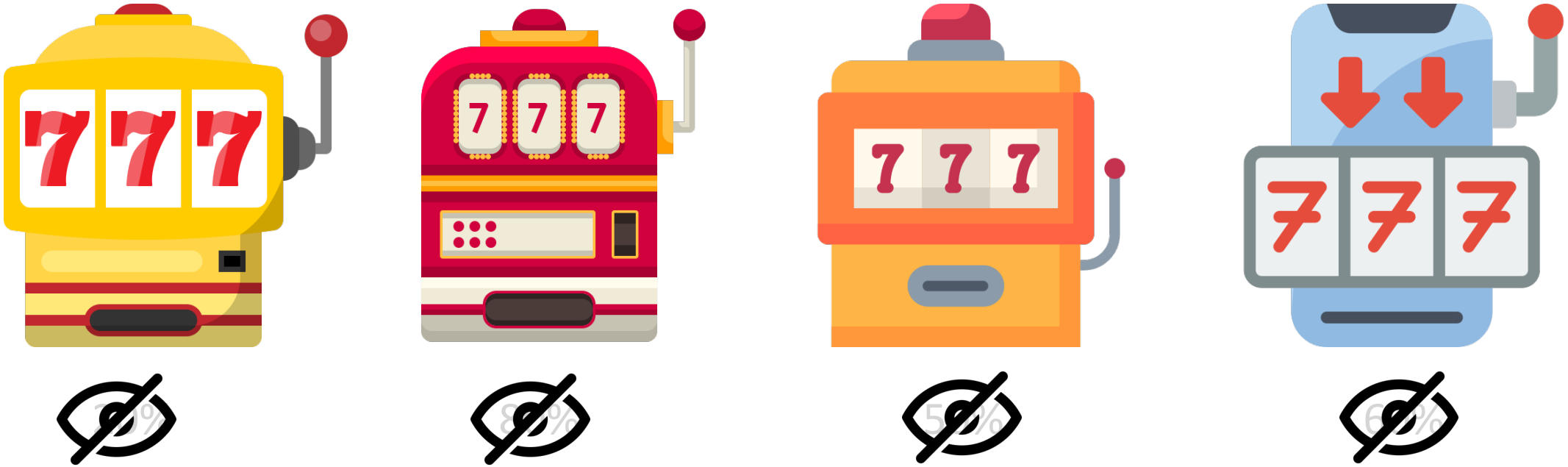
MODELS

$$y = \beta_0 + \beta_1 x + \epsilon$$

Here we will deal with reinforcement learning models (RL)

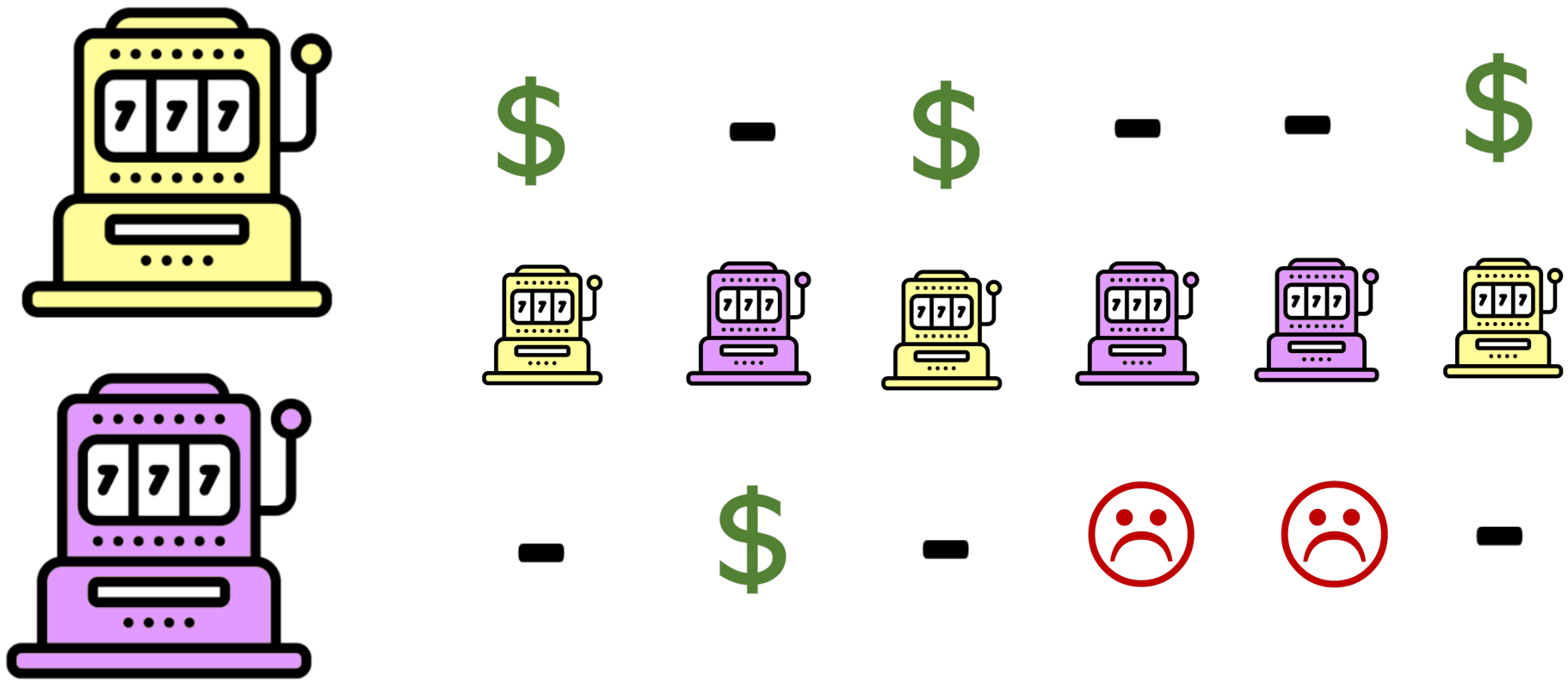


The n-armed bandit task



How often do they give a reward?

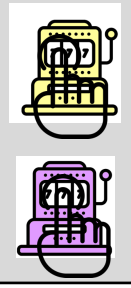
The 2-armed bandit task



Let’s learn how to model!

The Rescorla-Wagner model

R 1 0

a a^1 a^2 

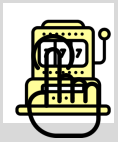
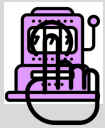
Q VALUE

α LEARNING RATE

$$\delta_t = R_t - Q_t$$

$$Q_{t+1} = Q_t + \alpha * \delta_t$$

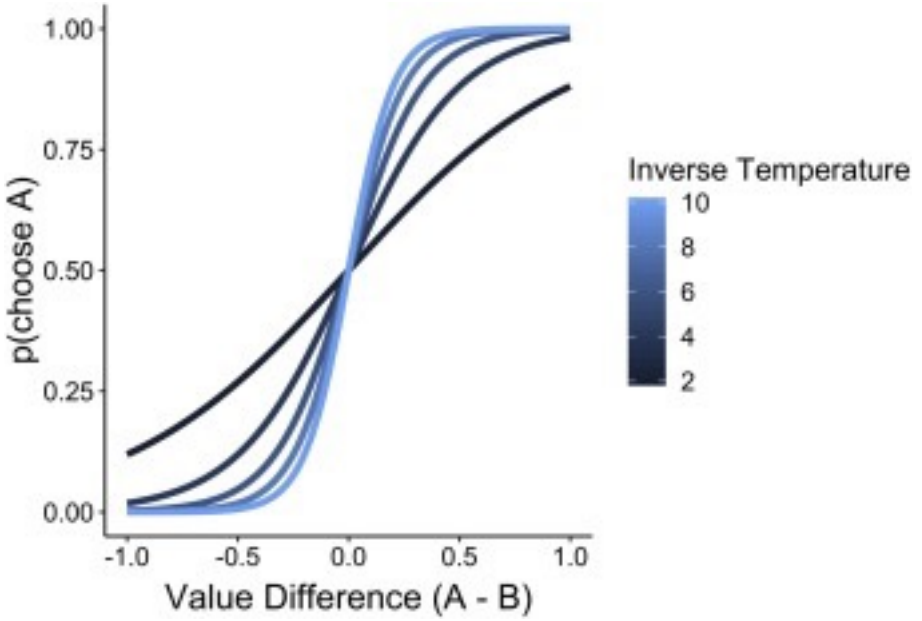
Choice rule

a a^1  a^2 

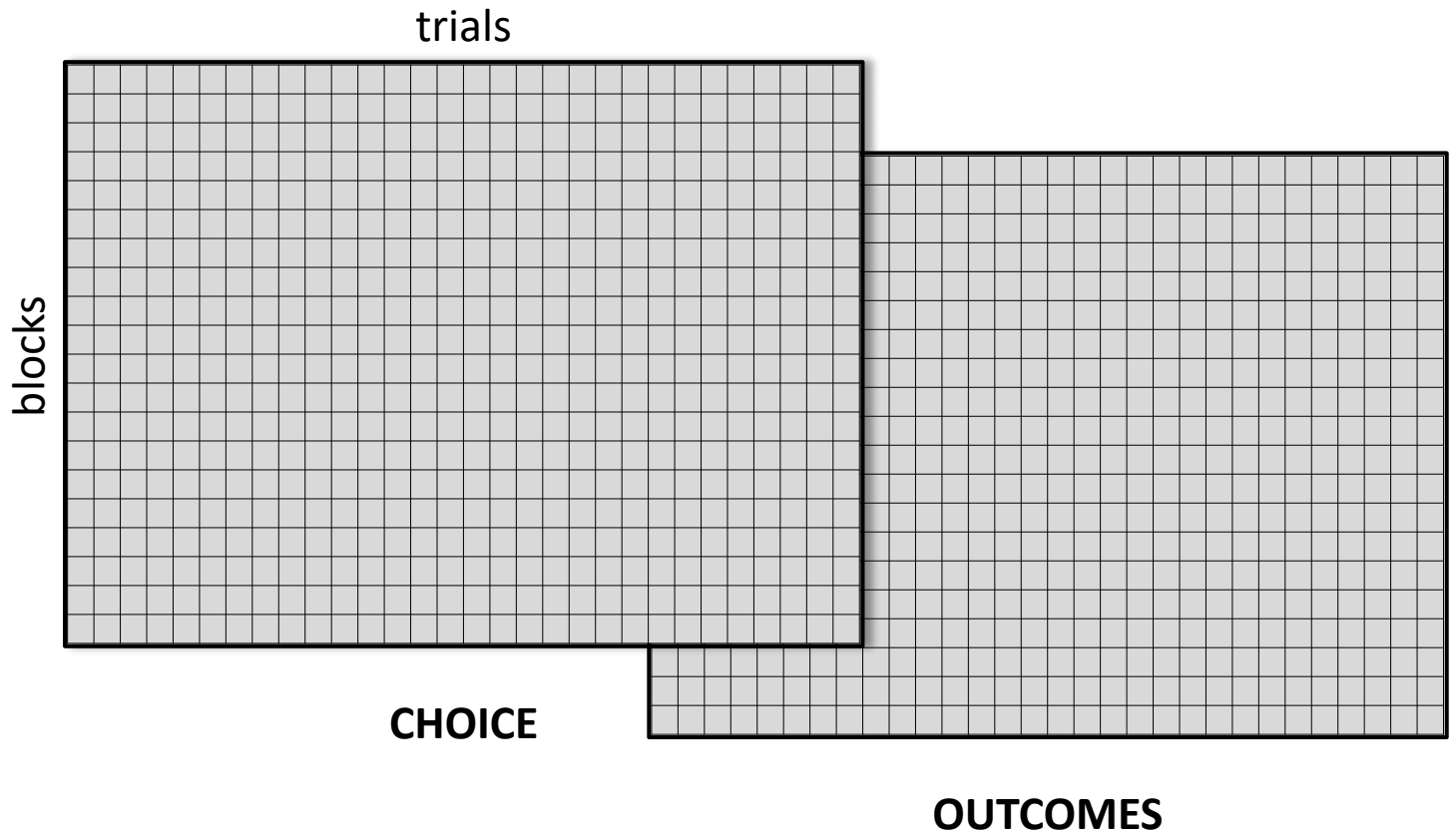
Q VALUES

β INVERSE TEMPERATURE

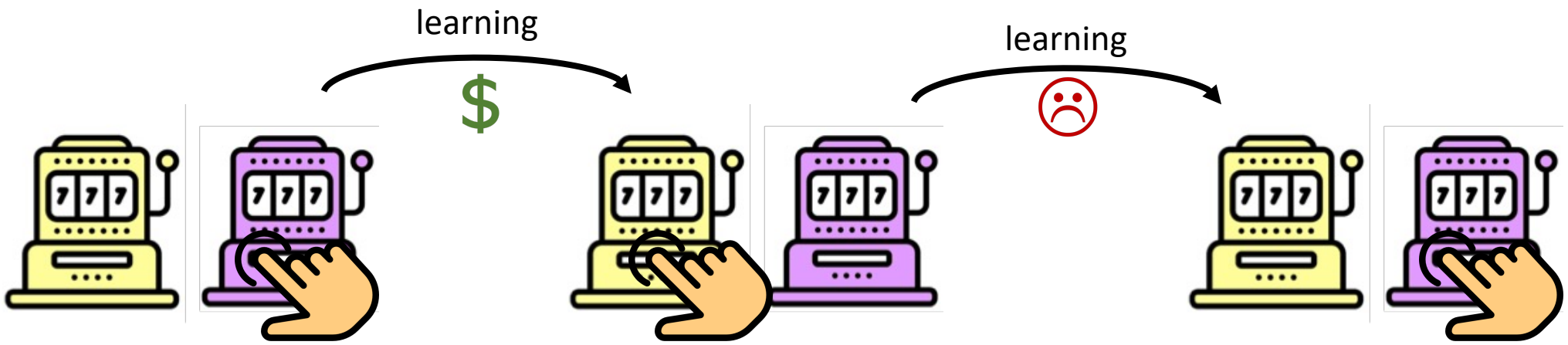
$$p(a^1) = \frac{1}{1 + e^{\beta * \left(Q(a^2) - Q(a^1)\right)}}$$



Our data



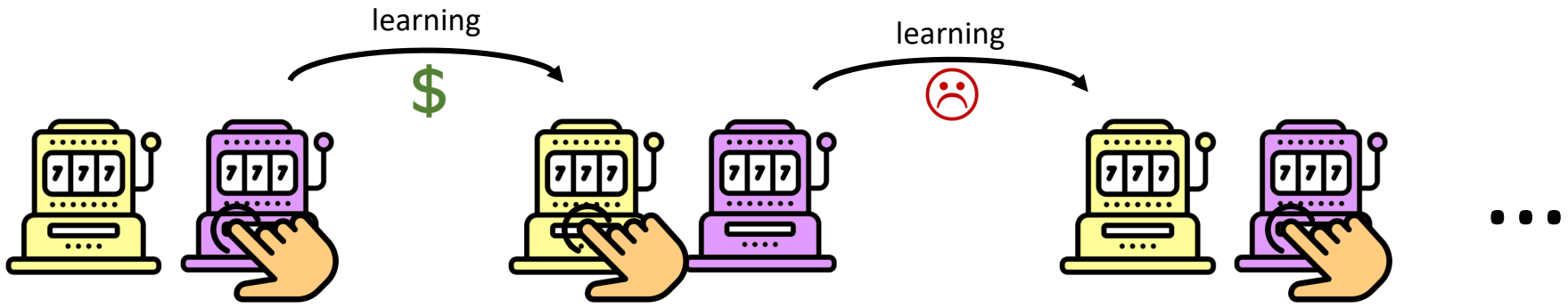
Probability of data



$p = 0.5$ $p = 0.3$ $p = 0.7$

$$p_{total} = 0.5 * 0.3 * 0.7 = 0.105$$

Probability of data



$$p_{total} = 0.5 * 0.3 * 0.7 * \cdots = 0.00000000 \ldots$$

$$\log(p_{total}) = \log(0.5 * 0.3 * 0.7 * \cdots) =$$
$$\log(0.5) + \log(0.3) + \log(0.7) + \cdots = -1020$$

Thank you!