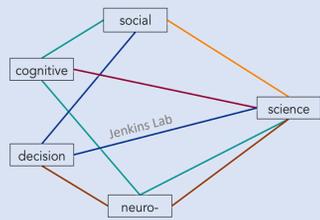


Effects of Social Context on Reward-based Learning

Huang Ham & Adrianna C. Jenkins
University of Pennsylvania
hamhuang@sas.upenn.edu



Motivation

- Humans can learn to produce behaviors that yield high rewards (**reward-based learning**), even subconsciously.
- Reward-based learning is sensitive to features of the learning context, including reward valence and magnitude¹.

How does information about **social context** affect reward learning?

- Monetary inequity** (advantageous, disadvantageous) and **social perception** (**warmth** and **competence**) are both known to shape economic decision-making². Do they also impact reward-based learning?

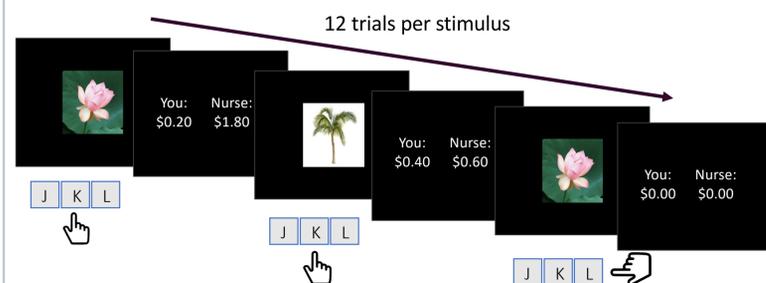


Experiment

Task: learn the rewardingness of pairs of stimuli (images) and actions (keyboard presses)³.

- In each of 8 sessions, participants encountered **5 images**, one at a time. For each, they pressed one of **three keyboard keys** and viewed the reward associated with the pairing.
- Known to subjects, each key press might generate \$0, \$1, or \$2 USD total. The reward would be split between the subject and another person, identified by social group information.
- Within each session, the split varied across the stimuli, and the social group information of the other person was fixed.
- Each block had different social group information, selected to cover a wide range of ratings of **warmth** and **competence**.
- Each subject was assigned either to the **advantageous condition**, where they always got more than 50% of the rewards, or the **disadvantageous condition**.

Sample: UPenn students, n = 41 in the advantageous condition and n = 53 in the disadvantageous condition.



People learn stimulus-action-outcome associations **better and faster** when they receive a larger share of the reward on each trial.

This effect of monetary inequity on learning arises early and continues over the course of learning.

Subjective value during learning is shaped by inequity, more than social perception, in a way that resembles effects during decision-making.

Candidate Models

We compared 3 computational models, all based on the reinforcement learning (RL) framework:

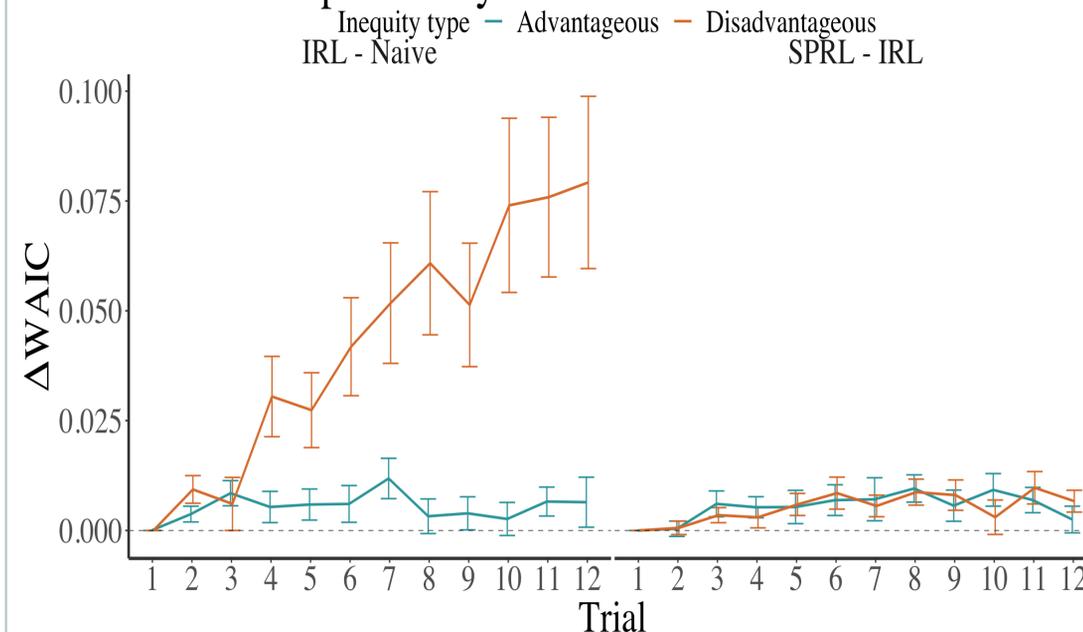
- Naïve RL: **ignores all social contextual information** and learns based on the total reward.
- Social Perception-weighted RL (SPRL)²**: allows subjective value to be shaped by **inequity and social perception**.
- Inequity-weighted RL (IRL)**: allows subjective value to be shaped by **inequity** (same as SPRL but ignores social perception).

Social Context	$\gamma = \gamma_0 + \gamma_w \text{warmth} + \gamma_c \text{competence}$	$u_t = r_t^{\text{self}} + r_t^{\text{other}}$
Learning	$Q_t[s_t, a_t] += \alpha(u_t - Q_t[s_t, a_t])$ $Q_{t+1}[s_t, a_t] += \phi(Q_0[s_t, a_t] - Q_t[s_t, a_t])$	
Action Selection	$\pi_t = \text{softmax}(\beta, Q_t[s_t])$	

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Model comparison by trial



Learning curves

