(In)Ability of the Win-Stay-Lose-Shift Heuristic to Predict Domain Differences in Exploratory Choice

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Motivation & Background

In decision-from-experience tasks, people tend to explore more in the domain of losses than gains (Krueger et al., 2017; Lejarraga & Hertwig, 2017). Operationalizing exploration as alternating between options and fitting behavioral data, the Win-Stay-Lose-Shift (WSLS) heuristic has been found to describe asymmetries in human exploratory choice behavior well. However, the exact mechanisms that allow the WSLS heuristic to account for these domain differences remain unclear. In the current study, we use simulated decision-makers to investigate whether and under which conditions the WSLS heuristic predicts domain differences in exploratory choice.

Research Question

How can the WSLS heuristic predict domain differences in exploratory choice?

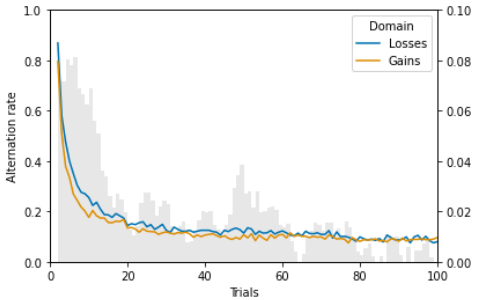
Method

- Decision-from-experience task with two options and 100 trials: 1 safe option with outcome S; 1 risky option (R) with high outcome with probability p and low outcome with probability 1-p
- Simulations: 1 million subjects
- Variables of interest: Expected value (EV) by option, EV differences, probability

Findings

True Alternation Rate

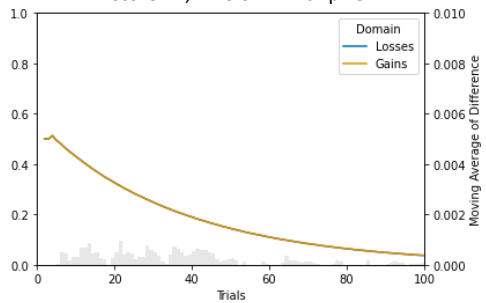
(Erev et al., 2010; Lejarraga & Hertwig, 2017)



More alternation in domain of losses than gains

Predicted Alternation Rate

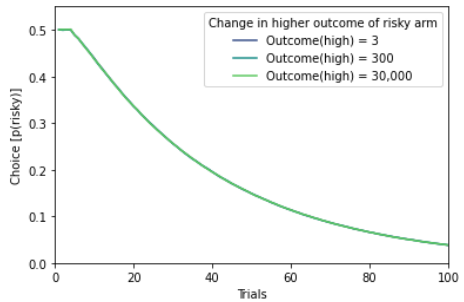
Gain: S: 2, R: 1 or 2 with p=.5;
Loss: S: -2, R: -3 or -1 with p=.5



WSLS does not predict domain differences of alternation

Predicted Choice Varying EV

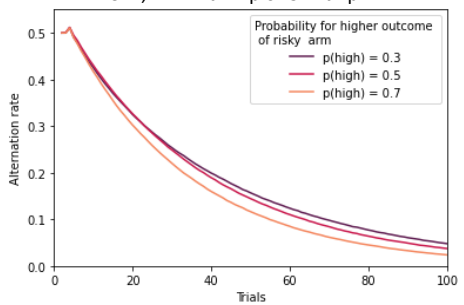
S: 2, R: Outcome(high) with p or 1 with 1-p



WSLS is not sensitive to EV and prefers the safe option

Predicted Alternation Rate Varying Probabilities

S: 2, R: 1 with 1-p or 3 with p



WSLS is sensitive to changes in the number of relative wins and losses

WSLS Heuristic

- Probability to stay given a relative win and shift given a relative loss are updated on every trial
- A relative win is defined as an outcome equal or greater to the outcome of the previous trial; relative loss is less than previous outcome
- If relative win:

$$p(stay|win)_{t+1} = p(stay|win)_t + \theta_{p(stay|win)_t} * (1 - p(stay|win)_t)$$
$$p(shift|loss)_{t+1} = (1 - \theta_{p(shift|loss)_t}) * p(shift|loss)_t$$

- If relative loss:

$$p(shift|loss)_{t+1} = p(shift|loss)_t + \theta_{p(shift|loss)_t} * (1 - p(shift|loss)_t)$$
$$p(stay|win)_{t+1} = (1 - \theta_{p(stay|win)_t}) * p(stay|win)_t$$

p = probability, t = trial, θ = change in p per trial

- Simulation uses symmetric starting p =.5, θ=.2

Discussion

In contrast to human decision-makers, simulated decision-makers who act according to the WSLS heuristic do not tend to explore more in the domain of losses than gains. Moreover, simulated decision-makers ignore information about the magnitude of EVs and are risk averse. Generalizations about the ability of the WSLS heuristic to be able to predict and account for human exploratory choice behavior should be avoided as the WSLS heuristic's performance heavily depends on design elements such as EV and probabilities of decision-making task.

References

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