Sequential sampling and utility maximization in risky choice

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Zoom link: https://upenn.zoom.us/j/92688645277?pwd=Wm43bVBTWlVDVndCRVRKOUlSaFBMUT09

INTRO

- **Multiplicative utility maximization theories** assume some form of interaction between payoffs and their corresponding probabilities in risky choice (e.g., EV, EUT and CPT).
- **Sequential sampling and additive evidence accumulation models** treat probabilities and payoffs separately with no explicit interaction between payoffs and probabilities (e.g., drift-diffusion model).
- **The binding problem**: In the absence of the multiplicative interactions between payoffs and probabilities in the attentional process, sequential sampling models are unable to make utility-maximizing predictions for complex risky decisions.

PROPOSED MODEL

- **Interactive sampling**: Attending to high probability makes it more likely to attend to corresponding payoff.

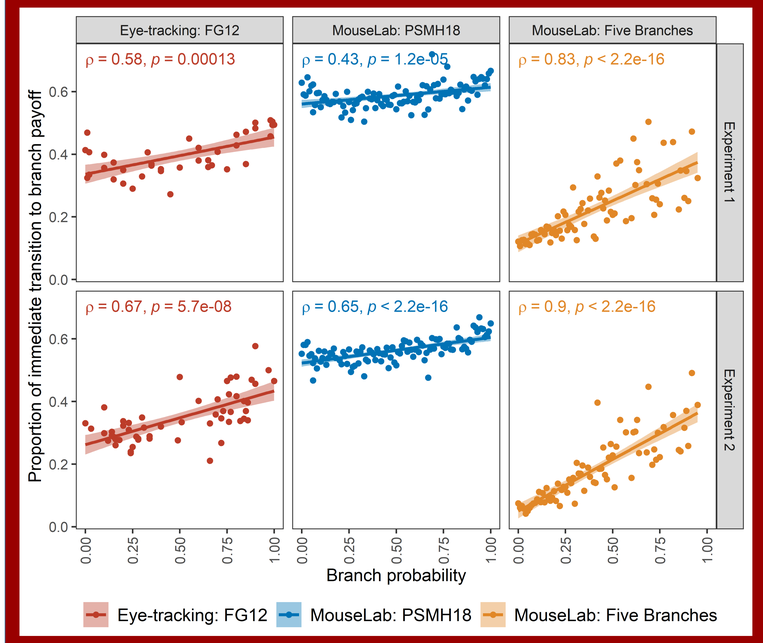

Fig. 1. Aggregate attention transition suggests that transition probabilities to payoffs depend on their corresponding branch probabilities.

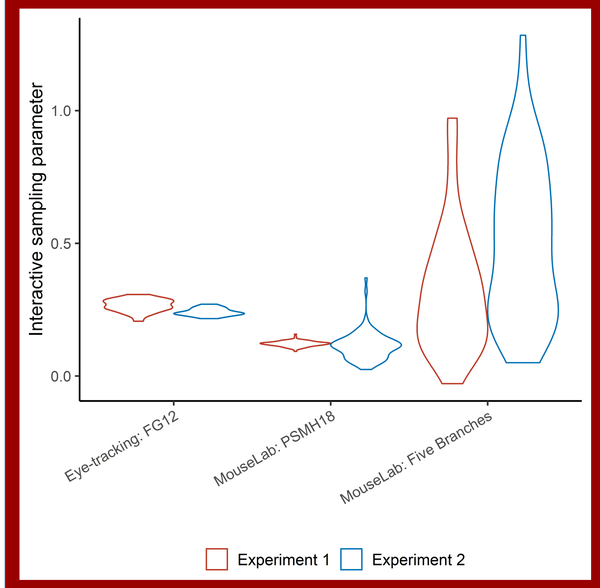

Fig. 2. Hierarchical Bayesian estimation shows positive interactive sampling parameter (controlling for many variables)

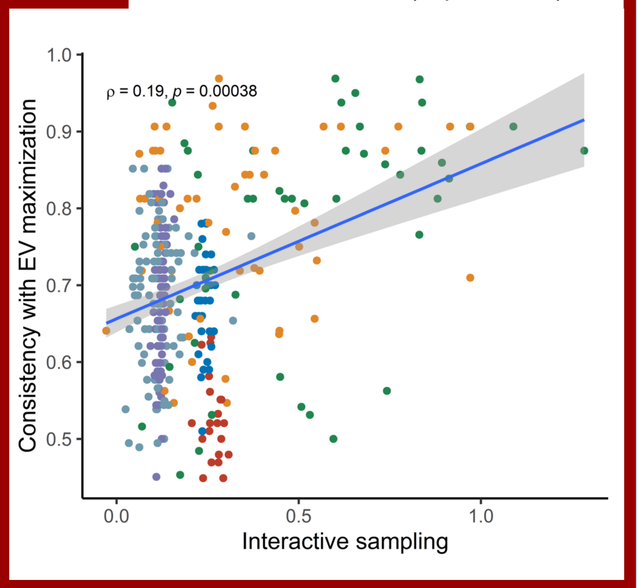

Fig. 3. Interactive sampling predicts expected value maximizing choice at the individual level.

DATA

- **Eye-tracking**: Fiedler & Glockner (2012), Experiments 1 (***N***=21) and 2 (***N***=36)
- **MouseLab**: Pachur et al. (2018), Experiments 1 (***N***=90) and 2 (***N***=90)
- **MouseLab**: Five-branch gambles, Experiments 1 (***N***=54) and 2 (***N***=49)

RESULTS

- On aggregate, attending to a high probability increases the likelihood of sampling the payoff from the same branch (see **Fig. 1**).
- In a Markov model of attention dynamics, which assumes that the transitions between the attentional states depend on a large number of variables, including, crucially, the values of the most recently attended probability (which represent the interactive sampling mechanism), we find almost all participants display positive interactive sampling tendency (see **Fig. 2**).
- Individual-level interactive sampling predicts expected value maximizing choice (see **Fig. 3**).

CONCLUSION

- We propose an interactive sampling mechanism to solve the binding problem for complex risky choice and validate the model with six process tracing data.