What Causes Enhanced Processing of High-Value Options?

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BACKGROUND

- In both perceptual and value-based decisions, response times (RTs) become faster as stimulus magnitude increases
- Shevlin et al. (2022) identified a novel, positive relationship between accuracy and value magnitudes where accuracy rates increased for higher-value stimuli
- This project will explore whether this effect is driven by motivational factors such as an experiments' incentive structure
- We hypothesized that providing decision-makers with a fixed, accuracy-based reward will reduce the positive value magnitude effect on accuracy rates

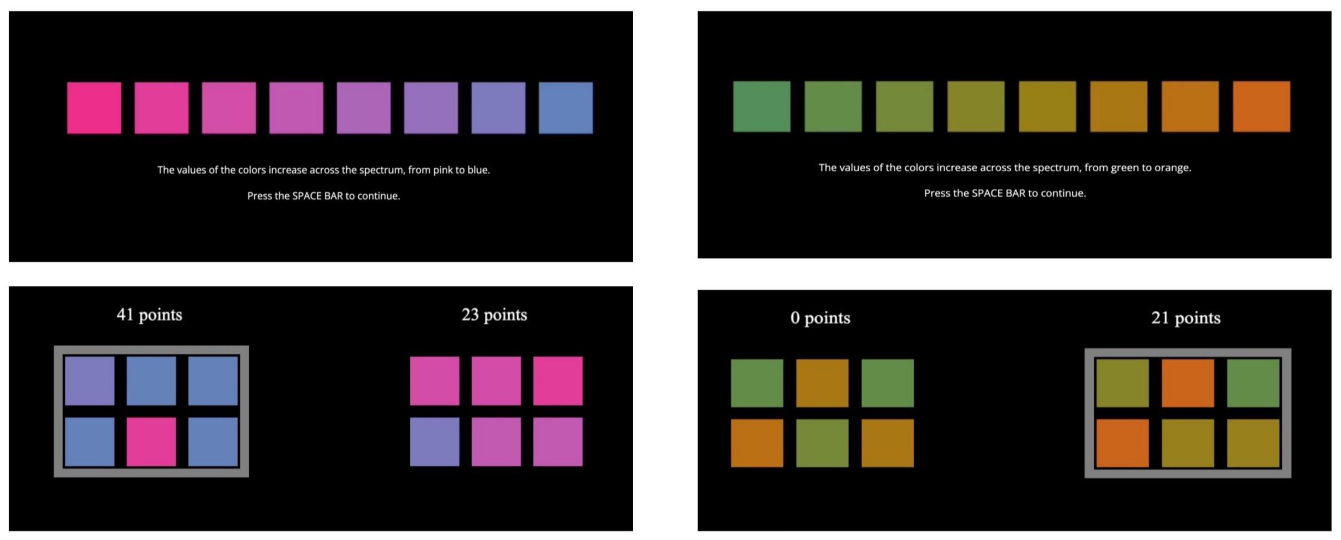
METHODS

- Participants (n=50) completed 300 trials, choosing between 2 x 3 arrays of color blocks where each color was assigned a point value. Participants first learned the color values
- Participants completed two types of decisions in a random order:

1) Value-Based Reward Blocks: Participants received the value of the chosen option in one randomly-selected trial

2) Accuracy-Based Reward Blocks: Participants received a fixed reward if they chose the better option in one randomly-selected trial

- The rainbow-color, color-spectrum value, phase order, and stimulus construction are randomized across subjects



Value-Based Reward Accuracy-Based Reward

Figure 1. Example screenshots from experiment

Top images display the color rainbows used in the task. Colors gradually changed across a perceptually uniform color spectrum (left: pink to blue; right: green to orange) to reflect increases or decreases in point values. Bottom images show practice trials in the value-based reward blocks (left) and accuracy-based reward blocks (right).

RESULTS

- We used a generalized linear model (GLM) with subject-level, mixed effects fit by maximum likelihood estimation to predict the probability of choosing the better option. We used a linear model with subject-level, mixed effects to predict log-transformed RTs
- Participants performed worse on trials in the second condition of the experiment, regardless of which condition was shown first ($\beta = -0.002$, $p = .001$)
- We accounted for this order effect in our GLM and found that the value magnitude effect was significantly positive for accuracy in the Value-Based Reward Block ($\beta = 0.101$, $p = .026$) and non-significantly positive in the Accuracy-Based Reward Block ($\beta = 0.074$, $p = .113$). Larger value magnitudes decreased RTs in both conditions (Value-Based: $\beta = -0.094$, $p = .0001$; Accuracy-Based: $\beta = -0.095$, $p = .0001$)
- There was no significant difference across conditions in the effect of value magnitude on accuracy rates ($\beta = -0.028$, $p = .665$) or RTs ($\beta = -0.017$, $p = .858$)

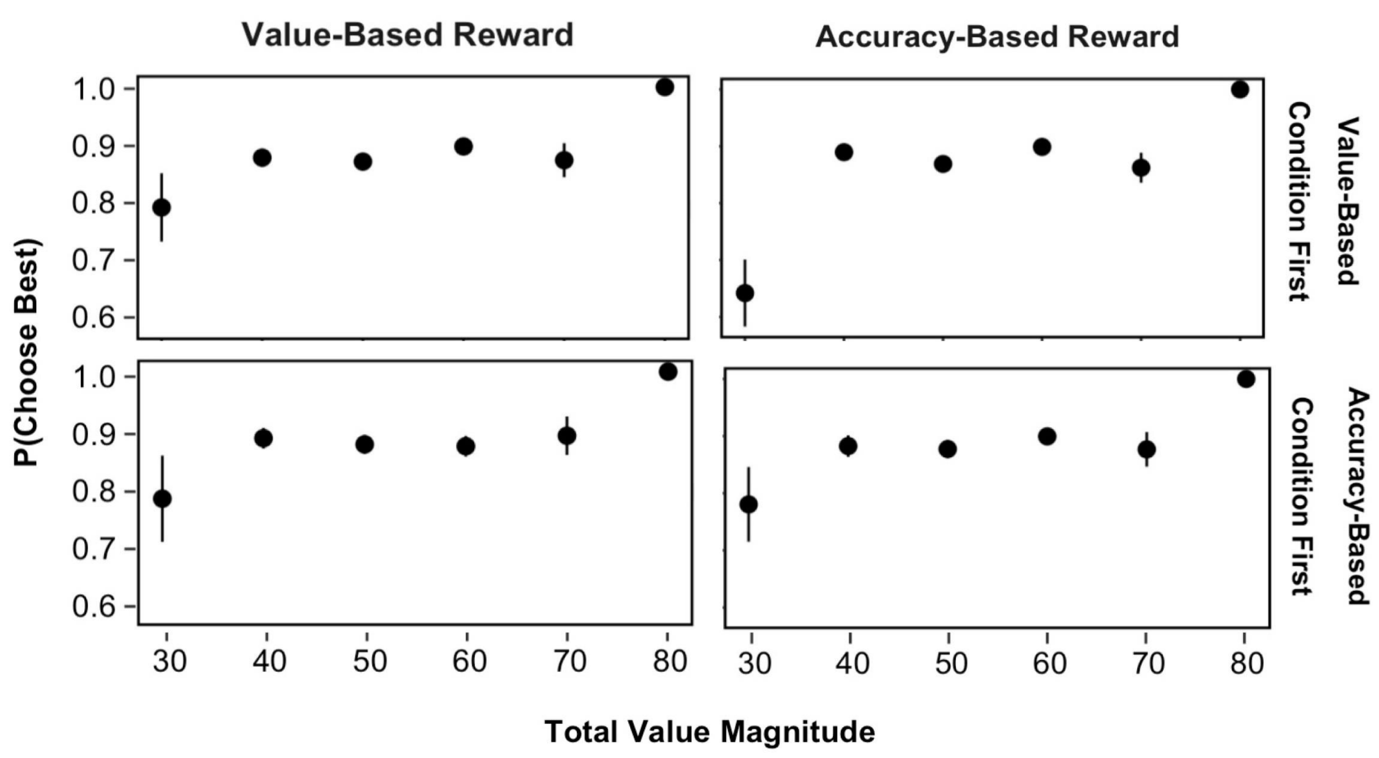


Figure 2. The effect of total value magnitude on accuracy rates.

Larger value magnitudes increased accuracy rates. However, we found that participants were less accurate in later trials, which reduced the value magnitude effect. Independent of condition order, we still observed a positive effect of value magnitude on accuracy rates.

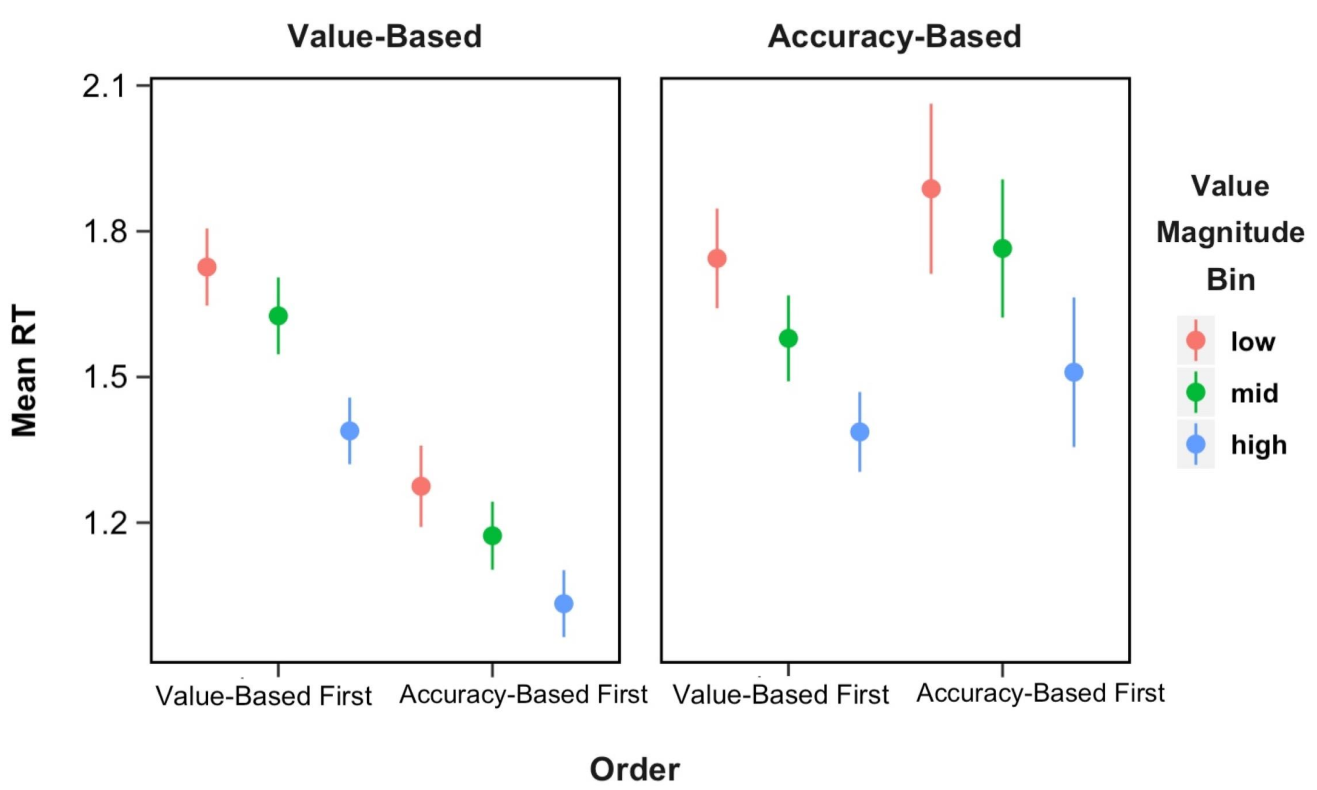


Figure 3. Participants' response times across experimental conditions.

Larger value magnitudes consistently decreased RTs. Participants responded faster in the condition they completed second.

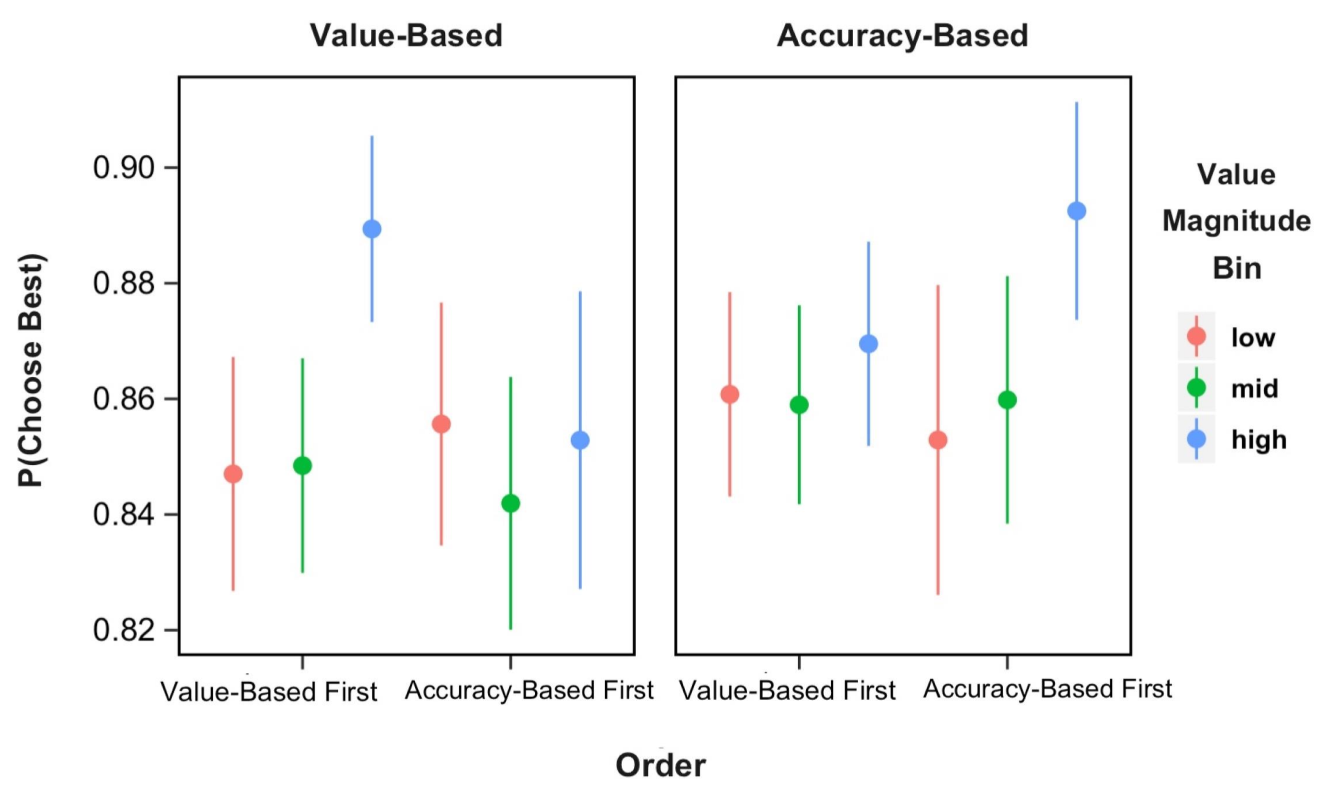


Figure 4. Participants' accuracy probabilities across experimental conditions.

Accuracy was higher for trials with larger value magnitudes when either reward condition was completed first. This value magnitude effect was reduced in the condition participants completed second. We account for this order effect in our GLM.

CONCLUSIONS

In this study, we explored whether motivational factors can influence the value magnitude effect on accuracy rates and RTs. We found a significant effect where larger value magnitudes increased accuracy rates in the Value-Based Reward condition but not in the Accuracy-Based Reward condition. However, after accounting for the order effect, we did not observe significant differences in the value magnitude effects across conditions. We will repeat the experiment with changes to the feedback process, including informing the participant of their rewards throughout the experiment and providing a fixed reward as feedback in the training phase of the Accuracy-Based Reward condition.

ACKNOWLEDGEMENTS

Funding: NSF Career Award 1554837 awarded to I.K., OSU Decision Sciences Collaborative Grant, and OSU Undergraduate Research Scholarship Grant