Predictiveness and Reward Effects on Attention can be Explained by a Single Mechanism

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The authors have withdrawn their manuscript because of a failure to replicate its main empirical result. Therefore, the authors do not wish this work to be cited as a reference. If you have any questions, please contact the corresponding author.

Details

We are withdrawing this manuscript because of a failure to replicate its main empirical result, viz. a reversal of the value effect reported by (Le Pelley et al., 2013) when the difference between good and bad outcomes was much smaller on high-value trials than on low-value trials (Experiment 2).

In the manuscript we report two implementations of Experiment 2. Experiment 2-a gave a marginal effect with a small sample size, while Experiment 2-b confirmed that effect in a larger sample.

In our initial experiments, many participants were unable to complete the task due to our stringent learning criteria. For that reason, the reviewers asked to replicate Experiment 2 again using a design that included all participants.

Our first attempt to replicate Experiment 2 in response to the reviewers did not yield any detectable attention effect. The experiment was performed in our laboratory instead of online and the participants were not paid based on their performance, but otherwise it was identical to the version described in the manuscript. Additional experiments in our laboratory confirmed that the participants did learn the difference between high and low value outcomes (which is a pre-requisite for value-based attention effects) even without monetary reward, and showed learned predictiveness (Lochmann and Wills, 2003) and inverse base rate effects (Medin and Edelson, 1988) previously reported in the literature.

We hypothesized that the task previously used in Experiment 2 was too difficult, and therefore re-designed it, changing the cover story, trial order etc. in ways that improved learning but would not be expected to affect attention dynamics. In two separate attempts to replicate Experiment 2 using this re-designed task, we not only failed to replicate the original result (greater attention to low-value cues with a large difference between outcomes), but obtained a robust effect in the opposite direction (greater attention to high-value cues with a small difference between outcomes) ($t_{184} = 3.09, p = .0023, d = 0.23$; $t_{55} = 5.76, p < .0001, d = 0.77$). We also ran another version of Experiment 1 (greater attention to high value/large outcome difference cues) using the new task design and replicated that result ($t_{106} = 5.38, p < .0001, d = 0.52$).

Given that we were unable to replicate our main empirical result, we are withdrawing this paper from Biorxiv. Either the initial result of Experiment 2 was a type 1 error, or was sensitive to subtle details of experimental procedure or population that we do not understand that prevent it from being theoretically useful. Given the mixed results of Experiment 2, it does not allow us to decide whether CompAct or the derived attention model gives a better explanation of value effects in learning. In our second attempt to replicate Experiment 2 using the revised design, we also had participants complete an inverse base rate effect task (based on Kruschke, 1996). This single group of participants produced a strong preference for high value/small difference cues - as predicted by the derived attention model - and a robust inverse base rate effect ($t_{60} = 7.73, p < .001, d = 0.99$) - as predicted by CompAct. It may be that neither model in its current form is adequate to explain the full array of attention effects on human learning.

References

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