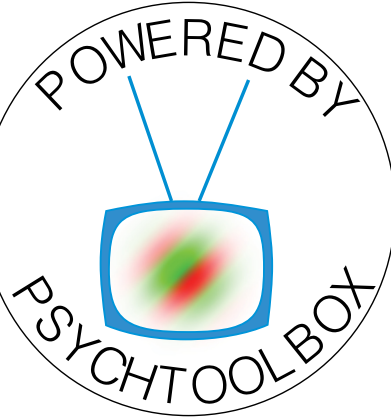
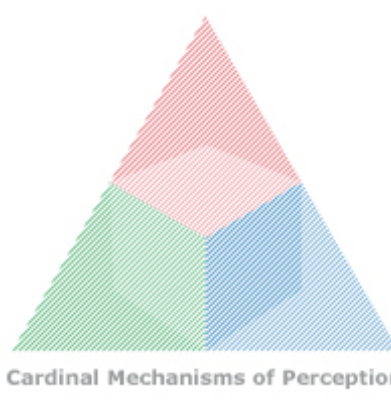


# Trade-off between search costs and accuracy in a visual and manual search task

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## Introduction

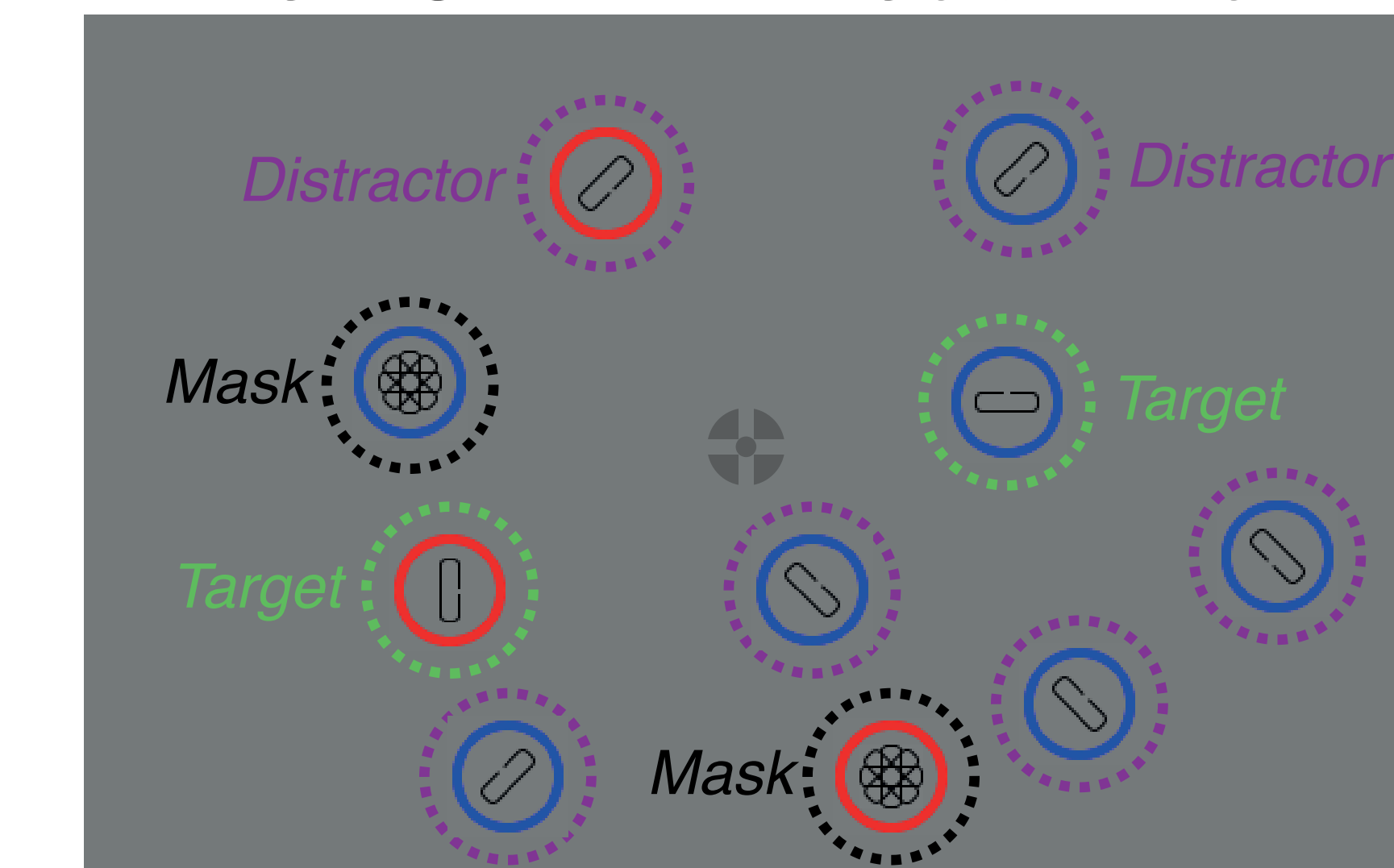
- While one study showed similarities in exploration behavior with eyes and fingers [1], another study found differences due to higher costs of manual actions [2]
- For decision-making in visual search, ~~one study~~ demonstrated a trade-off between discrimination difficulty and the temporal costs of eye movements [3]
- Is this trade-off specific for eye movements, or does it generalize to manual actions?**

## Methods

**Task:** find one of the two targets and discriminate the gap location; choose freely between targets, and complete as many trials as you can in 6:30 min.

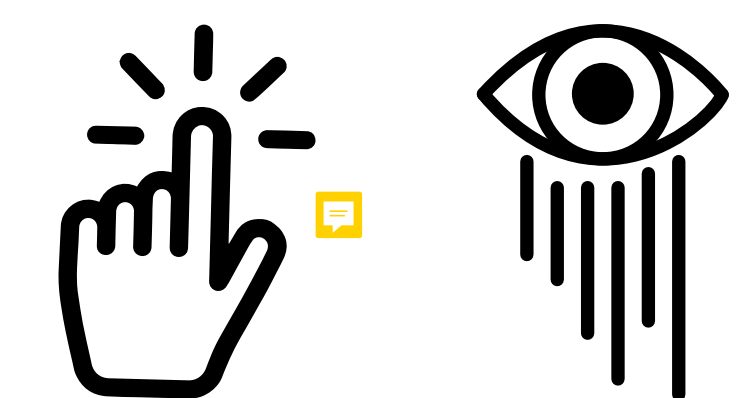
Ten stimuli in each trial

Feedback after each trial

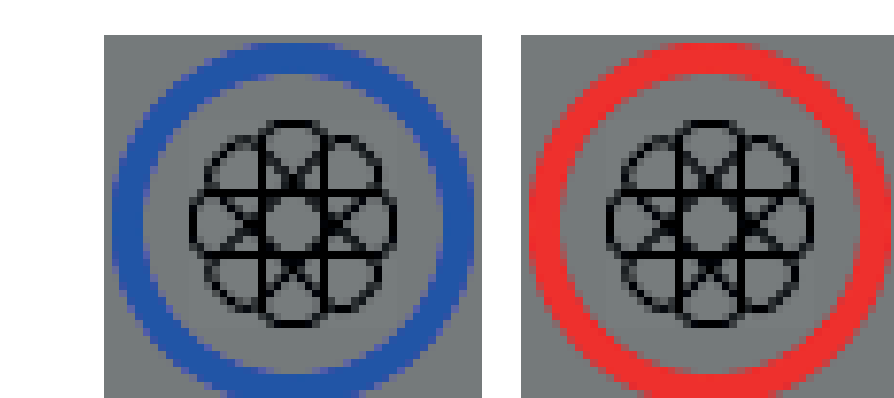


Time

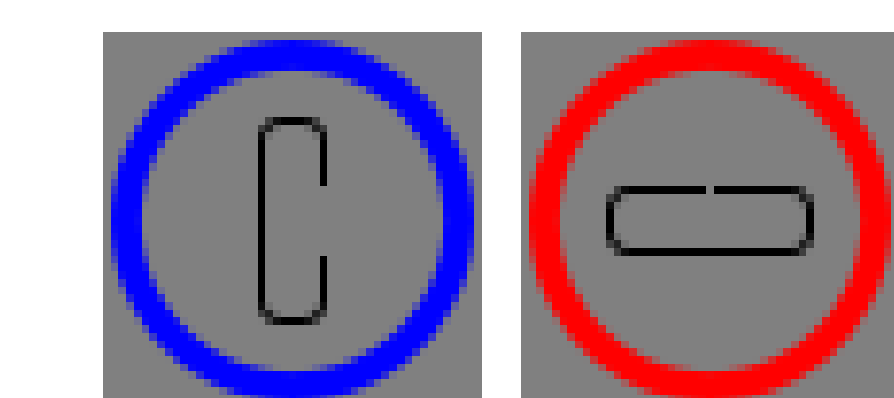
+/- 0.02€ Reward/punishment for right/wrong resp.



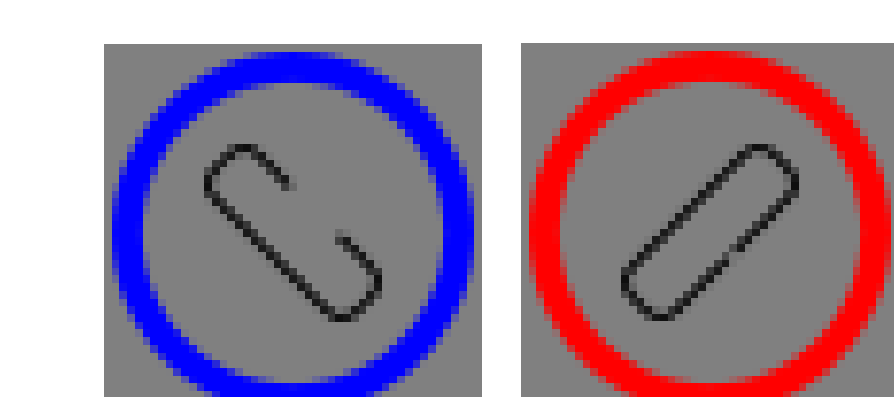
Two conditions: use finger taps (manual search) or eye movements (visual search)



Stimuli are masked, unless fixated or touched

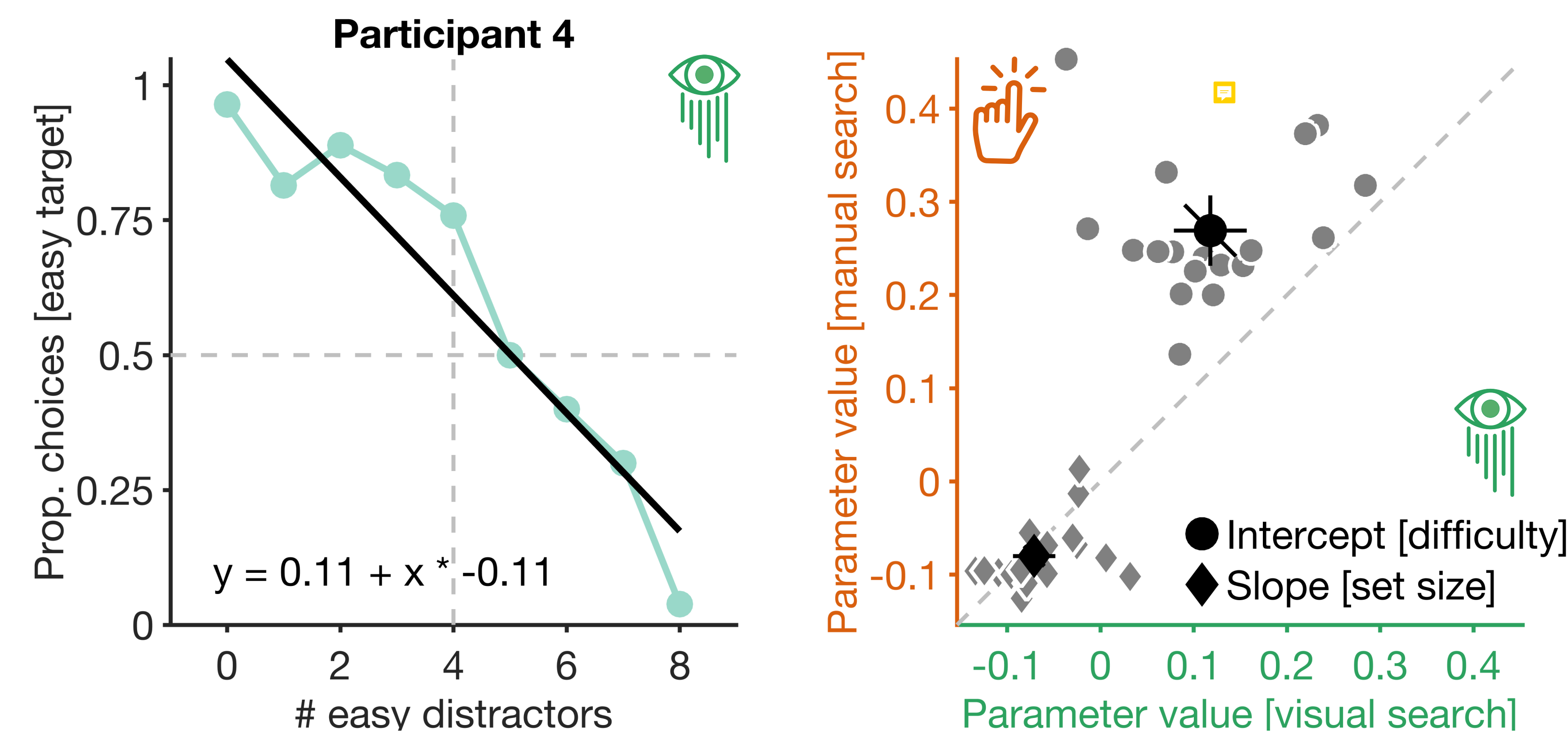


Manipulation 1: discrimination difficulty (easy- and difficult-to-discriminate target)

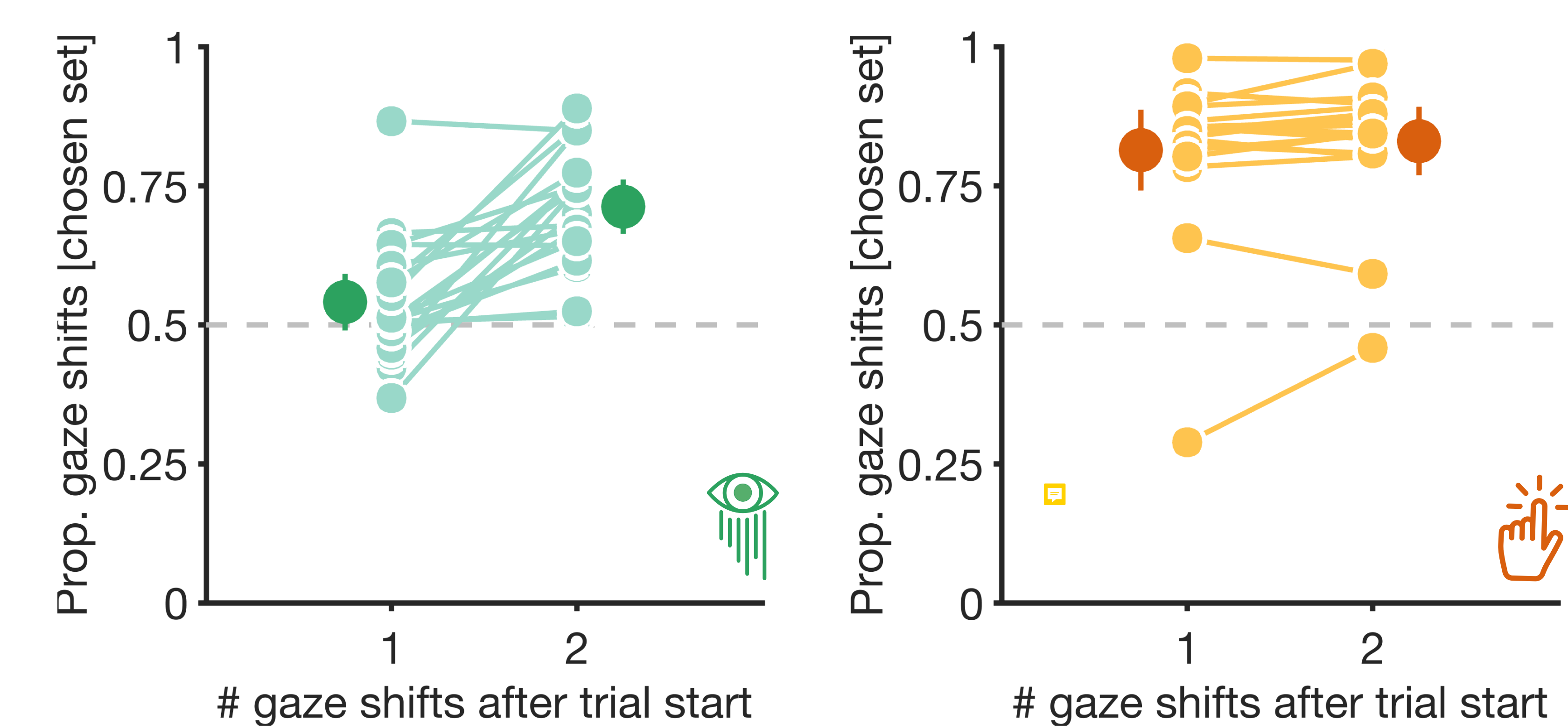


Manipulation 2: temporal costs of searching for a target (i.e., relative number of easy and difficult distractors in trial)

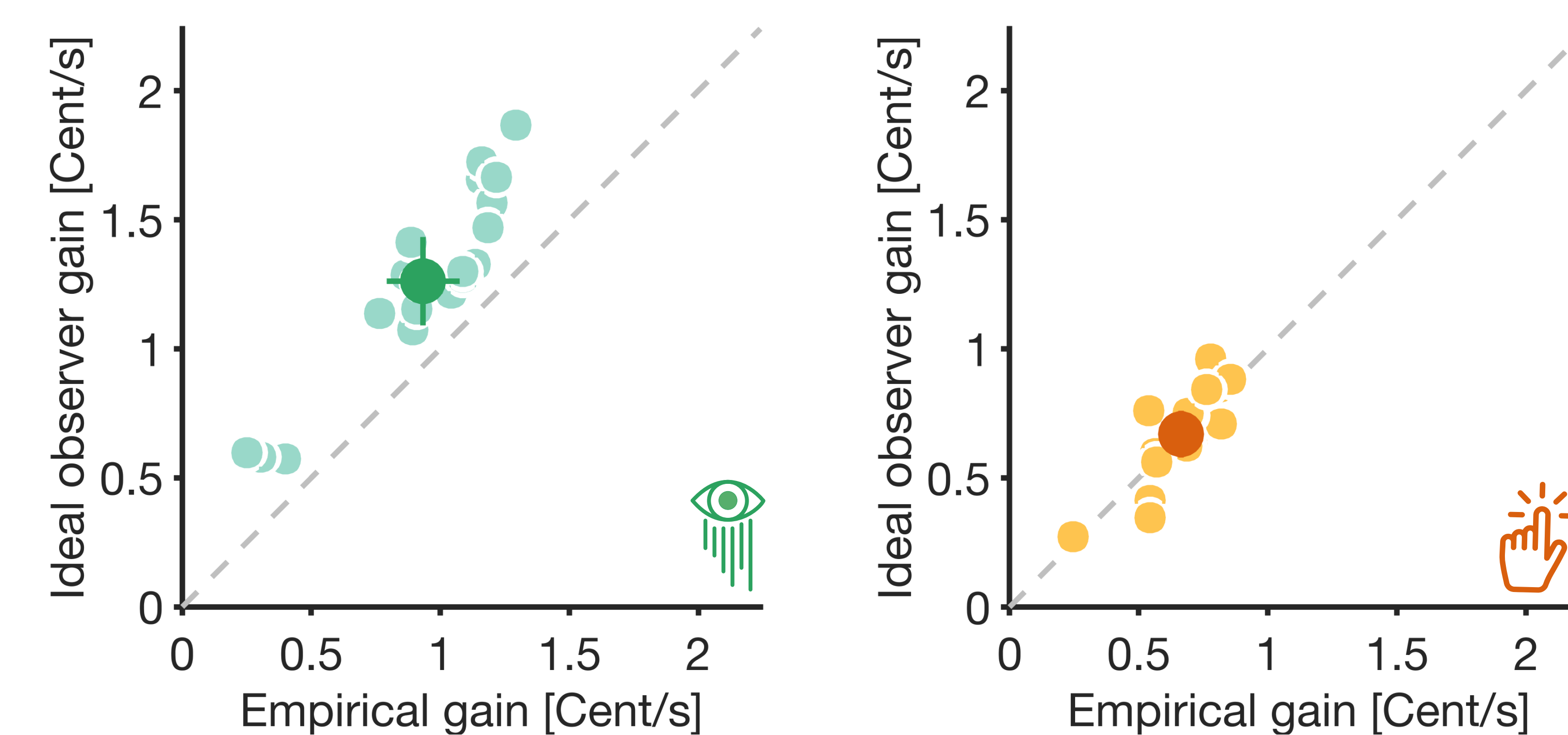
## Results



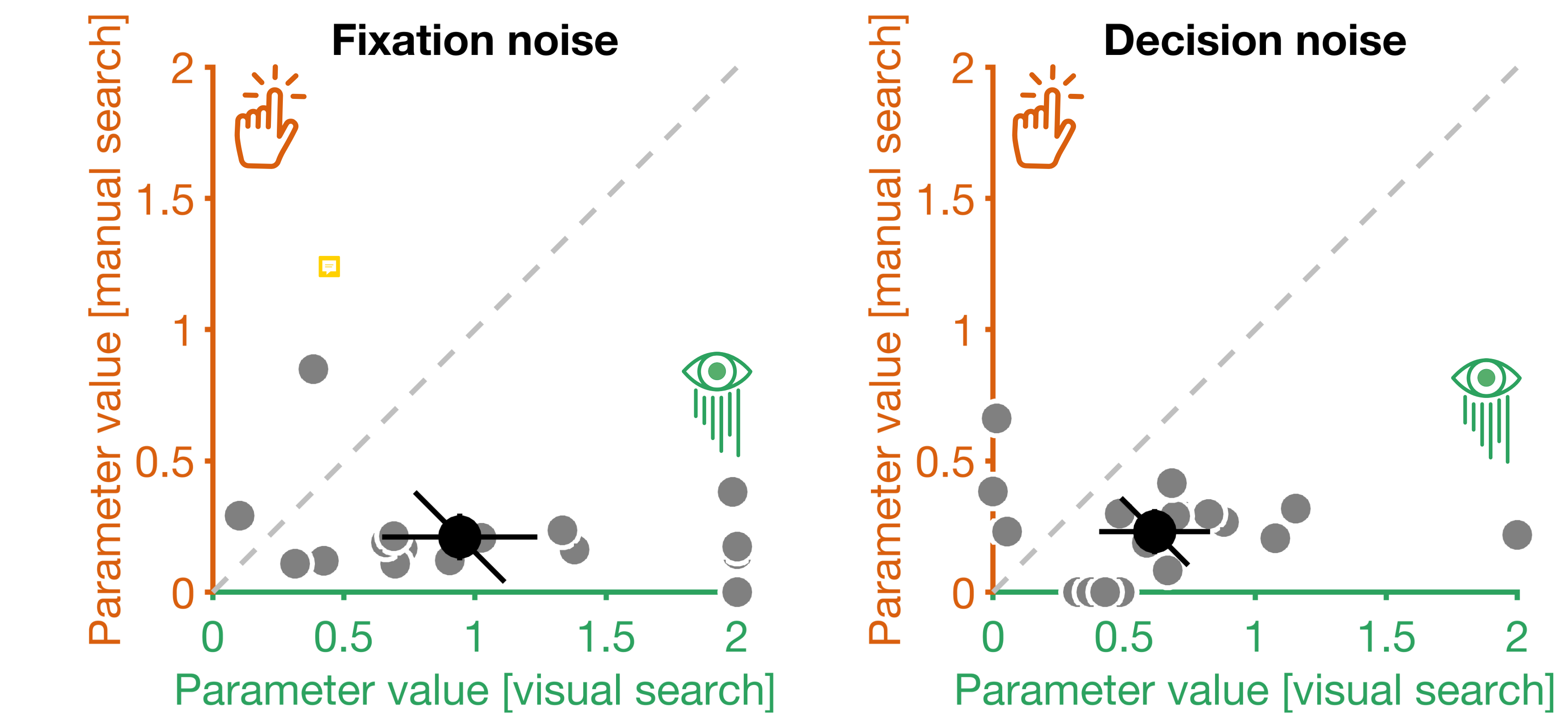
**Both effectors: participants considered search costs and discrimination difficulty when choosing targets**



**Participants had a stronger preference to fixate elements from both sets during visual search**



**Failure to maximize monetary gain per unit of time (i.e., performance) during visual search**



**Model fitting reveals that performance is more strongly constrained by noise during visual search**

## Conclusion

- The previously reported near-optimal trade-off between search costs and discrimination accuracy [3] constitutes a general strategy for humans to optimize decision-making behavior
- However, the slower time course of manual actions makes choice behavior less susceptible to noise, compared to fast-paced eye movements [cf. 2]

### References

- [1] Lio, G., Fadda, R., Doneddu, G., Duhamel, J. R., & Sirigu, A. (2019). Digit-tracking as a new tactile interface for visual perception analysis. *Nature Communications*, 10(1), 5392.
- [2] Diamond, J. S., Wolpert, D. M., & Flanagan, J. R. (2017). Rapid target foraging with reach or gaze: The hand looks further ahead than the eye. *PLoS computational biology*, 13(7), e1005504.
- [3] Wagner, I., Henare, D., Tünnermann, J., Schubö, A., & Schütz, A. C. (2023). Humans trade off search costs and accuracy in a combined visual search and perceptual task. *Attention, Perception, & Psychophysics*, 85(1), 23-40.

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