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

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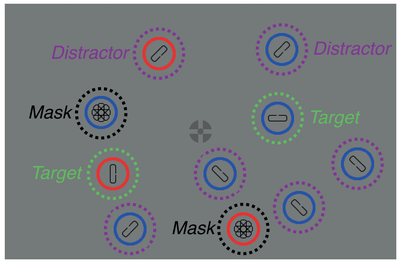
Introduction

- Humans must balance the influence of different factors when choosing between multiple courses of action
- Previous work showed that humans can trade off their accuracy to discriminate object features against the prospective temporal costs of eye movements to optimize performance in a visual search task [1]
- **Is this trade-off is specific for eye movements, or does it generalize to other effectors?**

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.

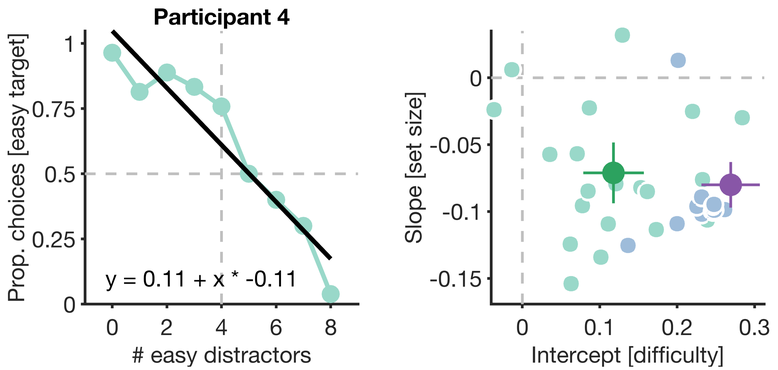
Two conditions: use finger taps (manual search) or eye movements (visual search)

Stimuli are masked, unless fixated or taped

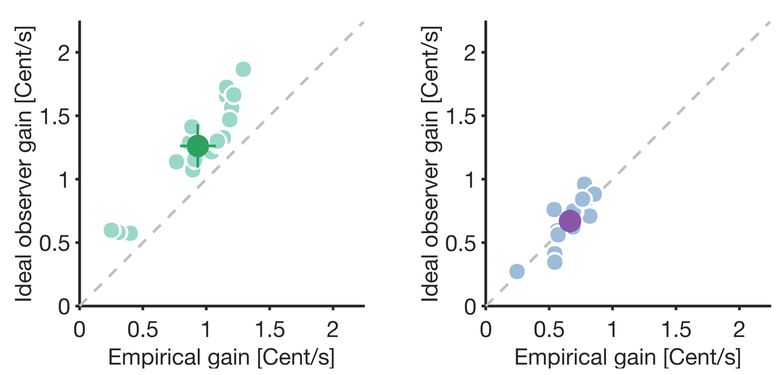
Manipulation 1: discrimination difficulty (easy- and difficult-to-discriminate target)

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

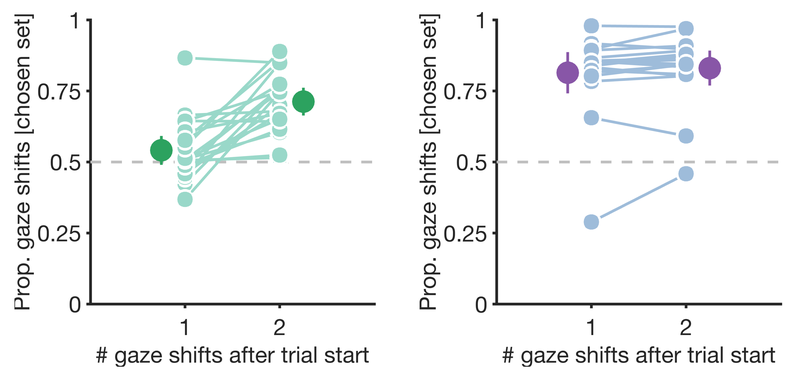
Results



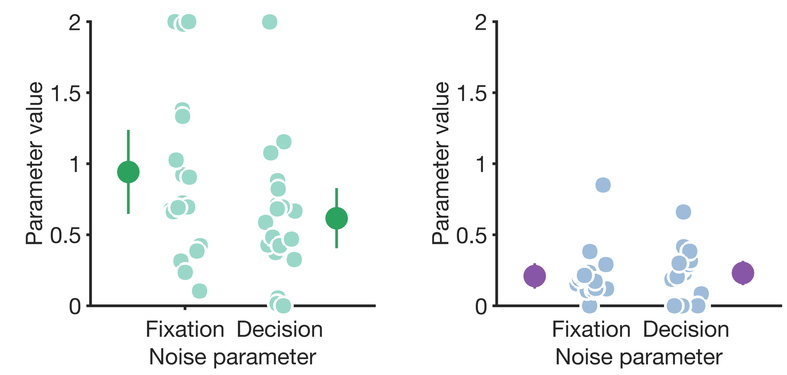
Both effectors: participants considered search costs and discrimination difficulty when choosing targets



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



Participants had a stronger preference to fixate elements from both sets 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 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

References

[1] 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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