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A central research goal in the cognitive sciences has been to understand the processes that underlie selective attention, or the ability to focus on goal-relevant information. Two opposing theories have been proposed in an effort to explain how selective attention emerges: one suggests that attention improves continuously over time, whereas the other proposes that attention improves at a discrete time point. While outcome-based data (e.g., reaction time) have successfully provided evidence for both accounts, there has been no empirical evidence to differentiate them. In this study, we used mouse-tracking in a flanker task that provided time sensitive measures associated with selective attention. Specifically, we recorded the path of realtime movement trajectories to assess characteristics of continuous and discrete shifts in selective attention. Our results strongly suggested that selective attention increased gradually over time, as opposed to at a discrete point, thus providing support for a continuous account of selective attention.

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Tracking Flanker Task Dynamics: Evidence for Continuous Attentional Selectivity

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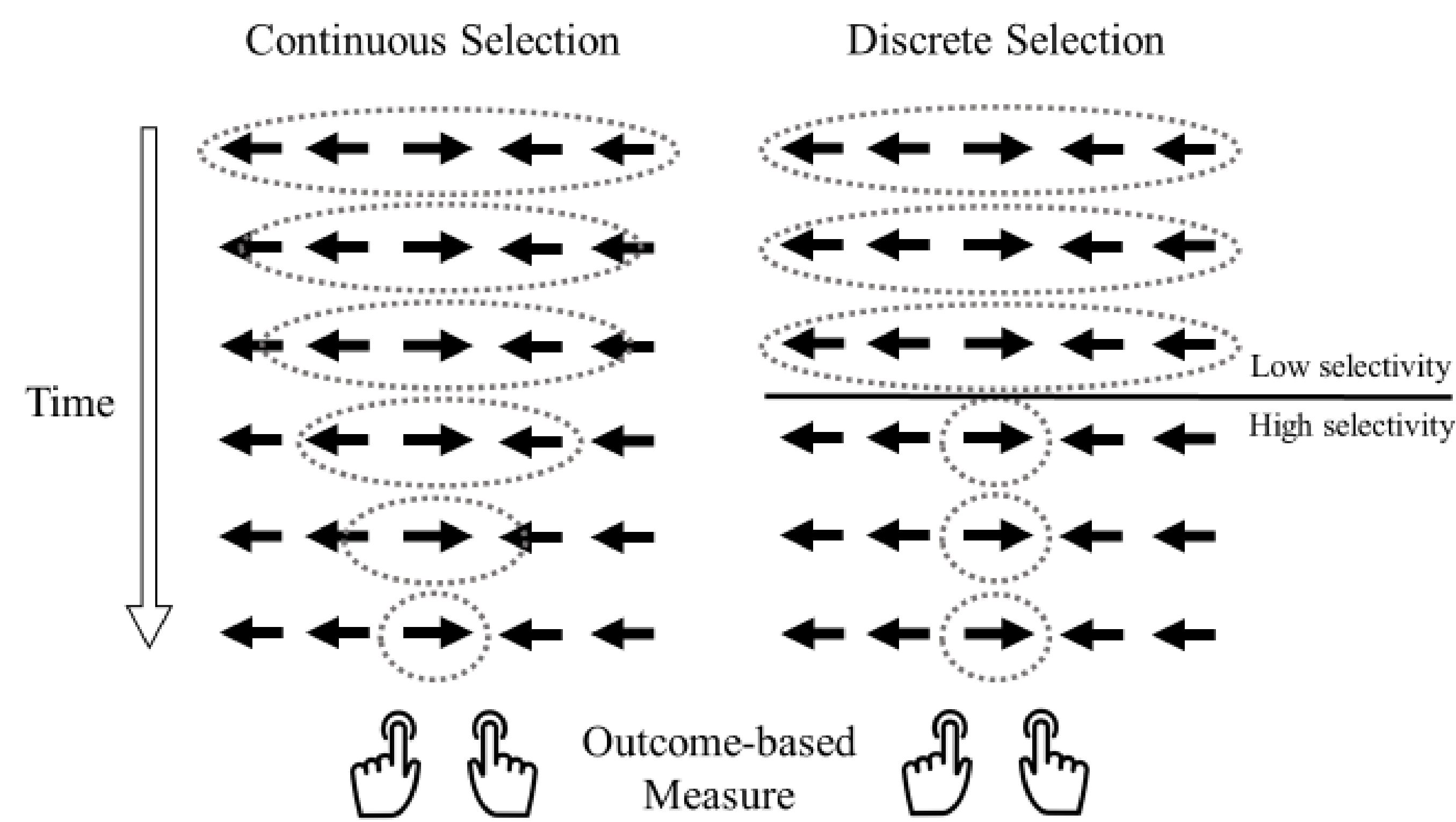


Introduction

Selective attention involves focusing in on goal-relevant information and ignoring goal-irrelevant information.

Two main hypotheses have been proposed to explain how selective attention is implemented:

1. Selective attention increases **continuously** over time (Heitz & Engle, 2007)
2. Selective attention shifts from a low- to a high-state of selectivity at a **discrete** point in time (Hübner, Steinhauser, & Lehle, 2010)



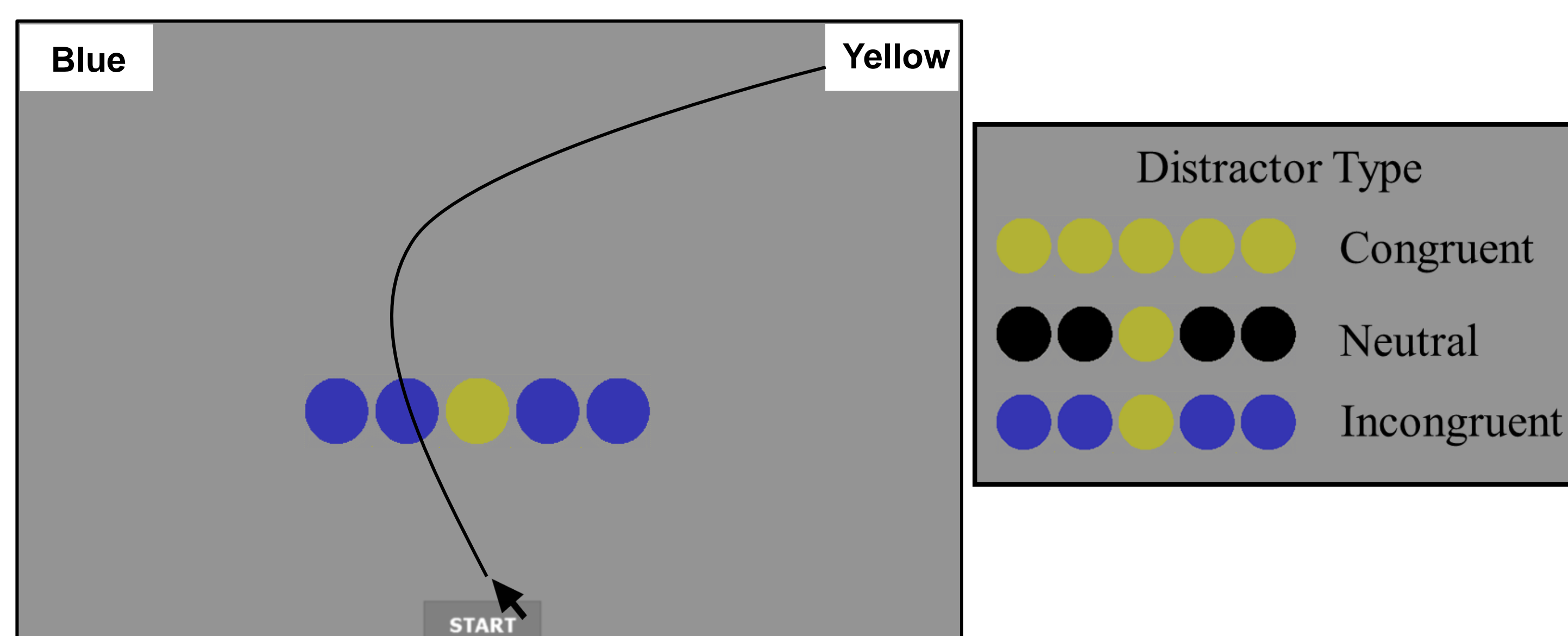
Research Question:

Does selective attention improve continuously or discretely over time?

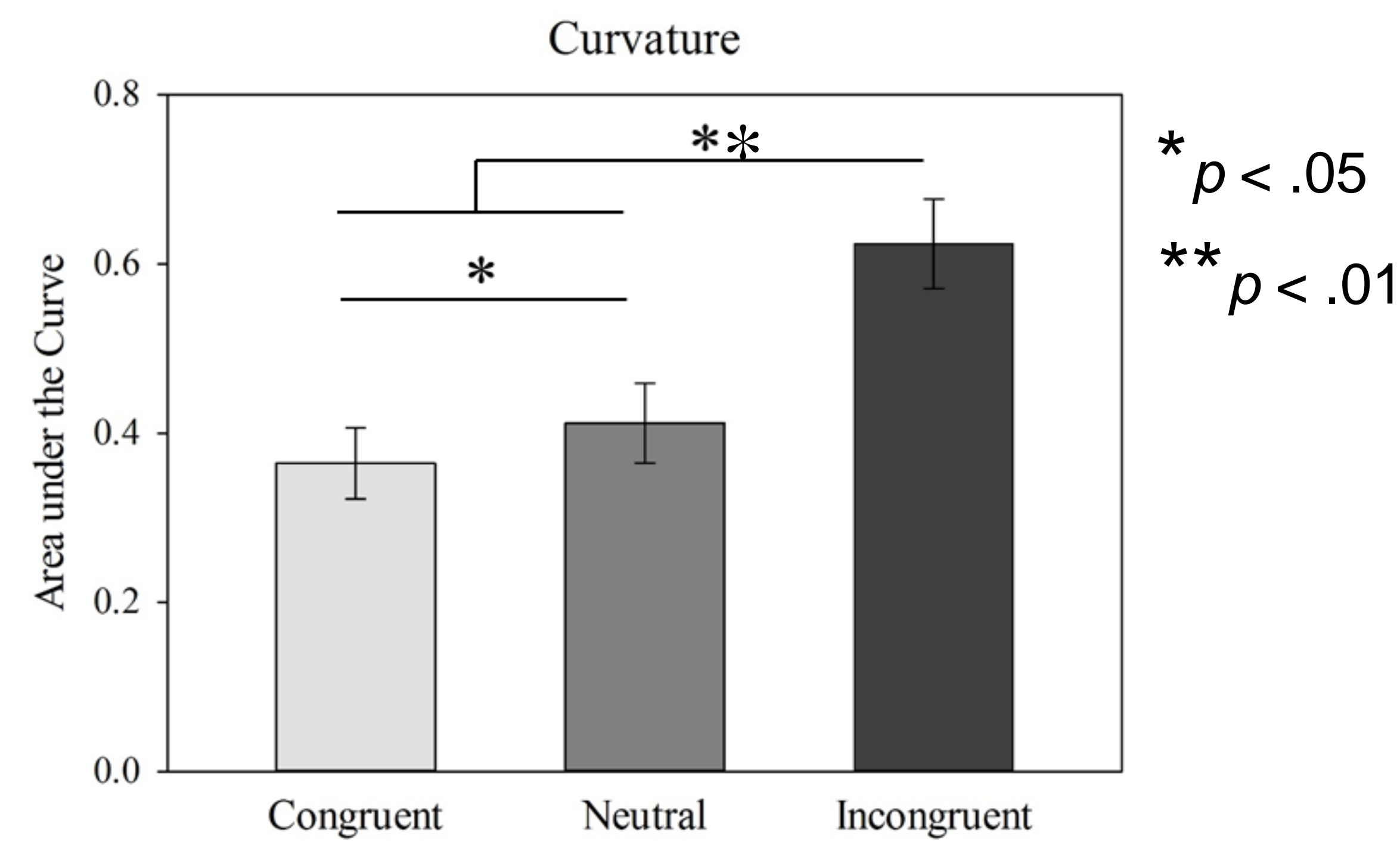
Methods

Flanker task: Participants were instructed to attend only to the central object and ignore the “flanking” distractors.

Movement tracking: We recorded real-time movement trajectories as participants moved from the start location to one of the two response locations.



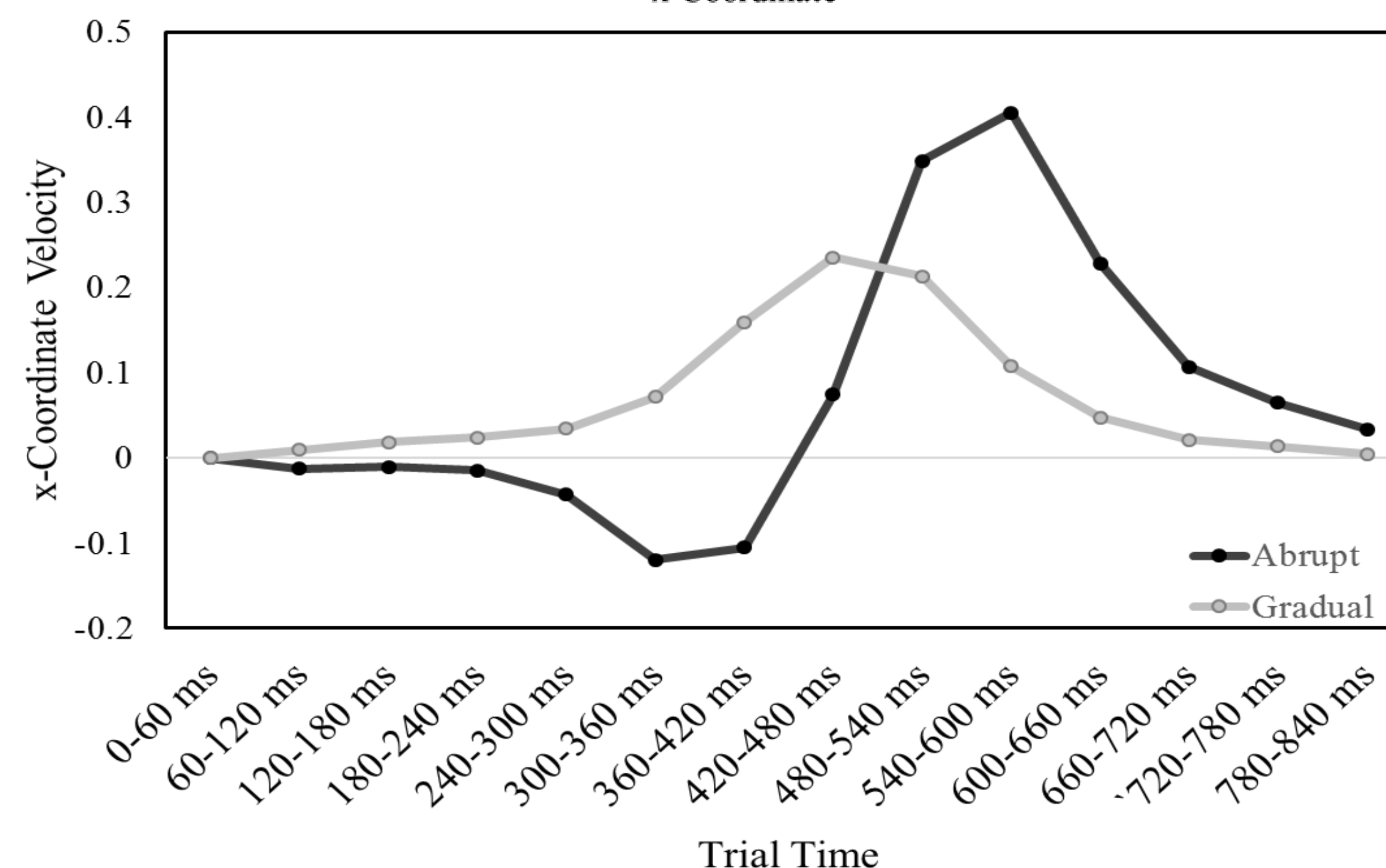
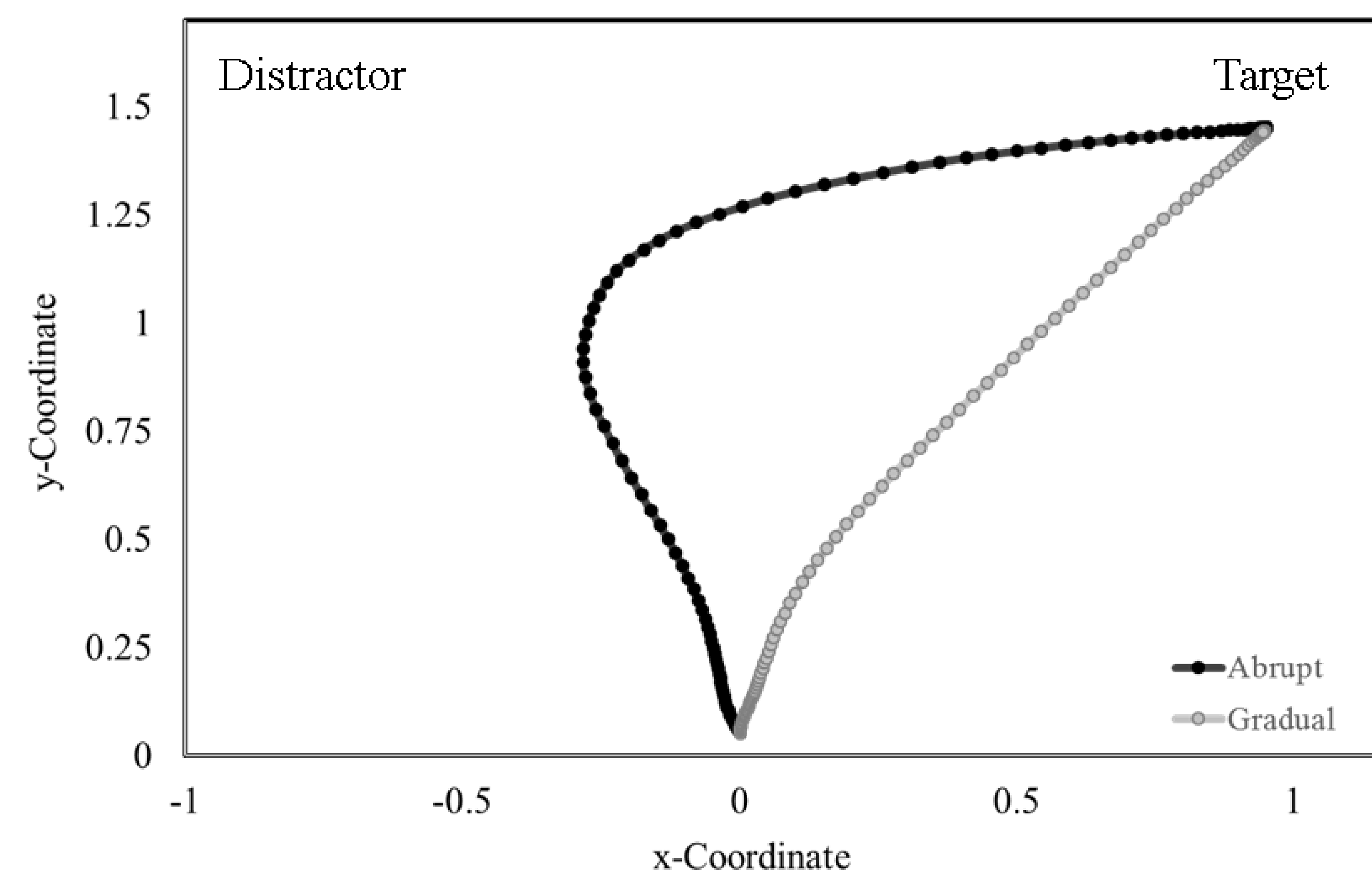
Results- Movement Curvature



Results- Continuous vs Discrete

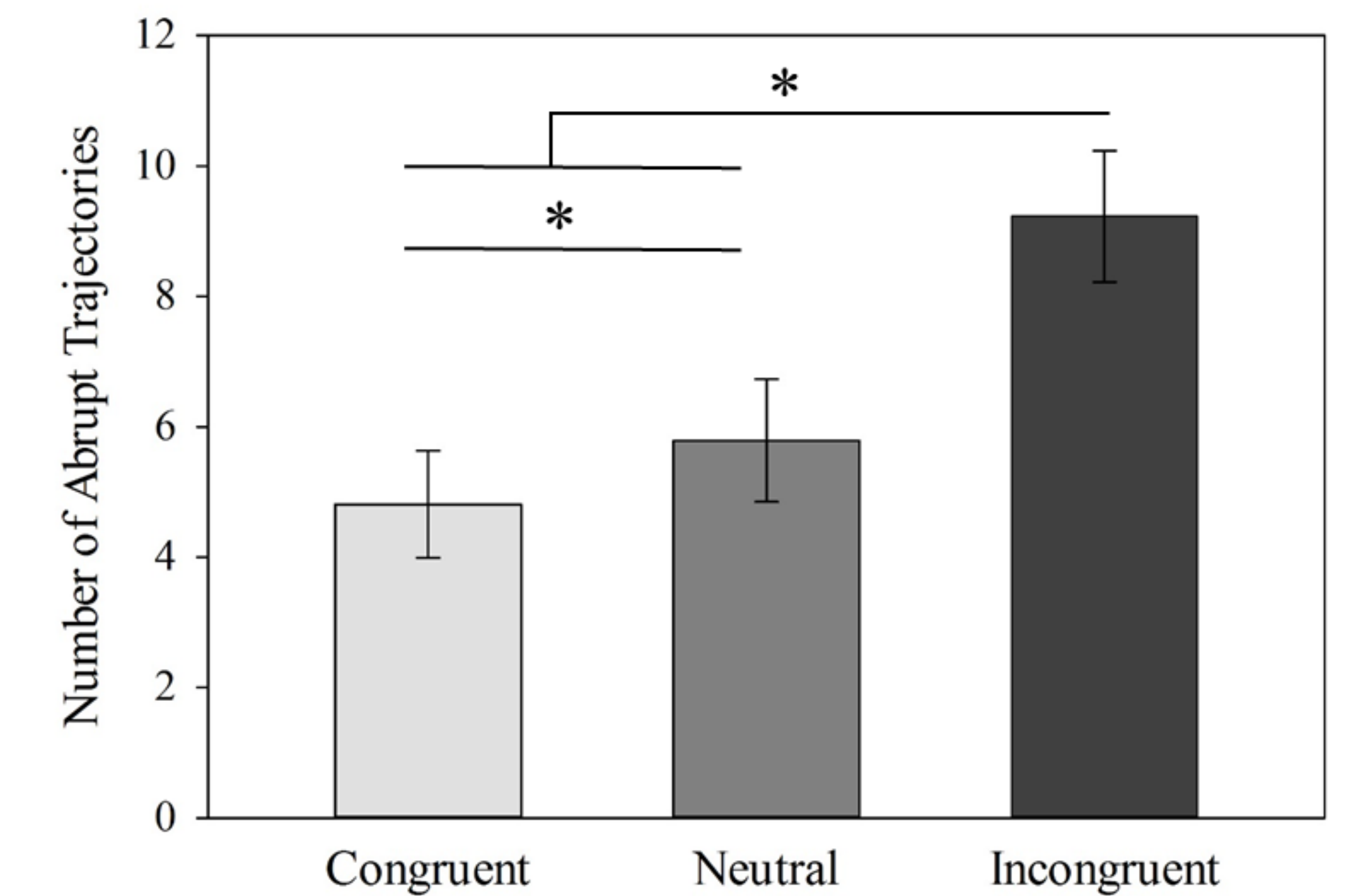
We coded movements that reflected either abrupt or gradual trajectory shifts toward the correct response location

- 84.4% of movements were characteristic of gradual shifts:

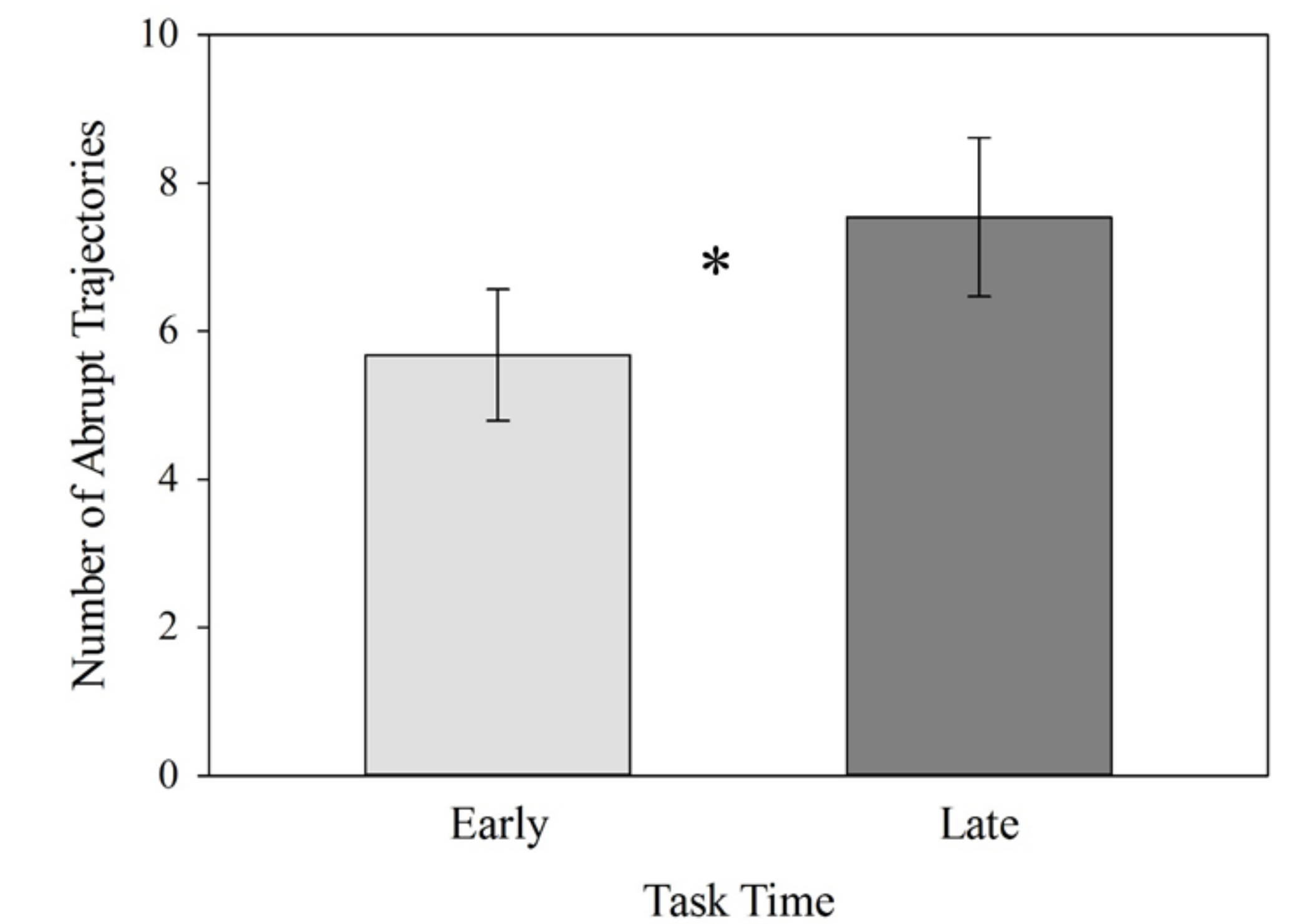


Abrupt trajectories moved faster toward the distractor response location at earlier time points compared to gradual trajectories.

While most movements in the flanker task were characteristic of gradual shifts, we explored what factors were associated with discrete-like, or abrupt trajectories.



Abrupt trajectories were more likely to occur in the incongruent condition, when there was strong distractor interference.



There were significantly more abrupt trajectories in the first half of the flanker task compared to the last half, suggesting that discrete movements are associated with fatigue.

Discussion

Our results suggest that selective attention improves continuously over time, as opposed to discretely over time.

- Movement tracking data revealed that trajectories were strongly representative of continuous selective attention, indicated by a gradual path toward the target response location.

References

Heitz, R. P., & Engle, R. W. (2007). Focusing the spotlight: Individual differences in visual attention control. *Journal of Experimental Psychology: General*, 136(2), 217.

Hübner, R., Steinhauser, M., & Lehle, C. (2010). A dual-stage two-phase model of selective attention. *Psychological review*, 117(3), 759.