# Tracking Flanker Task Dynamics: Evidence for Continuous Attentional Selectivity


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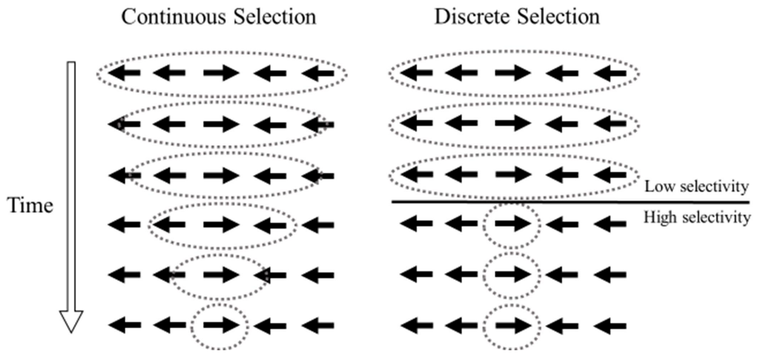
## Introduction

**Selective attention** involves bringing focus to goal-relevant information and ignoring goal-irrelevant information.

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

1. Selective attention increases ***continuously*** over time.[1]
2. Selective attention transitions from a low- to a high-state of selectivity at a ***discrete*** point in time. [2]



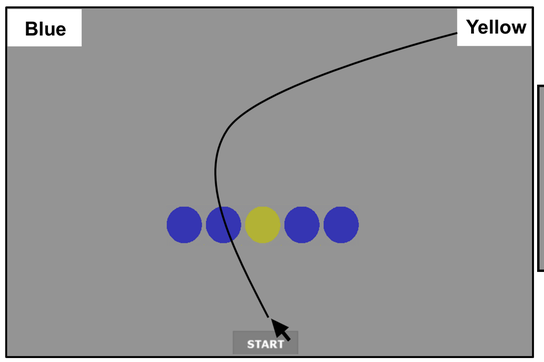

**Research Question**:

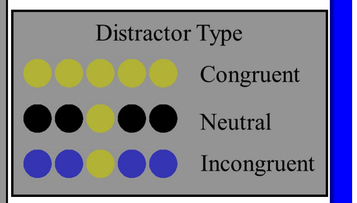
Does selective attention improve continuously or discretely over time?

## Method

**Flanker task**: Participants were instructed to attend only to the central target object and ignore the "flanking" distractors, and to then move the mouse cursor to the correct response location.

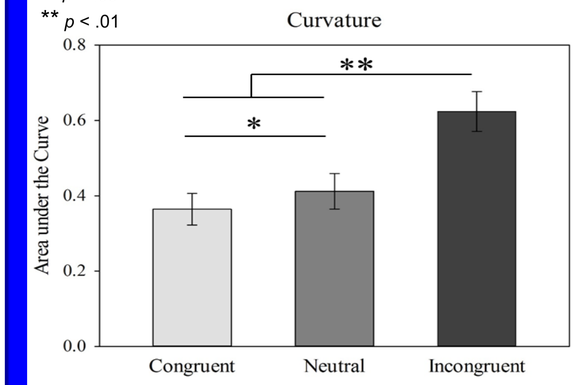
**Movement tracking**: We recorded real-time mouse movement trajectories as participants moved from the start location to one of the two response locations. [3]




432 total trials, 144 for each distractor type.

## Results: Movement Curvature



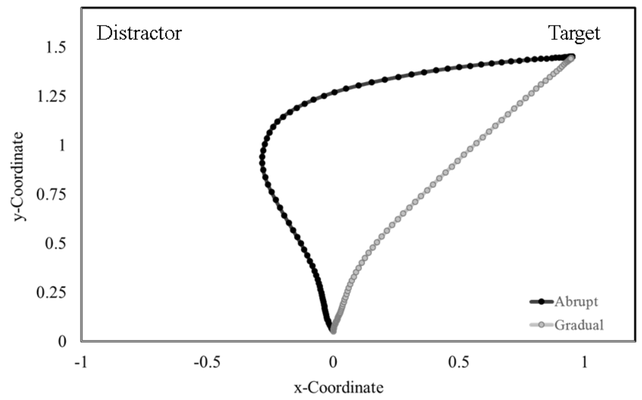

Increased curvature indicates greater deviation away from the path to the target response, or greater attraction to the distractor response.

Incongruent distractors elicited significantly greater curvature compared to the other distractor types.

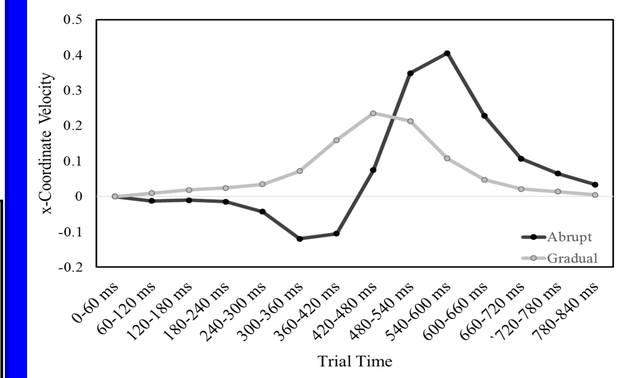
## Results: Continuous vs Discrete

We coded movements to indicate either **abrupt or gradual** trajectory shifts toward the target response location.

- Movements exceeding a maximum curvature threshold of .9 were coded as abrupt shifts. [4]



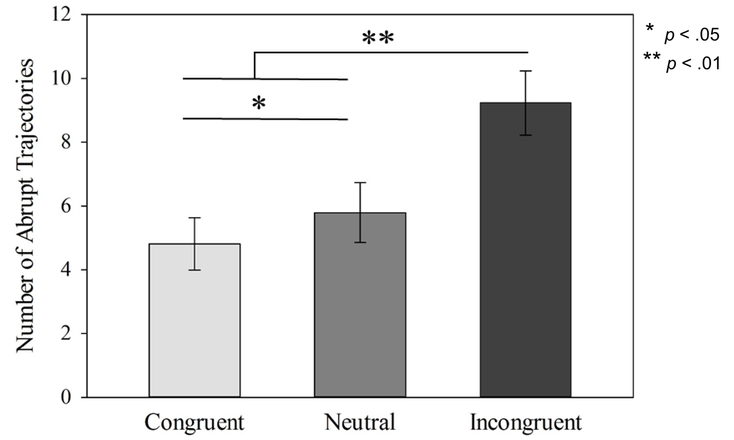

89.4% of movements (8935 total) were characteristic of **gradual** shifts



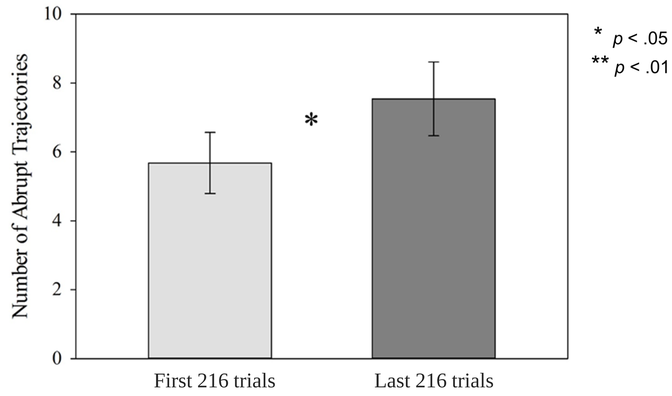

Positive and negative x-Coordinate values indicate movement toward the target or distractor response, respectively.

Abrupt trajectories **moved faster toward the distractor** location at **earlier time points** (180 - 420ms, all *ps* < .003) compared to gradual trajectories.

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




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




There were significantly more abrupt trajectories in the first half of the flanker task compared to the last half (432 total trials), suggesting that discrete movements may result from **mental or motor fatigue**.

## Summary

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

- Movement trajectories were overly representative of continuous selection, indicated by a gradual path toward the target response location.
- The subset of abrupt trajectory shifts that we observed were associated with trials that elicited uniquely strong distractor interference and fatigue.


**References**

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2. Hübner, R., Steinhauser, M., & Lehle, C. (2010). A dual-stage two-phase model of selective attention. *Psychological review*, *117*(3), 759.
3. Freeman, J. B., & Ambady, N. (2010). MouseTracker: Software for studying real-time mental processing using a computer mouse-tracking method. *Behavior research methods*, 42(1), 226-241.
4. Freeman, J. B. (2014). Abrupt category shifts during real-time person perception. *Psychonomic bulletin & review*, 21(1), 85-92.



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