

INVESTIGATING GUIDANCE FROM PERIPHERY DURING VISUAL SEARCH IN REAL-WORLD SCENES: SCENE CONTEXT VS. OBJECT CONTENT

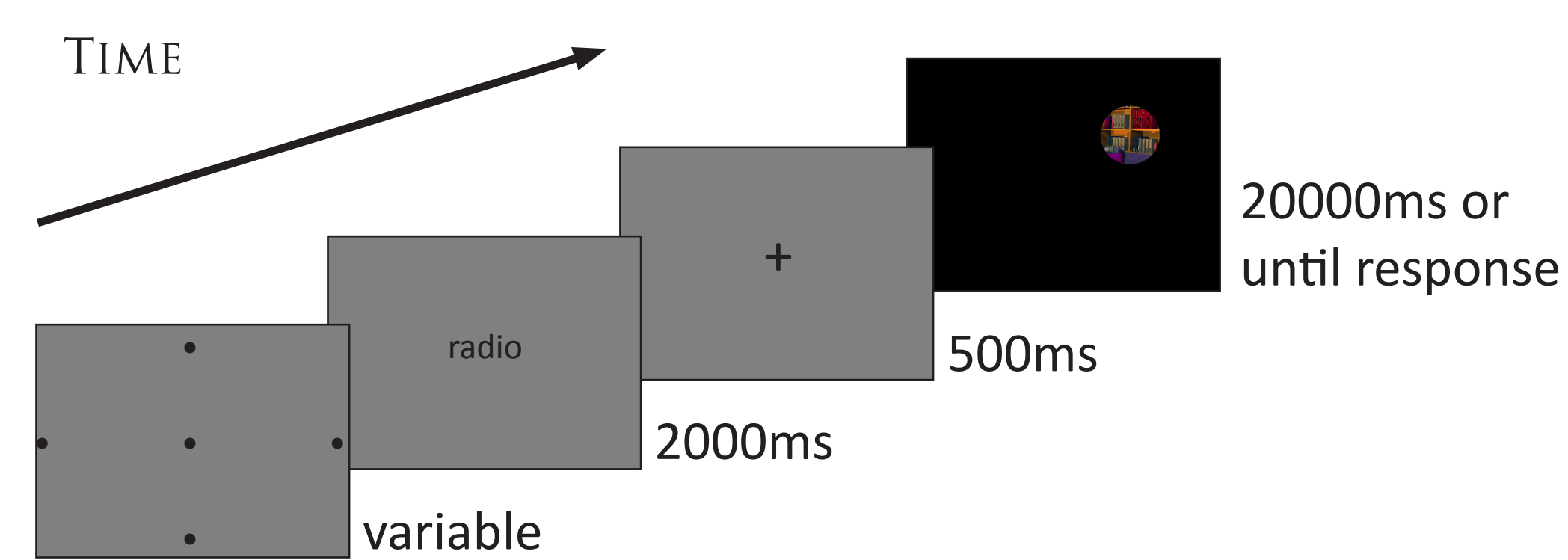
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BACKGROUND

- Recent studies have established that when searching for an object in a scene, eye movements are guided towards targets based on scene context (Castelhano & Henderson, 2007; Ehinger et al., 2009; Neider & Zelinsky, 2006; Torralba et al., 2006).
- When no immediate visual information is available in the periphery, scene context typically dominates search strategies (Castelhano & Henderson, 2007).
- In contrast, when peripheral information is available, other studies have shown that fixations tend to be directed to high spatial frequency information, corresponding to objects within the scene (van Diepen & Wampers, 1998).
- Studies examining image statistics suggest object features are more likely to attract attention and predict where fixations will occur (Parkhurst, Law & Niebur, 2002).
- The present study examined how eye movements are affected by immediately-available information in the periphery and how search strategies are affected by the availability of scene context and object information.

GENERAL METHODS

- In order to control the availability of scene information in the periphery, participants searched for a target through a 4° diameter gaze-contingent moving-window (Castelhano & Henderson, 2007; Henderson et al., 1997; van Diepen et al., 1998).
- The original search scene was shown foveally (inside the window), while the scene information was manipulated extrafoveally across four conditions (varying across the two experiments).
- Stimuli consisted of computer-generated scenes, displayed on a 21" CRT monitor at an 800x600 pixel resolution, subtending 38.1° x 28.6°.
- Eye movements were tracked using an EyeLink 2000 Eyetracker (SR Research) at a sampling rate of 2000Hz.

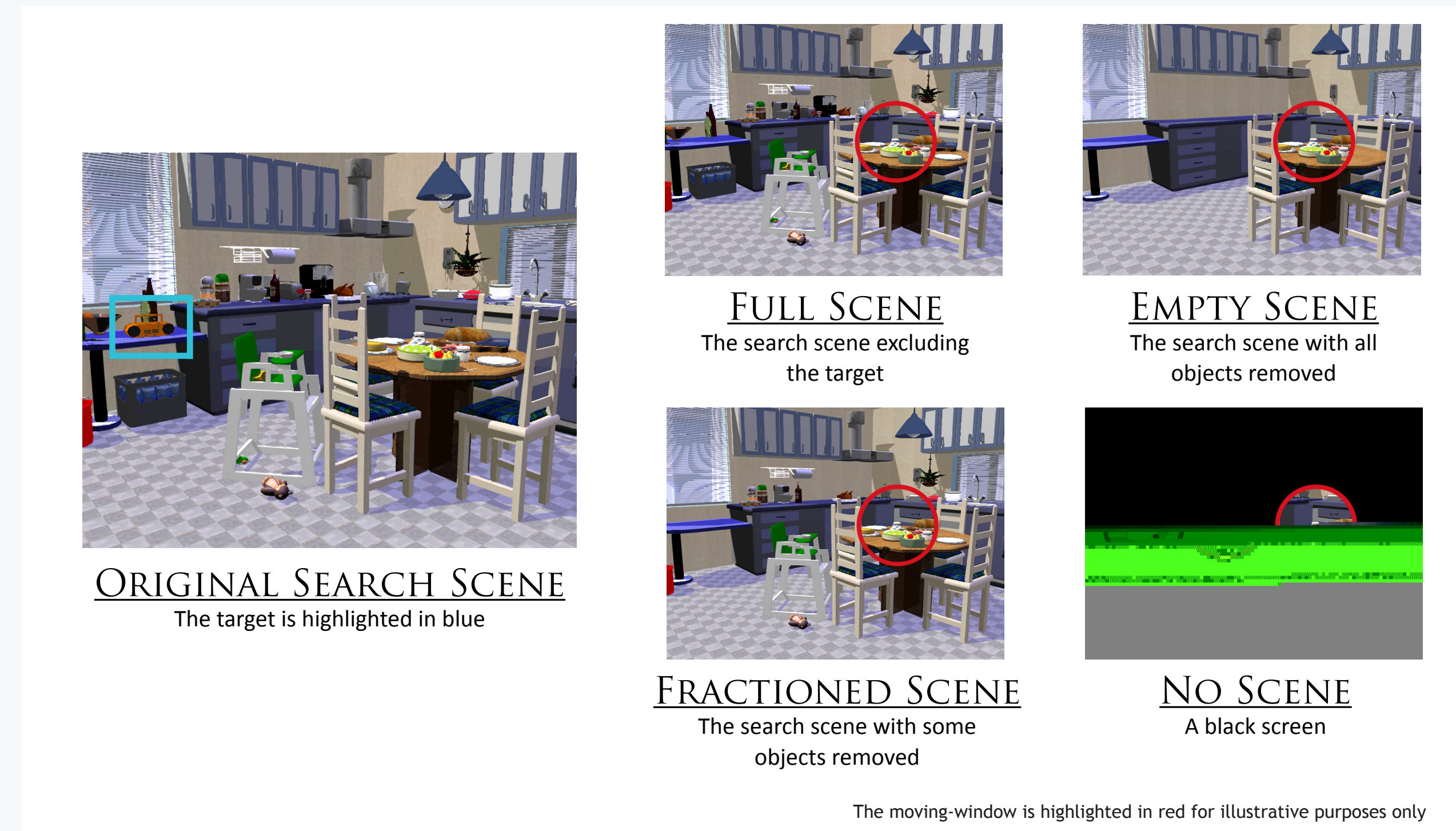


Trial sequence for the no scene extrafoveal condition.

EXPERIMENT 1

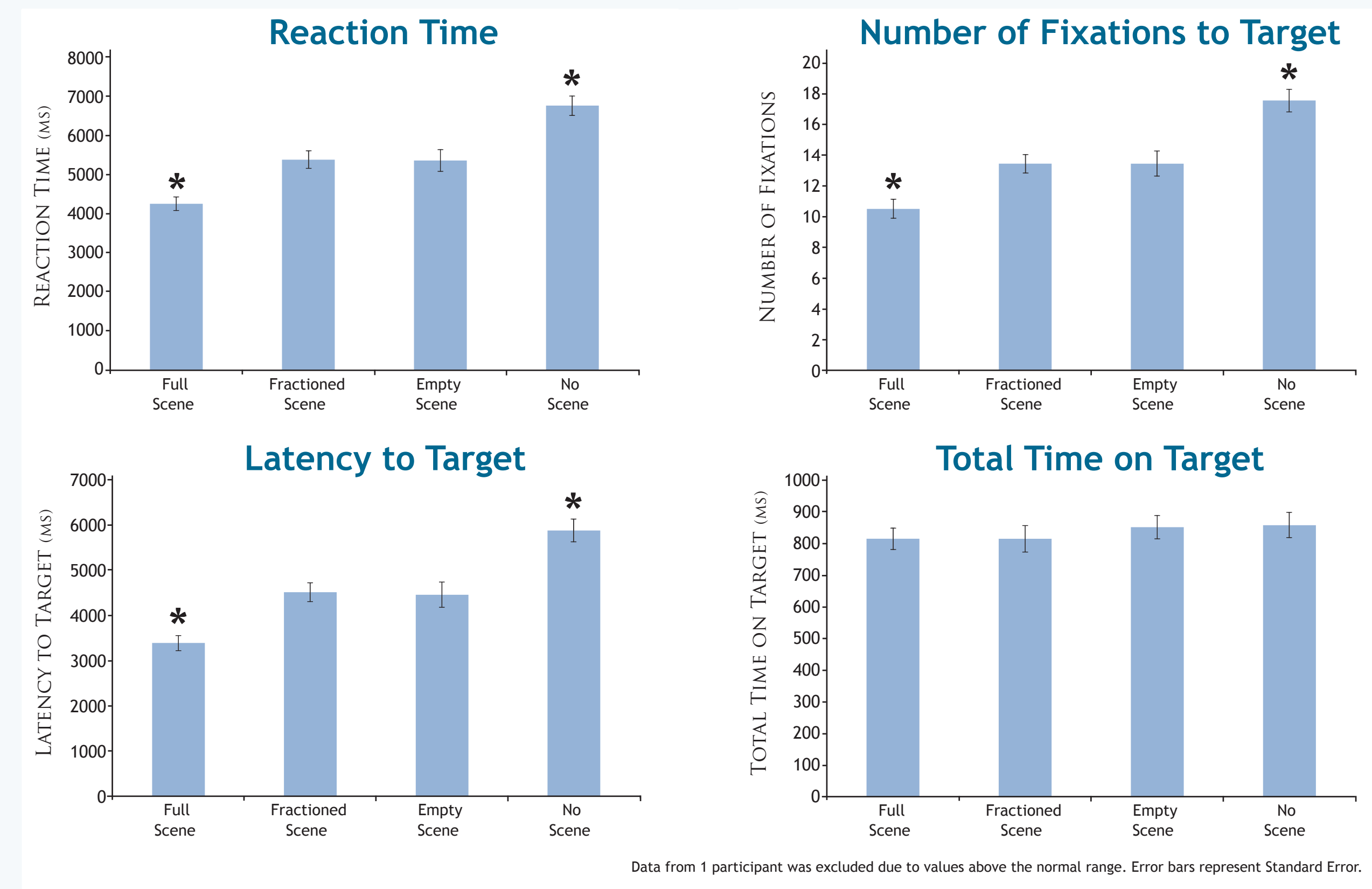
METHODS

- 28 Queen's University undergraduates, with normal or corrected-to-normal vision.



RESULTS

- The average accuracy rate was 87% and did not differ significantly by scene condition.

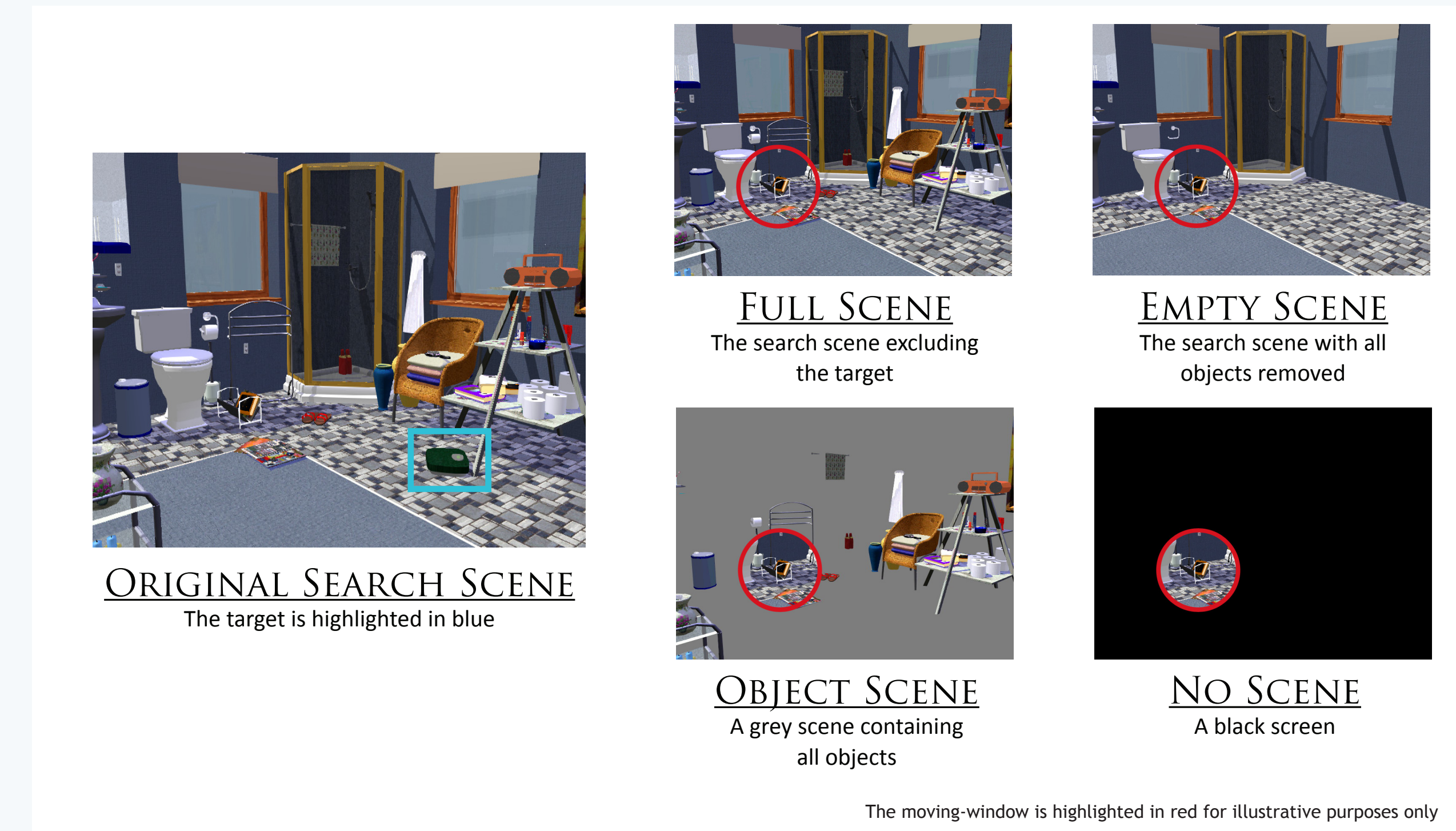


- When empty and fractioned scenes were shown extrafoveally, participants performed better across all measures than when no scene was presented.
- Due to the lack of difference between the empty scene and fractioned scene in eye movement measures, it is unclear what the relative contribution of scene context and object content is in the guidance of eye movements.
- However, it suggests that scene context may play a stronger role in guidance since it is present in both scene conditions. We manipulated the presence of scene context in the next experiment.

EXPERIMENT 2

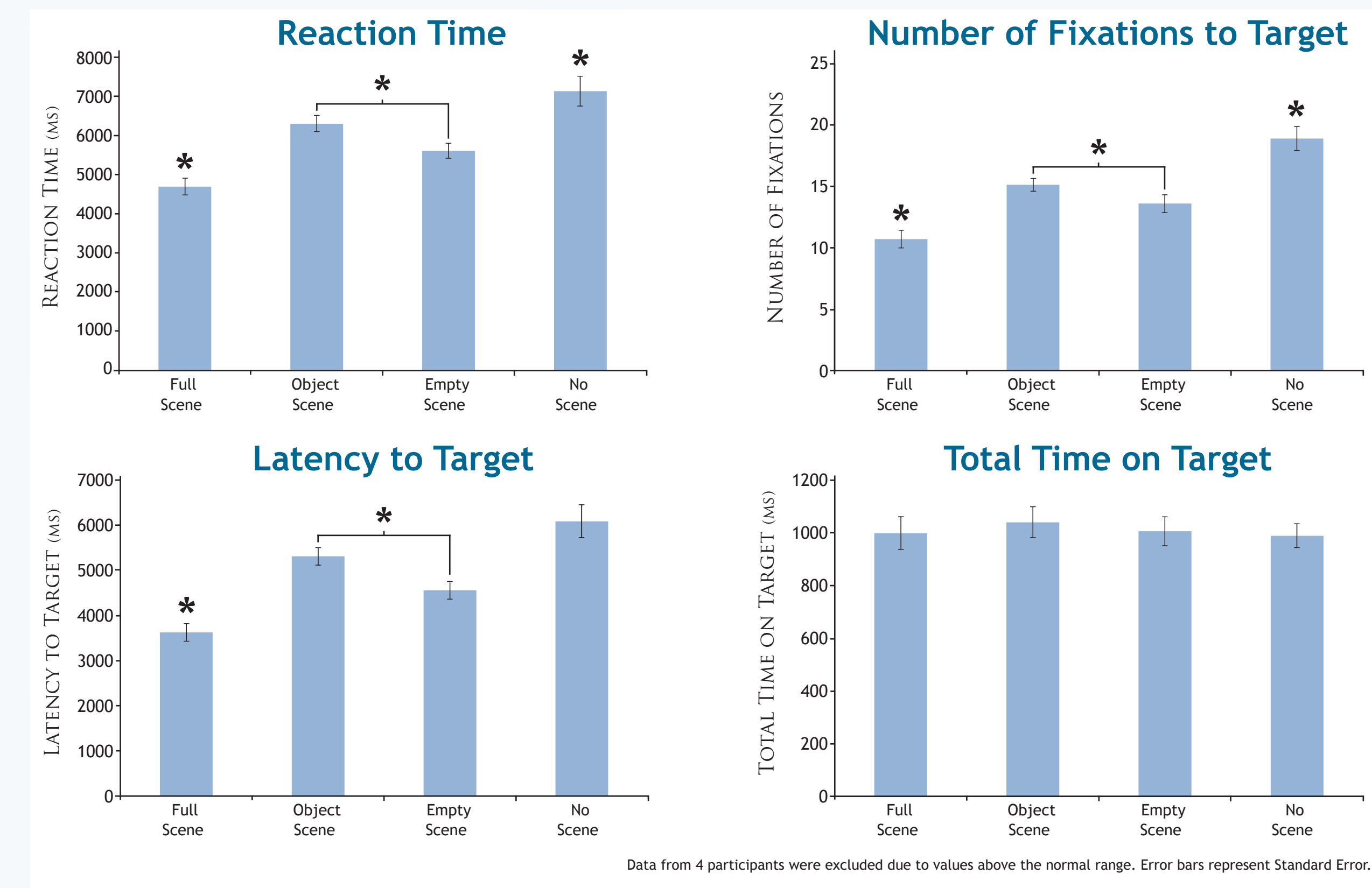
METHODS

- 28 Queen's University undergraduates, with normal or corrected-to-normal vision. None participated in Experiment 1.



RESULTS

- The average accuracy rate was 86% and did not differ significantly by scene condition.



- The object scene condition had a significantly slower reaction time than the empty scene condition.
- Measures of eye movement efficiency (number of fixations and latency to target) also showed that participants were slower to locate the target when object content alone was presented.
- Manipulation of the extrafoveal scene information did not seem to affect measures of target verification (e.g., total time) as there were no significant differences found between conditions.

CONCLUSIONS

- As expected, participants were much faster at locating targets when the entire scene was available, and had much slower search performance when no extrafoveal information was available.
- Providing scene context information extrafoveally resulted in better search performance than object content alone, suggesting that scene context may be more useful in guiding eye movements than object-based features.
- Despite previous research positing that eye movements are guided by high spatial frequency information (van Diepen & Wampers, 1998), we found that scene context produced more effective guidance to target objects.
- Although object properties might be helpful in predicting fixation placement, having information about the context of a scene can help restrict search regions to expected target locations, resulting in more effective search strategy.
- These results add to recent findings exploring the effects of top-down influences from search context and target information (Castelhano & Heaven, 2010; Malcolm & Henderson, 2010), and further suggests that scene context may also guide search when scene information is immediately available in the periphery.
- Further research is currently being undertaken to more closely examine the effects of peripheral information arising from scene context and object properties.

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