Robot eye-gaze directs attention in a location-based manner

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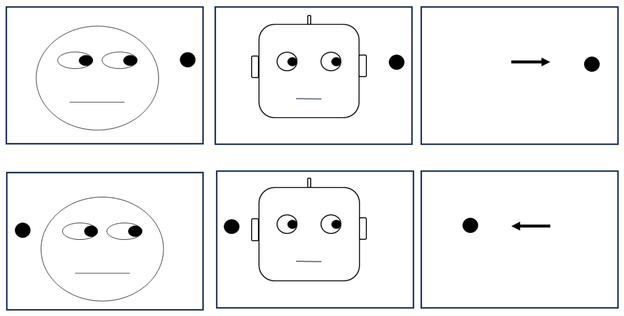
Introduction

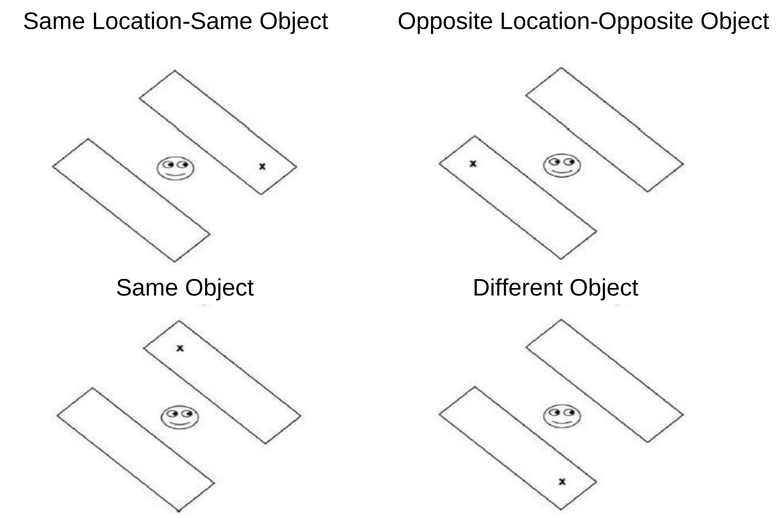
A variety of stimuli can be used to direct attention around the visual world (Carrasco, 2011).

Given this variety, it is somewhat surprising that in standard cueing tasks (Posner, 1980), the size of the cueing effect across cue type are often comparable (Freisen & Kingstone, 1998; Pratt & Hommel, 2003; Wiese et al., 2012), suggesting similar underlying mechanisms.



However, emerging evidence suggests that cues may direct attention in qualitatively different manners (Chacon-Candia et al., 2023; Marotta et al., 2018) that cannot be observed in a standard cueing paradigm. Specifically, eye gaze directs attention to locations while arrows direct attention to objects (Marotta et al., 2012).

Evidence for Location and Object-based Attention



Using this paradigm, Marotta et al. (2012) found:

a *location-based effect*: faster RTs to same location-same-object trials compared to same object trials for faces but not arrows.

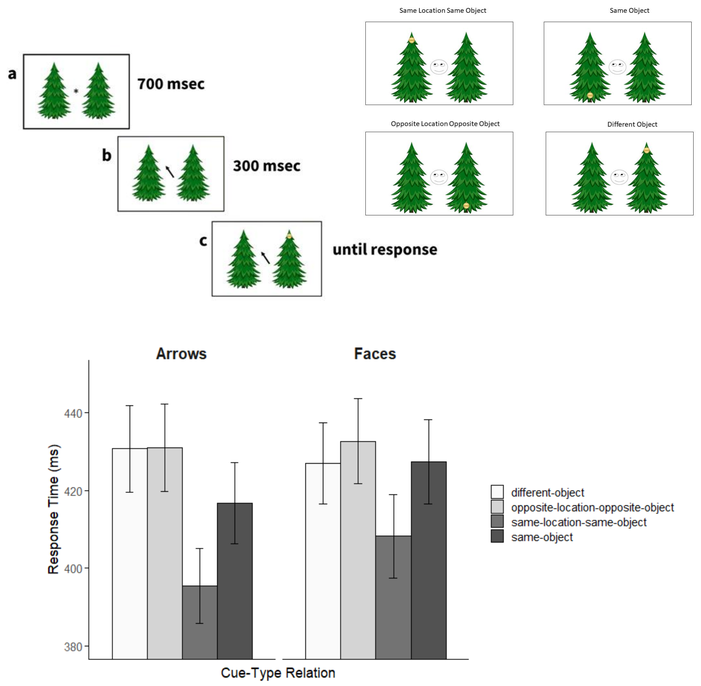
an *object-based effect*, faster RTs to same object trials compared to different object trials for arrows but not faces.

Here, we extend these results in two ways. In experiment 1, we attempt to replicate this finding using more real-world stimuli. In experiment 2, we investigate whether a novel cue type, a robot face, directs attention to locations or objects.

Exp 1: Replication of Marotta et al. (2012)

62 participants (34 females, 24 males, 3 non-binary and 1 agender, age range 18-40 years) were recruited from Prolific™.

Participants completed 256 experiment trials (128 face cue and 128 arrow). Cue type varied randomly on a trial by trial basis.

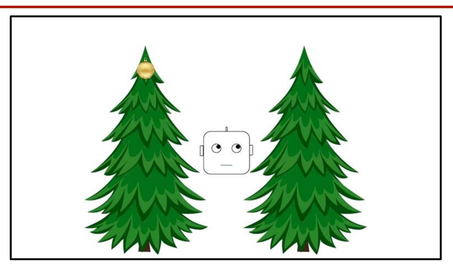


In contrast to previous studies, we found a location-based effect for both faces, $t(61) = 7.17$, $p < 0.01$, $d = 0.91$, and arrow cues, $t(61) = 4.27$, $p < 0.01$, $d = 0.54$.

Consistent with previous studies we found an object-based effect for arrows, $t(61) = 3.15$, $p < 0.01$, $d = 0.40$, but not faces, $t(61) = 0.03$, $p > 0.05$, $d = 0.01$.

These results suggest a more complex mechanism in which arrows prioritize specific locations and this spreads to cued objects. This spread of attention does not occur for face cues.

Exp 2: How do robot cues direct attention?

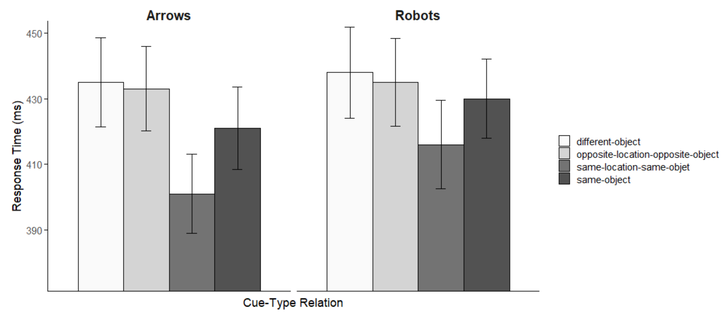


66 participants (26 females, 36 males, 3 non-binary, and 1 gender fluid, age range 21-35) were recruited through the Prolific™.

The experiment was identical to experiment 1 with the exception that, robot faces and arrow cues were used.

For more information about this study, please contact Polina Rafailova (cr6306@bard.edu)

Exp 2: Results



Paralleling experiment 1, we observed a location-based effect for both arrows, $t(61) = 5.36$, $p < 0.01$, $d = 0.65$, and robots, $t(61) = 3.45$, $p > 0.05$, $d = 0.44$.

In addition, we observed an object-based effect for arrows, $t(61) = 3.11$, $p < 0.01$, $d = 0.39$, but not robots, $t(61) = 1.87$, $p > 0.05$, $d = 0.24$.

Our results replicate the findings for arrow cues in experiment 1 and further suggest that robot faces direct attention in a location-based manner.

Conclusions

Across two experiments, we replicated the finding of object-based effects for arrows but not faces. In contrast to previous studies, we found location-based effects for both arrows and faces (Marotta et al., 2012).

Our results suggest that when arrows are used, an individual's attention is first directed to a specific location then attention spreads to the rest of the cued object. When faces (schematic or robot) are use, attention is directed to a specific location and locations within the same object are not prioritized over locations in non-cued objects.

We are attempting to further distinguish between two possible mechanisms of attention and test aspects of the schematic and robot faces that may interact with these effects. Specifically, do physical characteristics such as the presence of eyes or abstract characteristics such as trust modulate the manner in which attention is directed in the visual world?

References

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