

How Actions Change What We See (Maybe): The Effect of Visuomotor Action Preparation on Visual Crowding



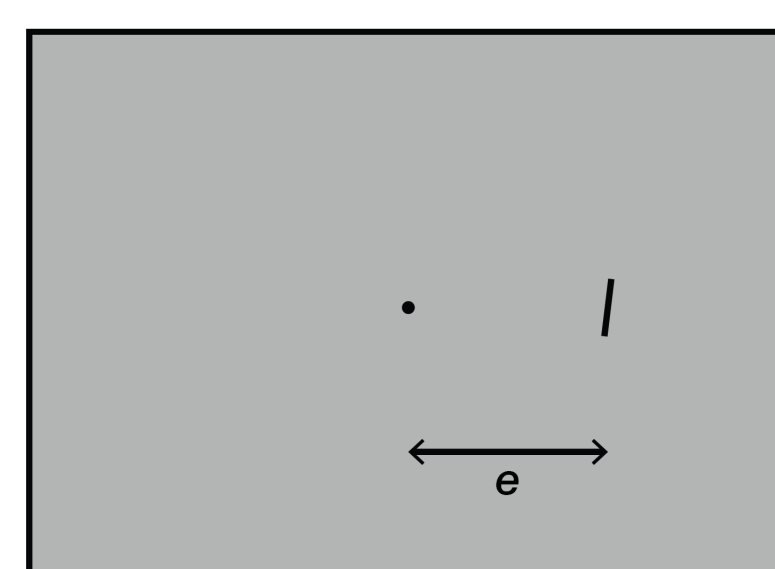
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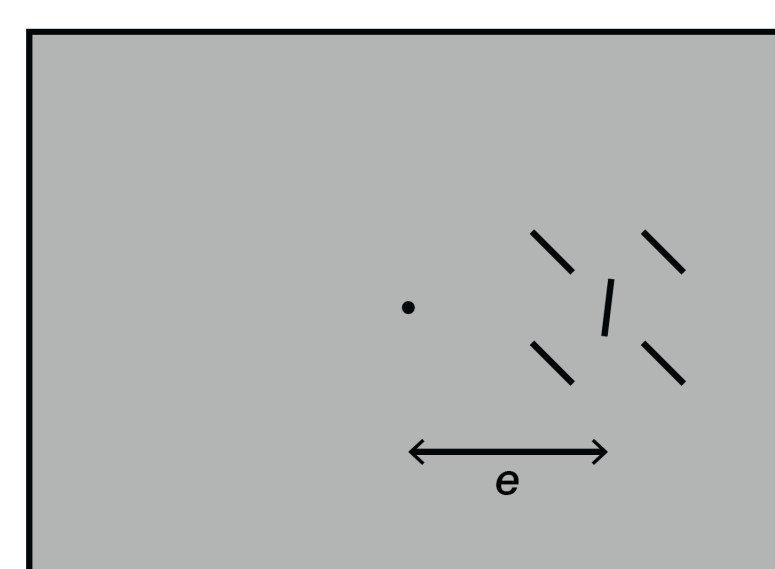
BACKGROUND

- **Crowding** is a visual phenomenon where multiple objects in the periphery can be detected, but not discriminated
- Action intentions modulate visual processing at an early stage and increase sensitivity for relevant features, e.g. orientation (Gutteling et al., *PLoS One*, 2011)
- Unclear if this influence extends to crowded stimuli

No crowding



Crowding



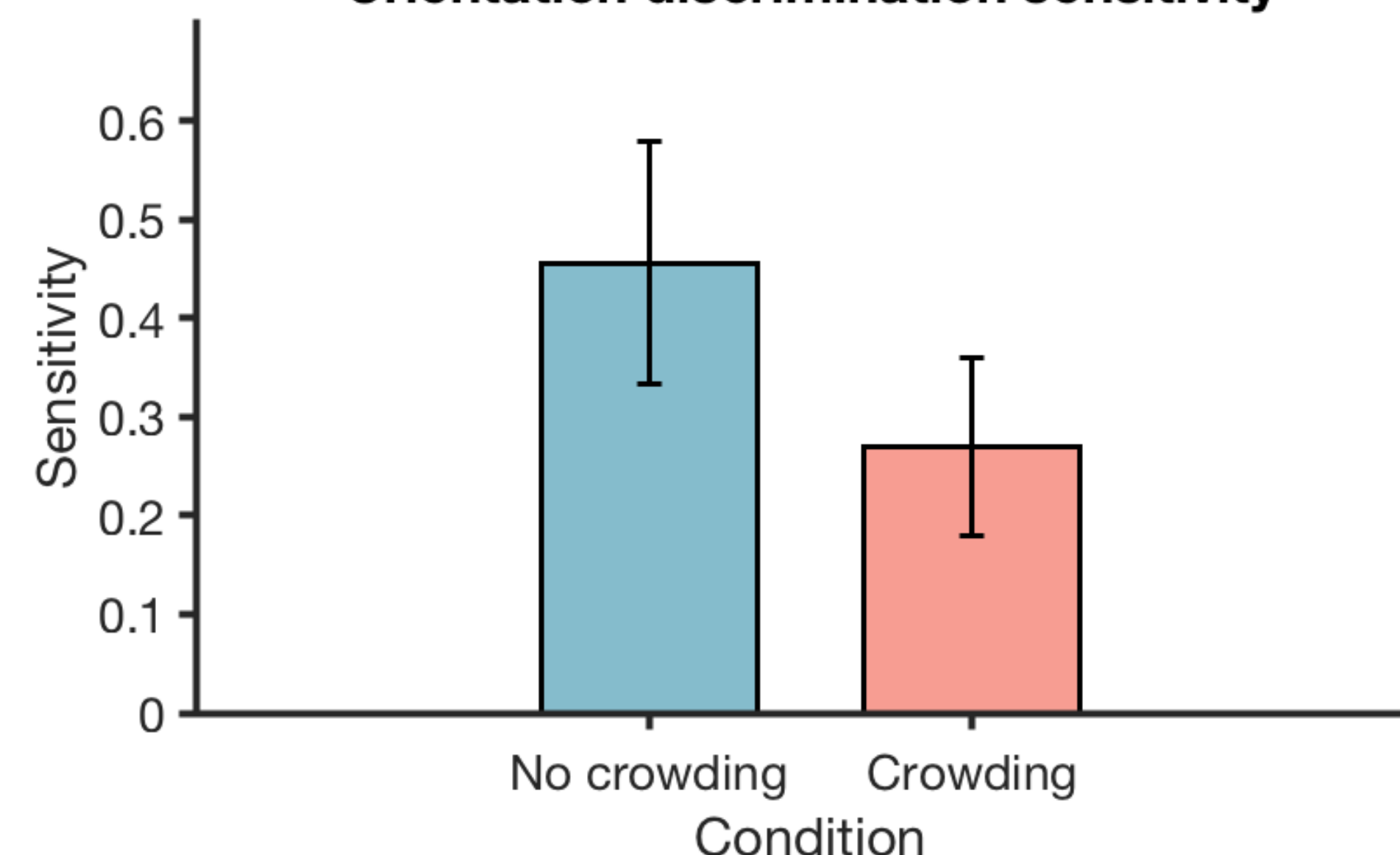
Sample stimuli,
with targets at
eccentricity $e = 14^\circ$
visual angle.

PURPOSE

This experiment assesses whether movement preparation improves the visual discriminability of objects in the periphery.

Crowding reduces orientation sensitivity

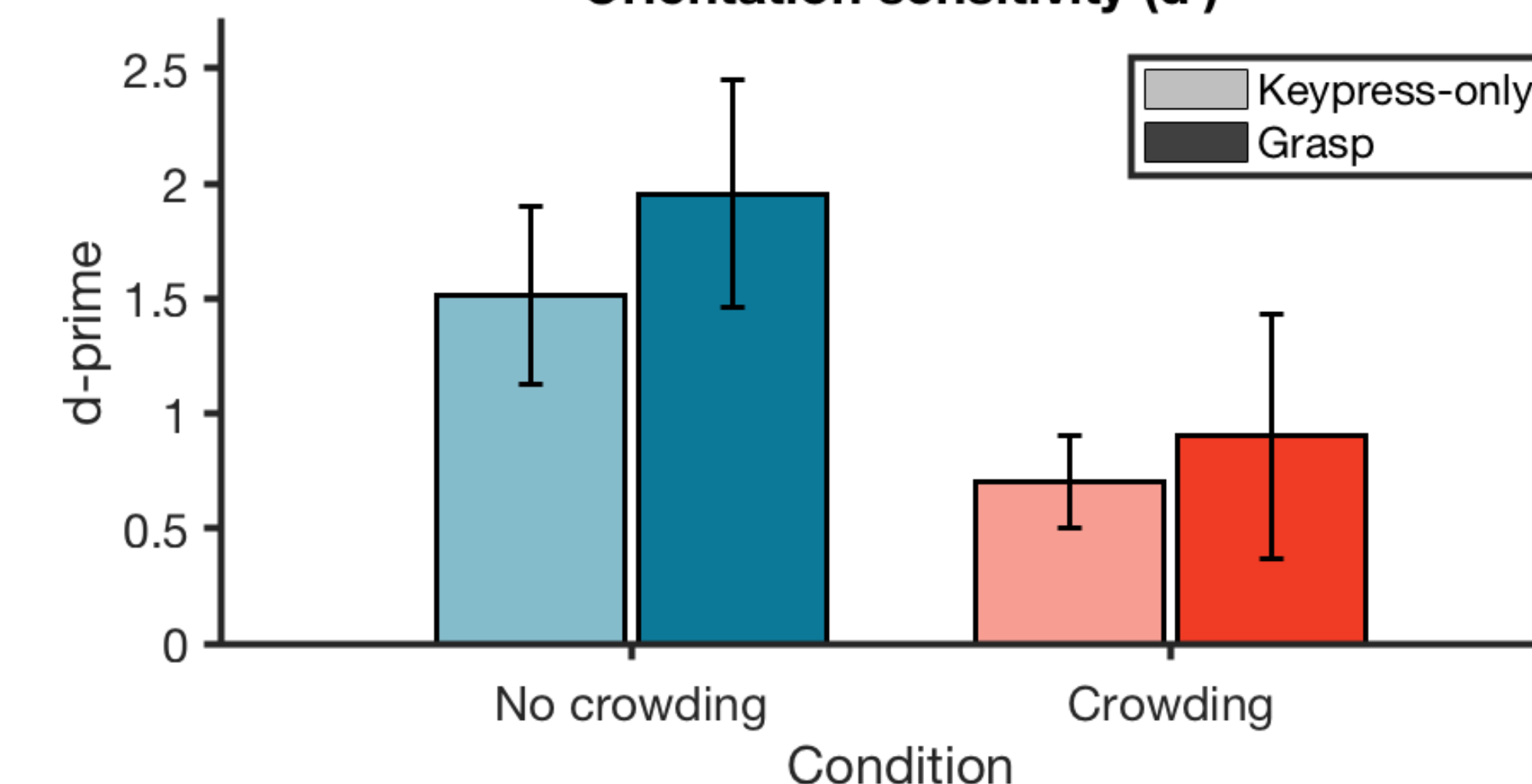
Orientation discrimination sensitivity



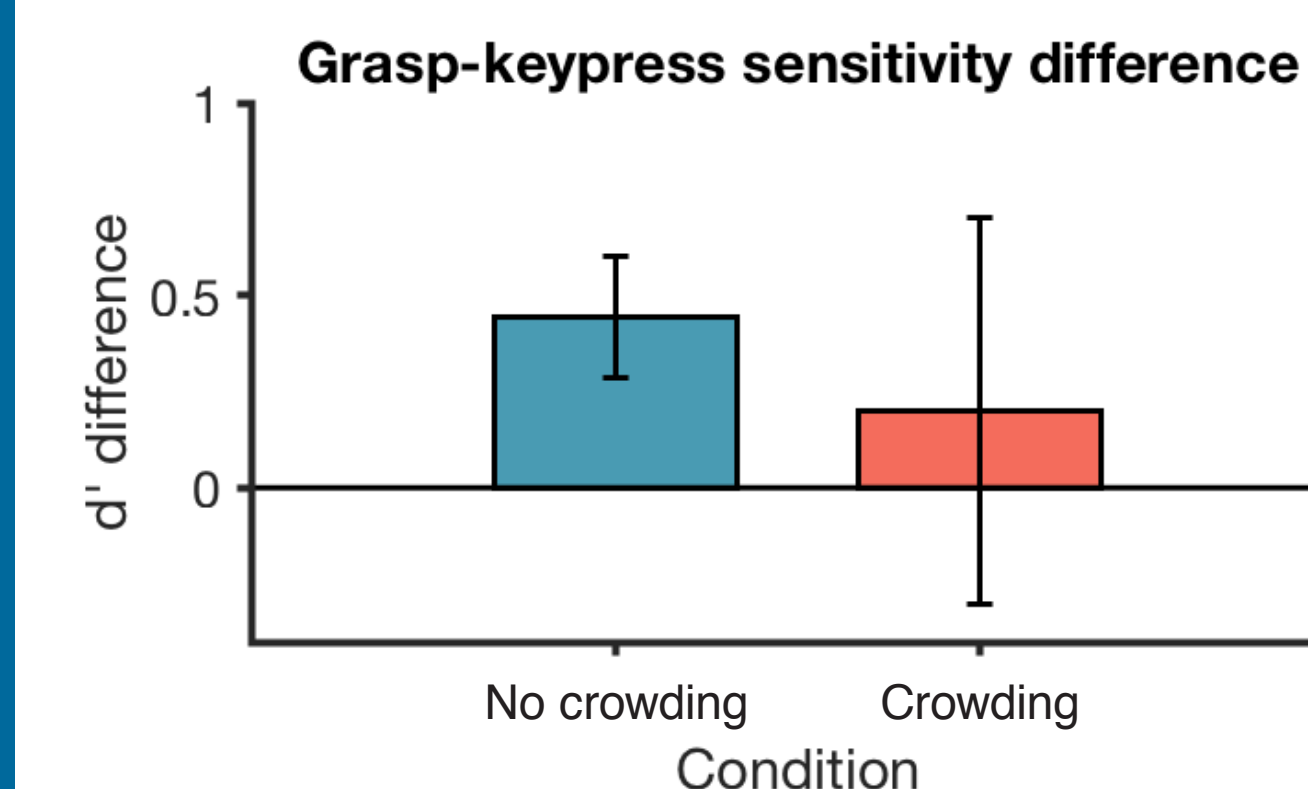
- Greater angle displacement from baseline (threshold) needed to identify orientation when target is crowded ($n=5$)
- Crowding reduced orientation sensitivity by average of 1.52° (SEM = 0.92°)
- Error bars are ± 1 SEM

Grasping enhances orientation sensitivity

Orientation sensitivity (d')



- Across both non-crowded and crowded conditions, orientation sensitivity (d' -prime) was greater when grasping was involved, than when the task was keypress-only ($n=5$)

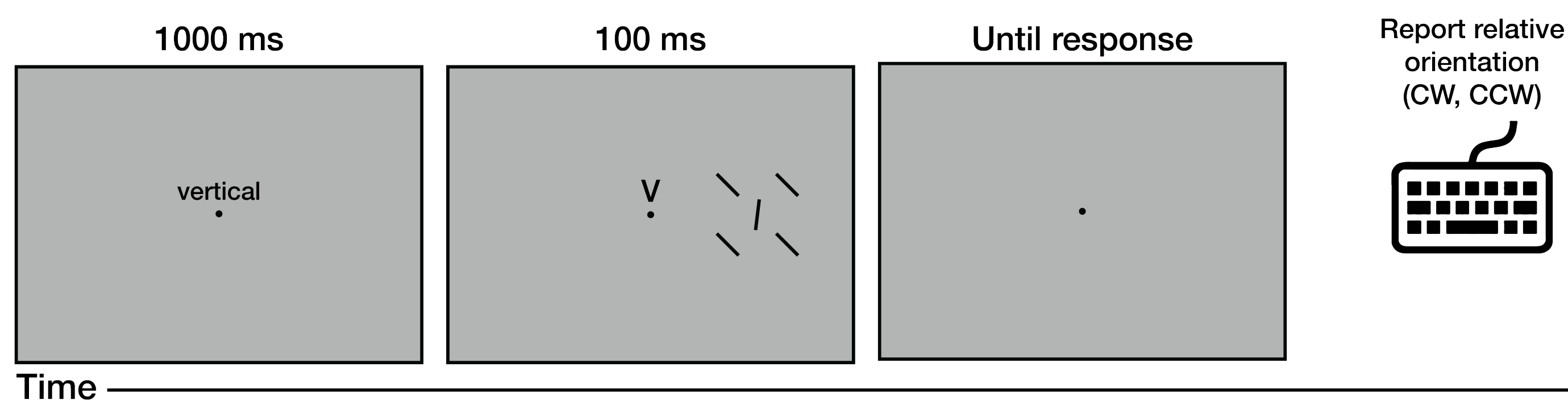


Grasping increased orientation sensitivity more for non-crowded conditions ($n=5$)

METHODS

Participants: Ten adult participants (six males) with good or corrected vision.

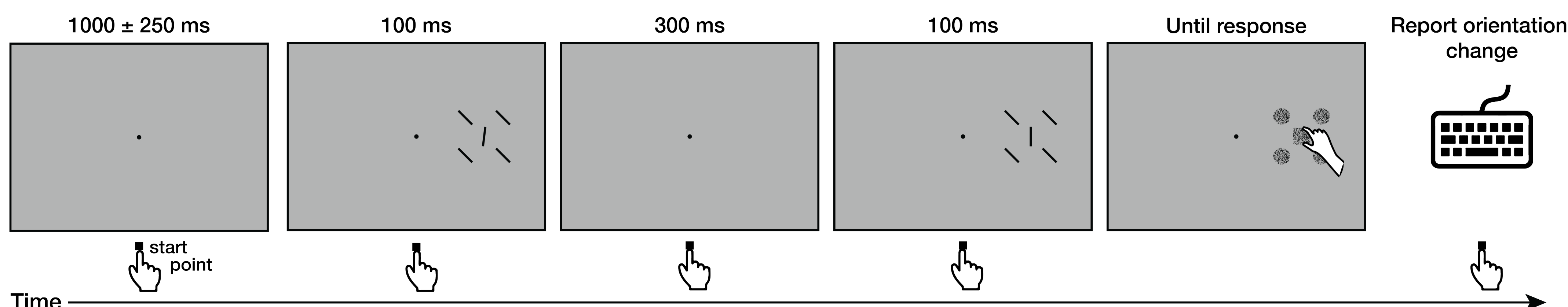
Threshold task:



- Measure of orientation sensitivity at 14° visual angle to the right of fixation
- Determined angle relative to horizontal/vertical at which orientation (clockwise vs. counterclockwise) could be identified at 80% accuracy
- Thresholds used in main experiment to determine magnitude of orientation change

Main experiment (grasping & keypress-only tasks):

- **Keypress-only task:** Report whether two stimuli's orientations are different
- **Grasping task:** Same as keypress-only, but grasp the 2nd stimulus; fingertips tracked with infrared-emitting diodes



CONCLUSIONS

- **Motor preparation may increase orientation sensitivity in the periphery, but its effect on crowding is unclear**
- Preparing to grasp potentially improves sensitivity to grasp-relevant features, e.g. orientation, in the periphery, but this increase is weaker when the target is crowded
- Crowding may weaken this effect of motor preparation

FUTURE DIRECTIONS

- In crowded displays, flankers may be allocated more spatial attention than target items (Chicherov & Herzog, *NeuroImage*, 2015)
- As motor preparation reallocates spatial attention to the target (Baldauf & Deubel, *Vision Research*, 2010), electroencephalography experiments could elucidate its attentional impact on crowding

ACKNOWLEDGMENTS

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