Eye-hand Coordination in Reaching and Grasping Vertically Translating Targets

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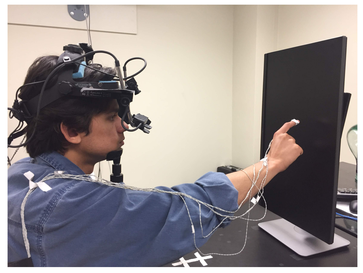
Introduction

Previous research in our lab has revealed that subjects direct their gaze to the eventual contact point of the index finger when grasping stationary or horizontally moving targets[1,2]. However, the thumb may become a more important position for gaze when intercepting a falling target – where a miscalculation in thumb placement could result in a missed target. The current study examined whether vertically moving targets generate different fixation patterns dependent on the direction of movement.

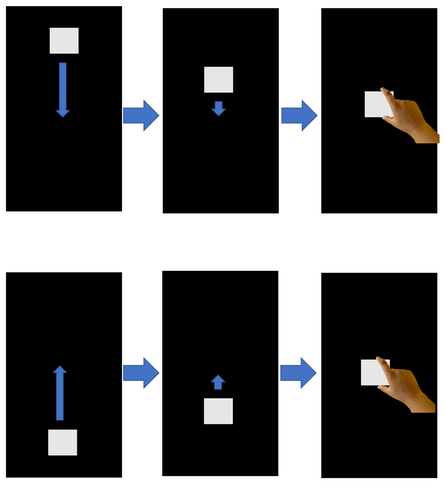
Methods

15 right-handed undergraduate Psychology students (9 female; *M* age = 20.6), with normal or corrected-to-normal vision, were recruited for this study. Motion Monitor software (Innovative Sports Training) was used to integrate 3-D position data collected from an Eyelink II and an Optotrak Certus into a common fame of reference.



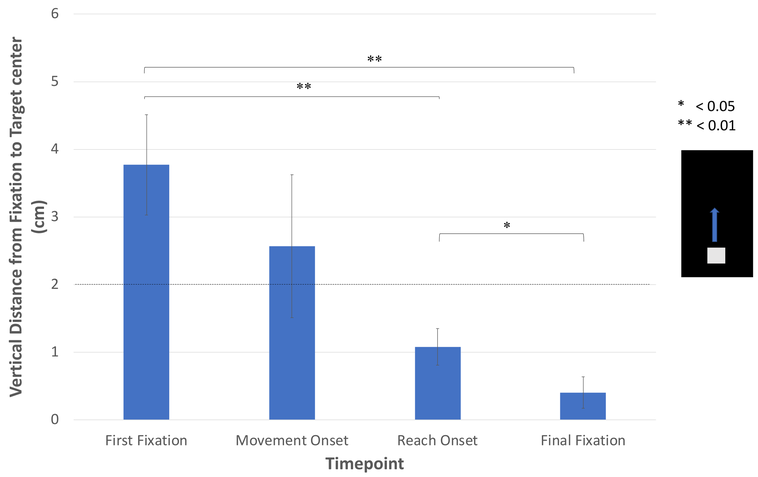
Experimental Design

A white 2-D 4 x 4 cm target generated by the MotionMonitor appeared at the top or bottom of the screen and began moving vertically toward the opposite end of the screen.

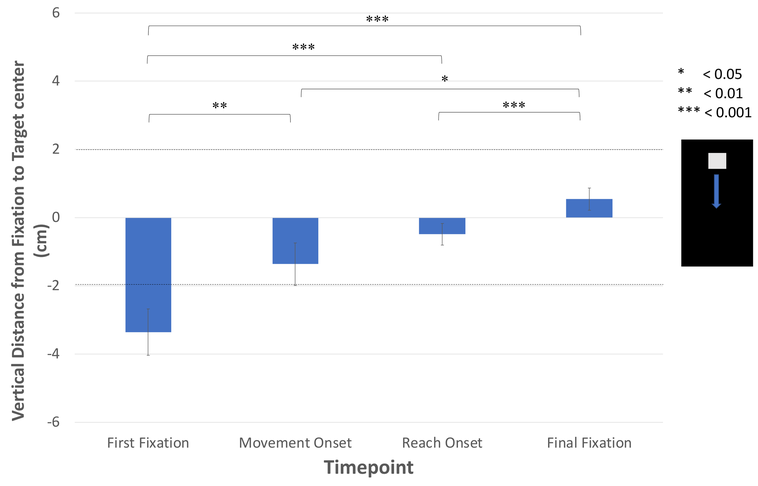


Subjects were instructed to "grasp" the target after hearing a tone (370 Hz for 0.5s). The moment the tone was presented during each trial varied so that Experimental trials consisted of grasps toward the center of the screen, while Distractor trials produced grasps above or below the center.

Increased Influence of the Thumb on Gaze during Downward trials

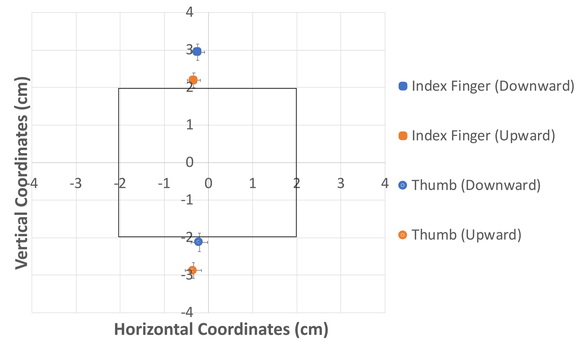


Upward moving targets. Anticipatory fixations ahead of the leading edge of the target were made when the target initially appeared on the screen, and shifted toward the leading edge at movement onset. At reach onset, fixations were made above the target center towards the target's leading edge, suggesting the influence of the index finger on fixation strategy while grasping. Fixations were not significantly different from center at grasp completion.



Downward moving targets. Anticipatory fixations ahead of the leading edge of the target were made when when the target initially appeared on the screen, and toward the leading edge at movement onset. At reach onset, fixations, although directed toward the lower half of the target, were not significantly different from target center, suggesting an increased influence of the thumb, in addition to the index finger, on fixation strategy while grasping. Fixations were not significantly different from center at grasp completion.

Finger Placement



On average, index finger and thumb placement was shifted up when grasping downward moving targets compared to upward moving targets. This suggests that the direction of target movement has an influence on grasp strategy.

Conclusion

- ❑ We see an increased influence of the thumb on gaze when grasping "dropping" targets but this influence does not overrule that of the index finger's.
- ❑ Future studies may incorporate the manipulation of target velocity and acceleration to mimic gravitational motion[3,4].

References

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