



Gaze and Grasp Preferences: The Influence of Target Shape, Position, and Direction of Motion

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Introduction

When grasping a block using a precision grip, grasp 'stability' is associated with the distance between the grasp line (connecting the index finger and thumb) and the object's horizontal midline¹. At the time of grasp, gaze also favours the object's midline, while demonstrating a slight rightward bias when grasping both stationary 3D objects^{2,3} and 2D targets².

When grasping horizontally moving targets, final index finger placement is positioned *ahead of a* leftward moving target's midline, and *behind a* rightward moving target's midline, demonstrating a slight leftward bias^{4,5}.

The purpose of this research was to determine 1) How a stationary target's position in relation to the reaching hand influences final gaze and grasp positions, and 2) How these strategies are influenced by the direction of target movement. Final gaze and grasp strategies were investigated while grasping symmetrical targets with and without a flat top edge (see *Experimental Design*).

Data Collection



Final eye position was recorded using an Eyelink II. Grasp movements were recorded by using an Optotrak Certus. All data was integrated into a common reference frame via Motion Monitor software (Innovative Sports Training). All participants were right-handed and had normal or corrected to normal vision.

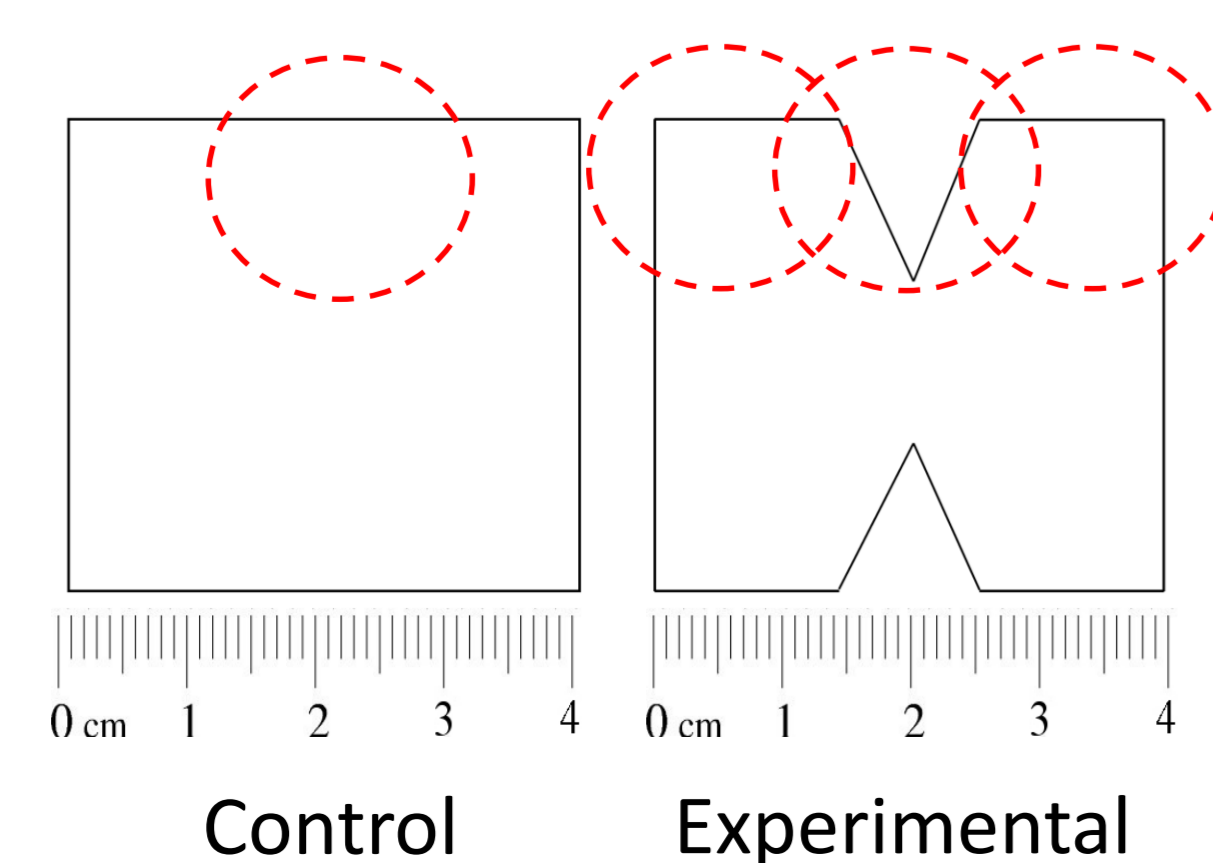
Experimental Design

Participants executed right-handed reach-to-grasp movements using their index finger and thumb for either Control or Experimental targets presented on a computer screen.

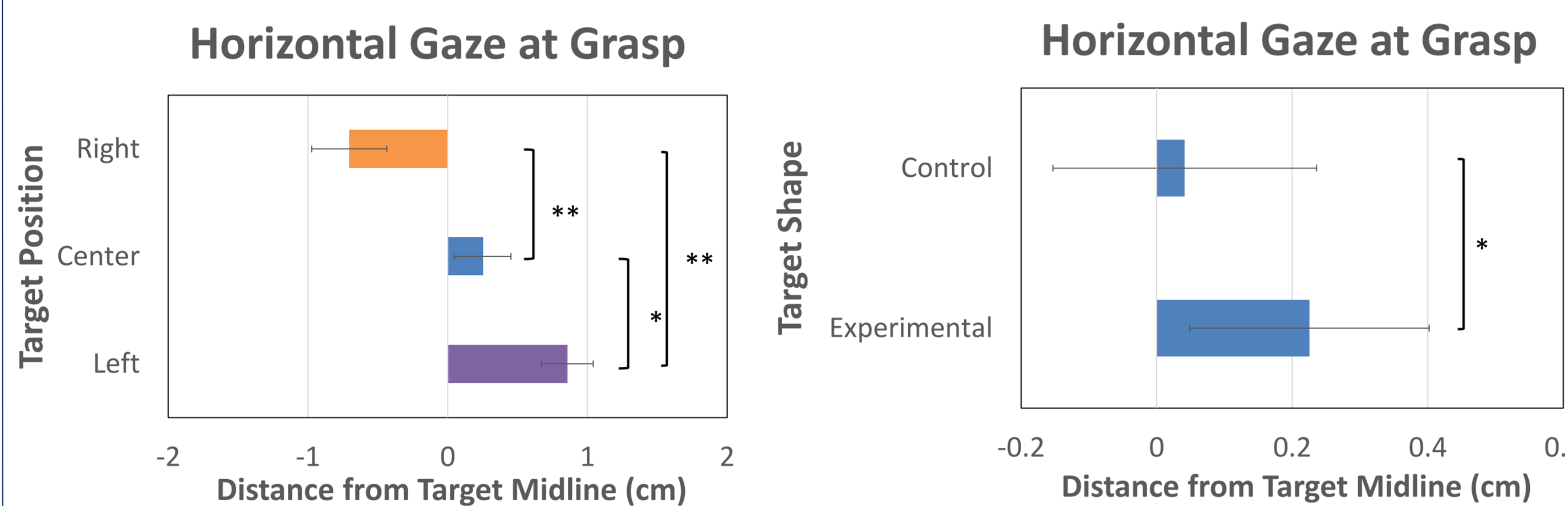
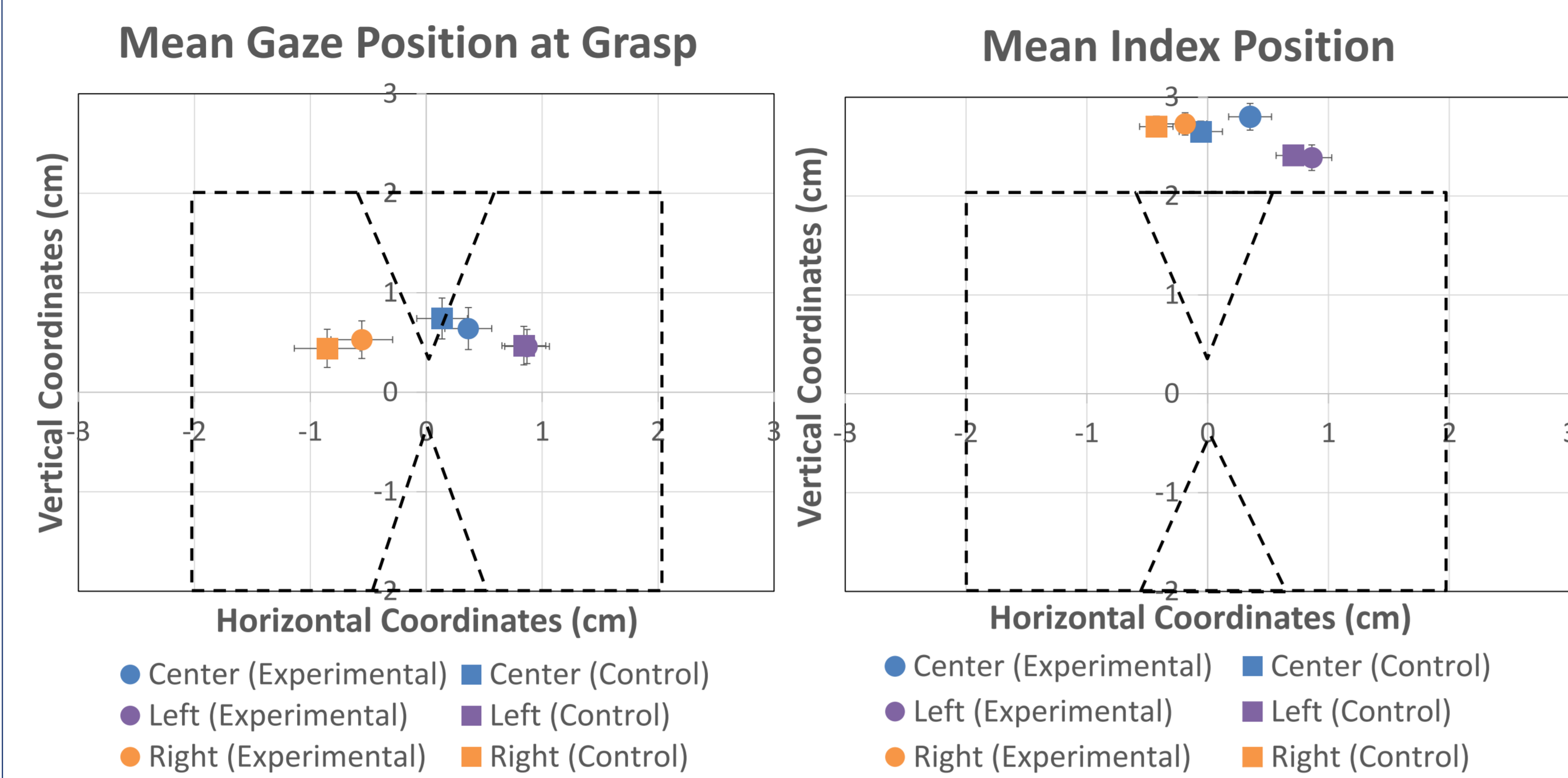
Experiment 1 (n = 18): Stationary targets were presented randomly at positions either 20 cm to the Left, 20 cm to the Right, or in the Center of the screen.

Experiment 2 (n = 19): Targets appeared on either the Left or Right side of the screen, and began translating horizontally toward the opposite side.

Participants were cued with a 'grasp tone' presented at early, middle, or late time points, requiring participants to reach toward the Left, Center, or Right side of the screen at early, middle, or late stages of target travel.



Experiment 1: 2D Stationary Targets

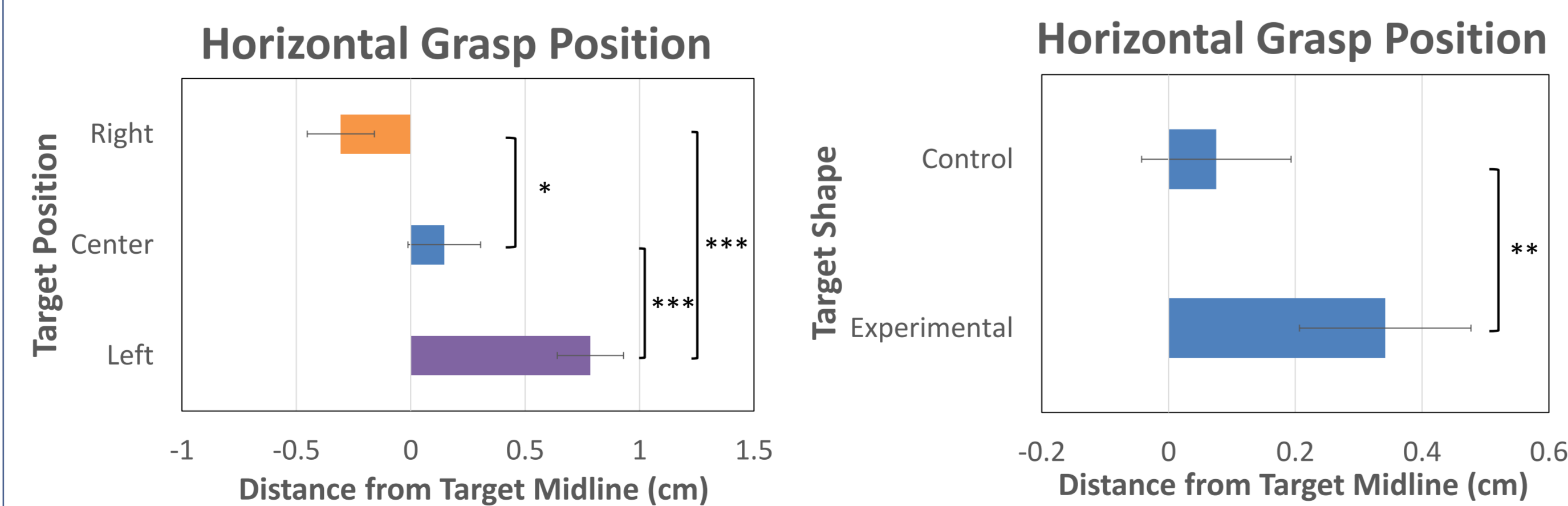


Average Horizontal Gaze at Grasp: Significant Main Effect of Target Position (p < .001):

- **Leftward Targets:** Final gaze directed **Rightward**
- **Central Targets:** Final gaze directed toward the **Center**
- **Rightward Targets:** Final gaze directed **Leftward**

Average Horizontal Gaze at Grasp: Significant Main Effect of Target Shape (p < .05):

- Final gaze positioned significantly **Rightward** when grasping Experimental targets



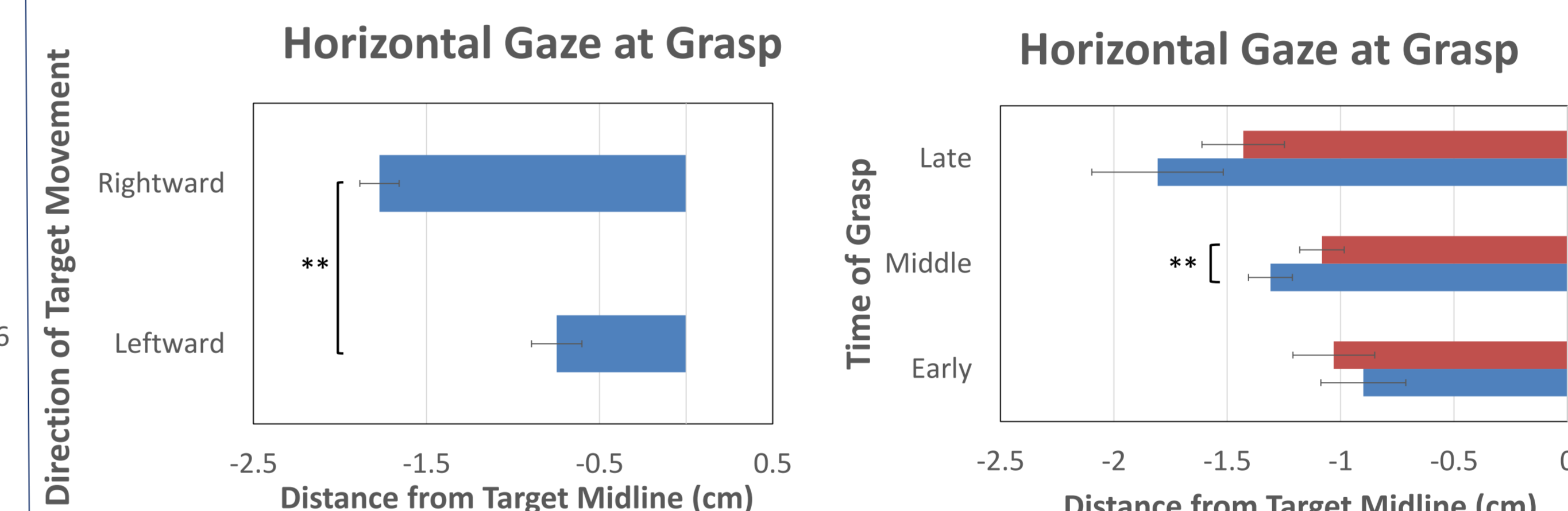
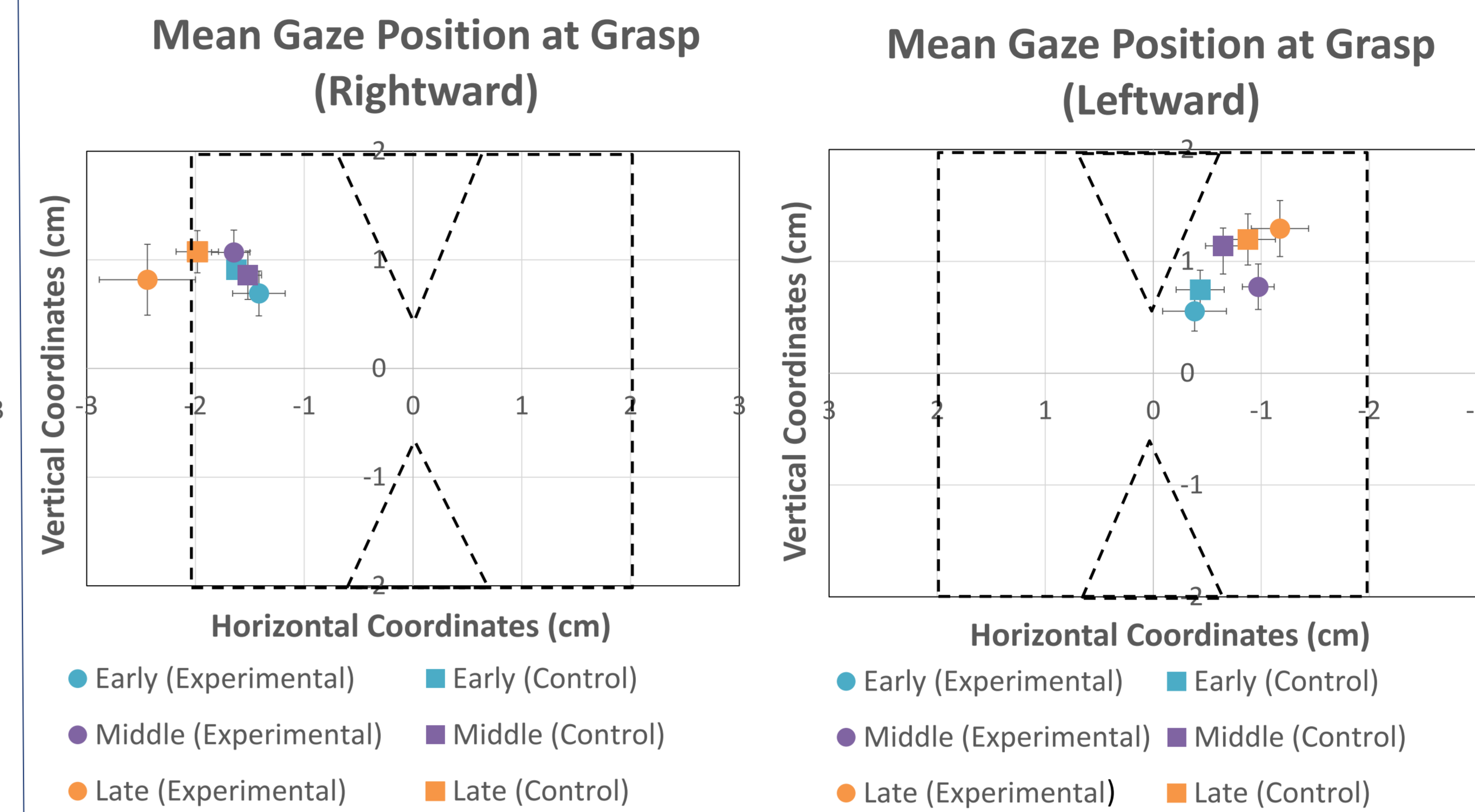
Average Horizontal Grasp: Significant Main Effect of Target Position (p < .001):

- **Leftward Targets:** Final index finger positioned **Rightward**
- **Central Targets:** Final index finger positioned toward the **Center**
- **Rightward Targets:** Final index finger positioned **Leftward**

Average Horizontal Grasp: Significant Main Effect of Target Shape (p < .01):

- Final index finger positioned significantly **Rightward** when grasping Experimental targets

Experiment 2: 2D Translating Targets

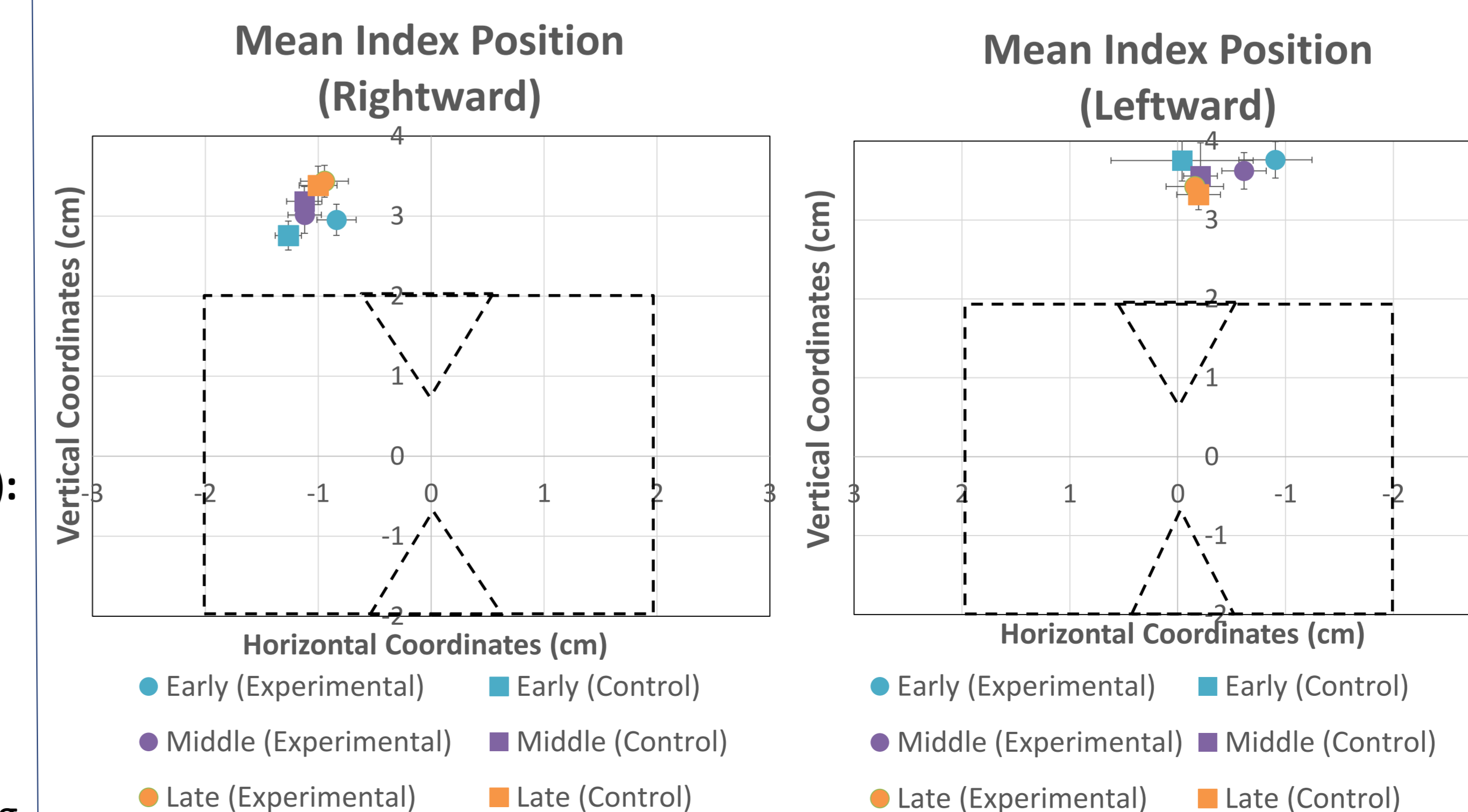


Average Horizontal Gaze at Grasp: Significant Main Effect of Direction (p < .001):

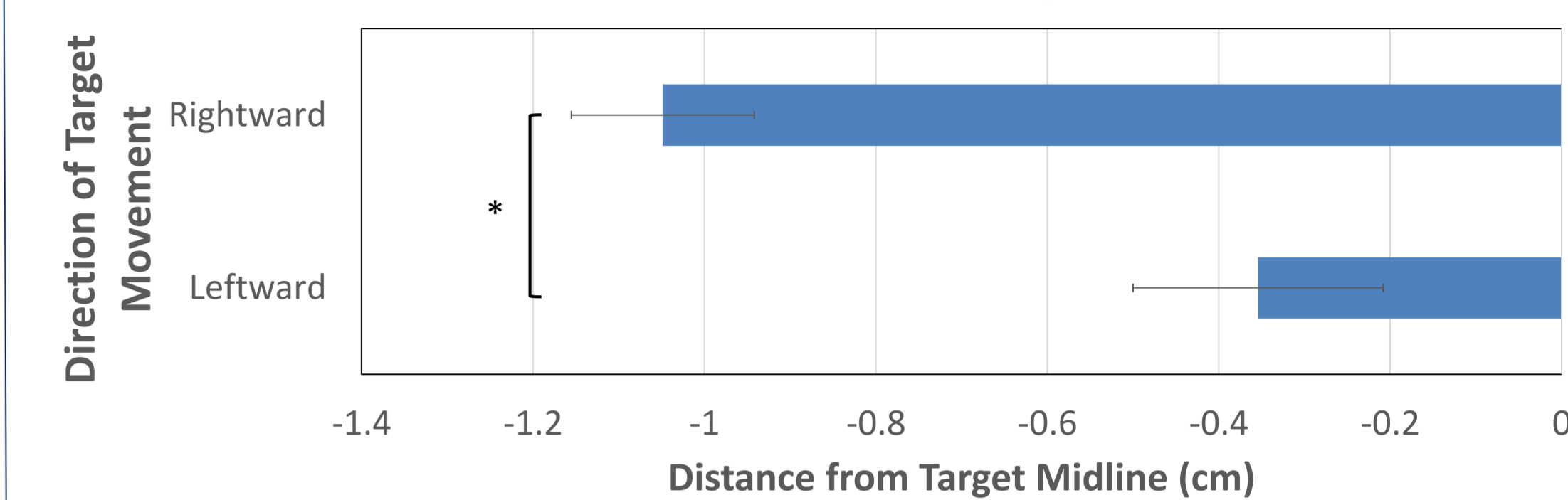
- Final gaze positioned significantly closer to the target's midline when grasping **Leftward** moving targets

Average Horizontal Gaze at Grasp: Significant Target Shape by Time of Grasp interaction (p = .05):

- When reaching toward the **Middle** of the screen final gaze is positioned significantly closer to **Control** target's midline



Horizontal Grasp Position



Average Horizontal Grasp: Significant Main Effect of Direction (p < .01):

- Final index finger positioned significantly closer to **Leftward** moving target's midline

Conclusions

Grasping stationary targets:

- Final gaze and grasp are directed toward locations that require the least amount of mechanical effort when grasping.
- Final gaze and grasp positions demonstrate a rightward bias when grasping shapes without a flat top-edge compared to the control shapes.

Grasping horizontally translating targets:

- Final gaze and grasp is directed toward the trailing edge of the target.
- As demonstrated previously⁵, final gaze and grasp positions are directed closer to the target's horizontal midline when grasping Leftward, compared to Rightward moving targets. This may suggest that participants unconsciously reach ahead of targets moving away from their reaching hand, to account for any potential error associated with reaching across the body.

References

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Acknowledgements

This research was supported by the Psychology Graduate Fellowship Fund and from the Natural Science and Engineering Research Council of Canada (NSERC) held by J.J.M.

