Where we look and where we grasp on an object: Changes in object shape and surface properties

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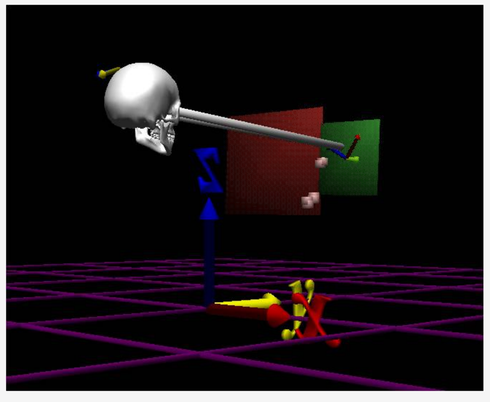
Introduction

Research has shown that grasp locations typically fall close to or across an object's center of mass (COM[1,2,]), with participants adjusting their grasp locations to coincide with small changes in COM location[1]. When reaching out to grasp an object, participants take advantage of visual cues to object symmetry to better determine the object's COM when selecting these locations[2].

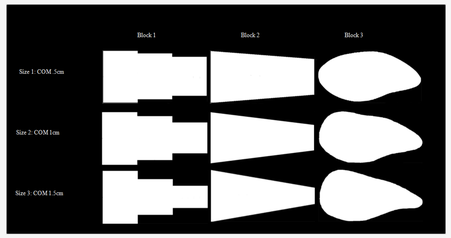
The purpose of this research was to examine the influence of COM location (Experiment 1) and variations in surface characteristics (Experiment 2a, 2b) on grasp and gaze positions.

Methods

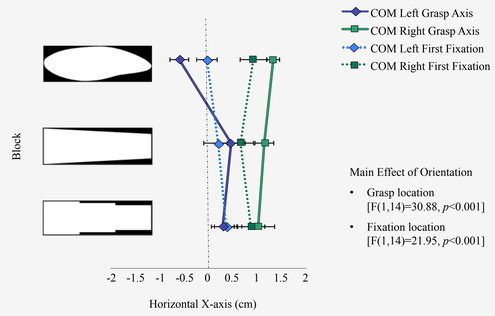
Reach-to-grasp movements and fixation data were collected with an Optotrak Certus and Eye-link II system. Data were integrated into a common frame of reference via Motion Monitor software.



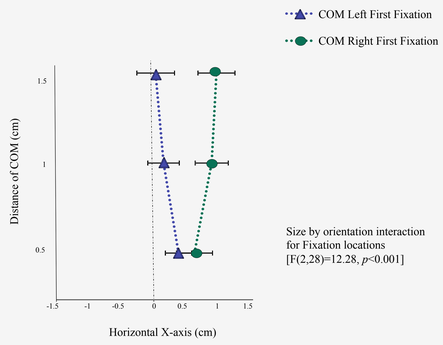
Experiment 1



COM location was dissociated from the object's horizontal center at three distances.

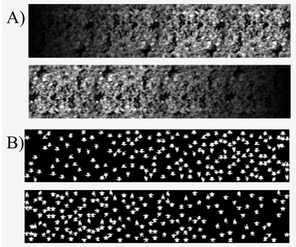


Orientation of COM was the largest influence on both grasp and fixation locations.

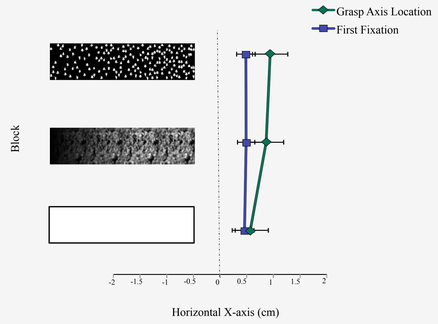


Fixations to objects with COM distances of 1cm and 1.5cm were significantly different than fixations to objects with COM distances of 0.5cm.

Experiment 2a

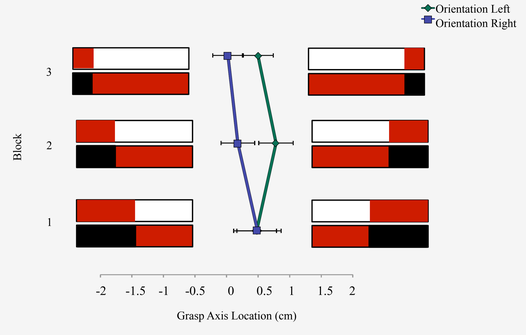


Gradients of luminosity (A) and numerosity (B) elicit leftward selection biases[3] and rightward bisection biases[4,5].



Grasp locations to the greyscale and star objects were significantly more to the right when compared to a control block.

Experiment 2b



Surface properties biased grasp locations away from the coloured areas. Significant differences in orientation was observed between blocks 2 and 3.

Conclusions

The orientation of the object's COM is the largest mediator in grasp and gaze position. Changes in COM distance has less influence on grasp position than fixation locations.

Attention to the local elements making up the shapes (as opposed to global processing) is biasing grasp positions. Rightward biases are observed when objects are made up of many small parts (Experiment 2a). Grasp positions are biased towards the center of the 'larger' shape (Experiment 2b).

Changes in object shape and changes in the local elements within a shape can differentially affect fixation and grasp locations when picking up an object.

References

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Acknowledgments

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