Representational Momentum in the Motor System?

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Introduction

• If presented with a moving object which suddenly disappears observers usually misjudge the object's last seen position as being further forward along the path of motion. This effect, called representational momentum, can also be seen in objects which change size or shape. It has been argued that the effect is due to perceptual anticipation.

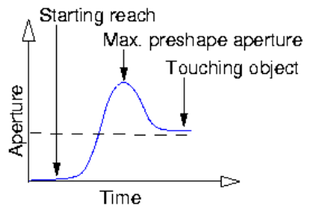
• Representational momentum has been investigated mainly in perceptual tasks. Recent developments in neuroscience suggest that motor tasks are less affected by visual illusions than perceptual tasks.

• Here, we tested whether representational momentum is present in the motor system.

Dependent Variables

Grasping: Maximum Preshape Aperture

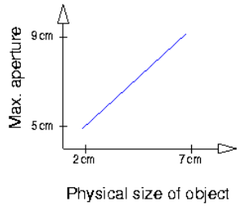
During the reach phase of a grasp (precision grip), index finger and thumb open to a maximal aperture:



The maximum preshape aperture is:

• linearly related to object size and therefore a measure for size - information in the motor system.

• a measure for the transfer of visual size -information to the motor system, if non-visual cues are minimized.

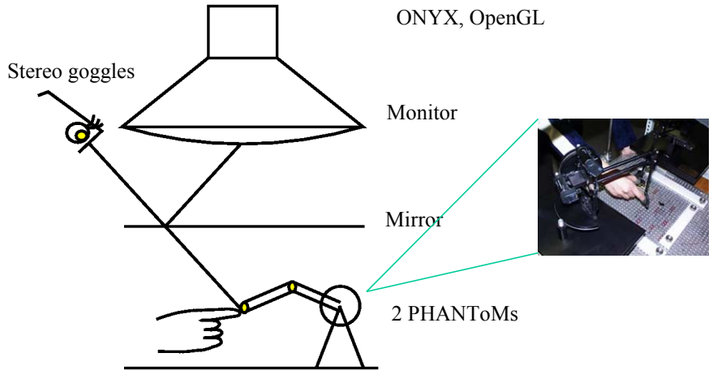


Perception

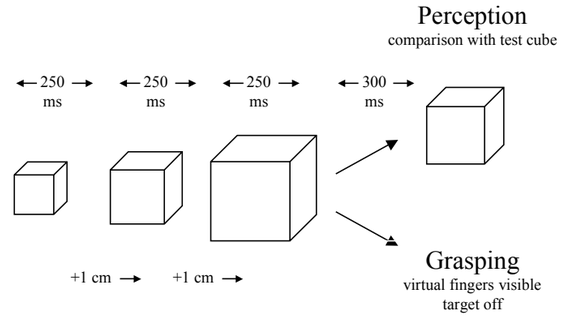
The method of constant stimuli was used to determine psychometric functions.

Methods

A virtual visual and haptic setup was used. Participants viewed a monitor via a surface mirror and stereo-goggles. Virtual haptic stimuli were generated using two robot arms (Phantom^{TM}): Index finger and thumb were attached to the robot arms and the robot arms generated force feedback similar to the feedback of real stimuli.



10 participants observed cubes which either increased or decreased in size:

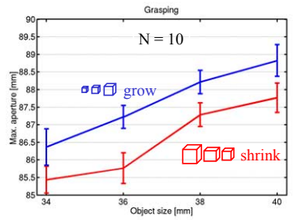


Participants performed two tasks:

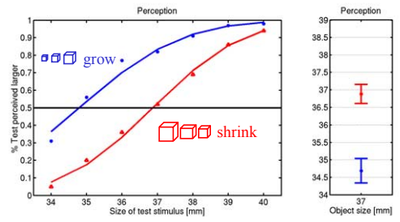
In the perceptual task participants compared the third cube to a standard (constant stimuli procedure). In the motor task, they grasped the third cube.

Results

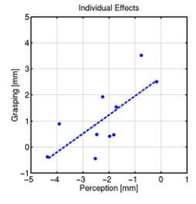
In the motor task participants opened their fingers by 1.1+/-0.4 mm wider if they grasped a cube which was preceded by smaller cubes than if they grasped a cube which was preceded by larger cubes. This is the well-known representational momentum effect:



In the perceptual task the representational momentum effect was reversed (-2.2+/-0.4 mm):

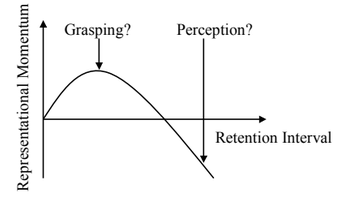


The motor effect and the perceptual effect correlated between observers (r=.71, p=.02).



Conclusions

It seems that representational momentum occurs also in grasping tasks. The correlation between observers suggests that the motor effect is related to the perceptual effect. However, our perceptual task showed a reversed effect. One reason for this discrepancy could be different time requirements of the perceptual and the motor tasks (cf. Freyd & Johnson 87):



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