



# Effects of the Ebbinghaus Illusion on grasping in a virtual environment



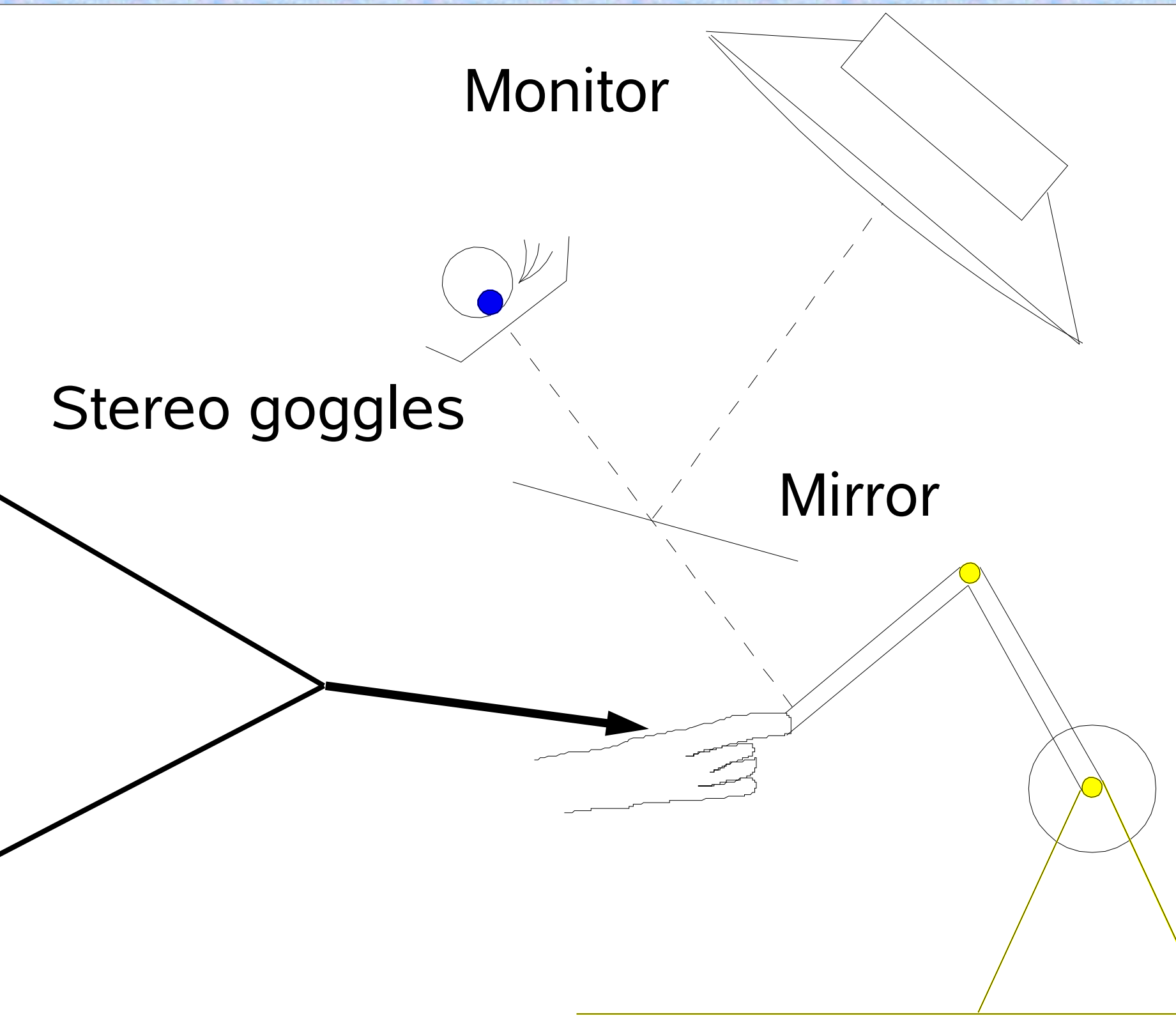
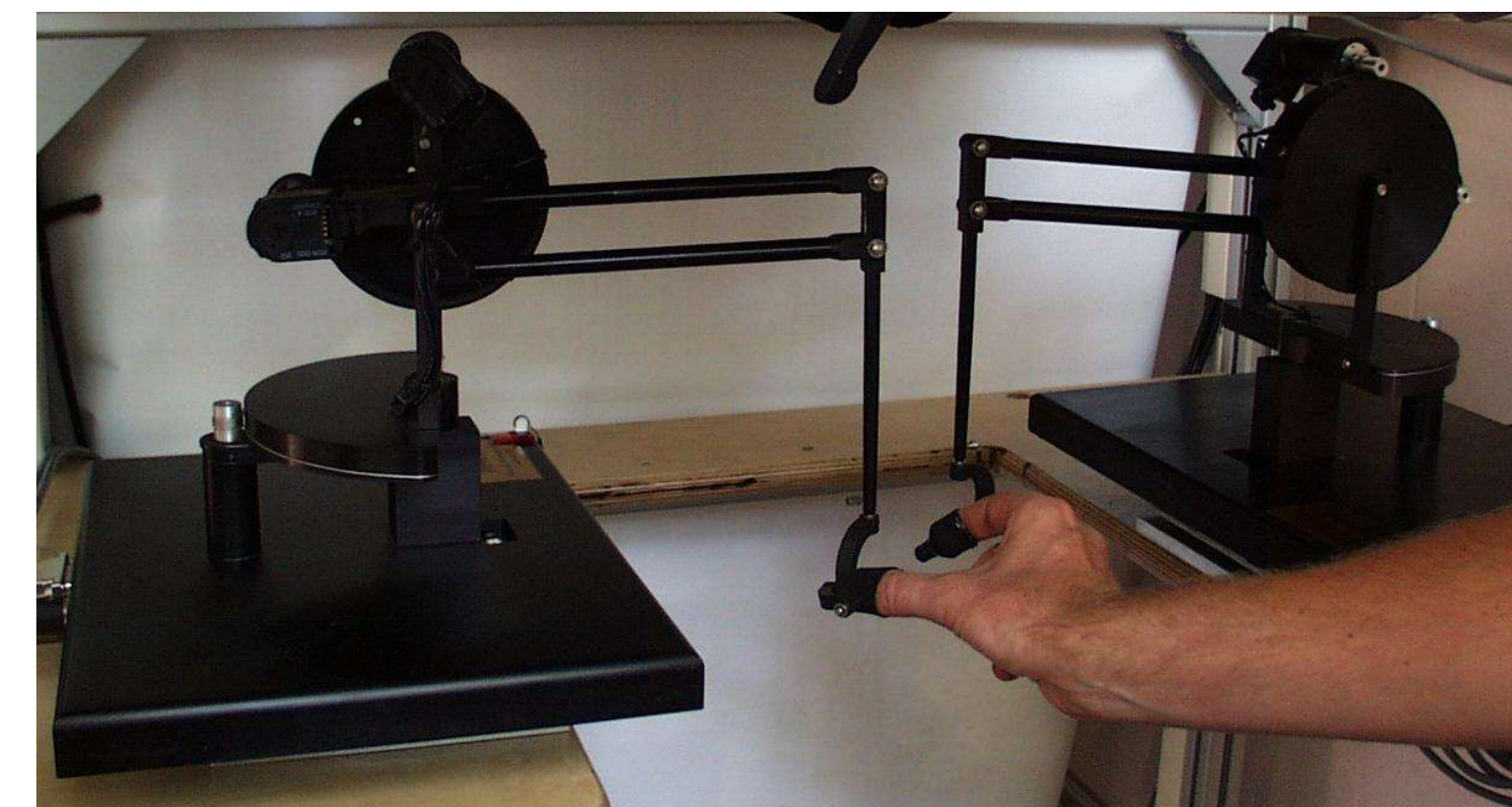
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## Introduction

It is an open question whether visual illusions affect motor actions in the same way as visual perception. One specific question is which perceptual measure should be used to be compared to grasping. Here, we compared “manual estimation” (participants indicate the size of a target using index finger and thumb) with a standard perceptual measure. Both measures are widely used, but have never been compared directly (an overview is given in Franz, 2001). In addition we evaluated the usability of a virtual environment for grasping studies.

## The virtual setup

Visual feedback was given using stereo computer graphics (OpenGL).

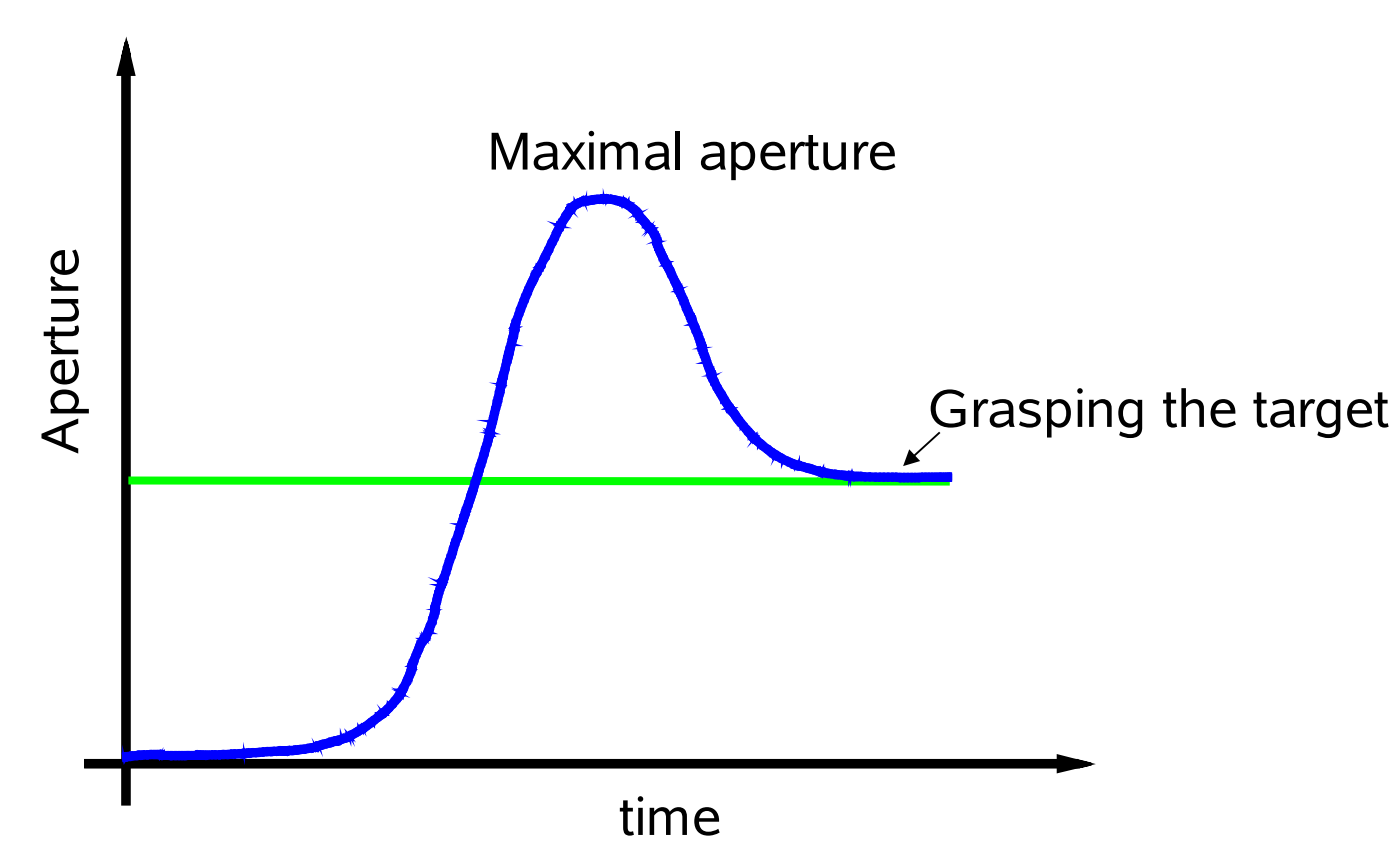


Haptic feedback was given using two Robot arms (PHANToMs™), of which one was connected to the index finger, the other one to the thumb, thus allowing a precision grip of the virtual target disc.

2 PHANToMs™

## Maximum Grip 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).

## Procedure

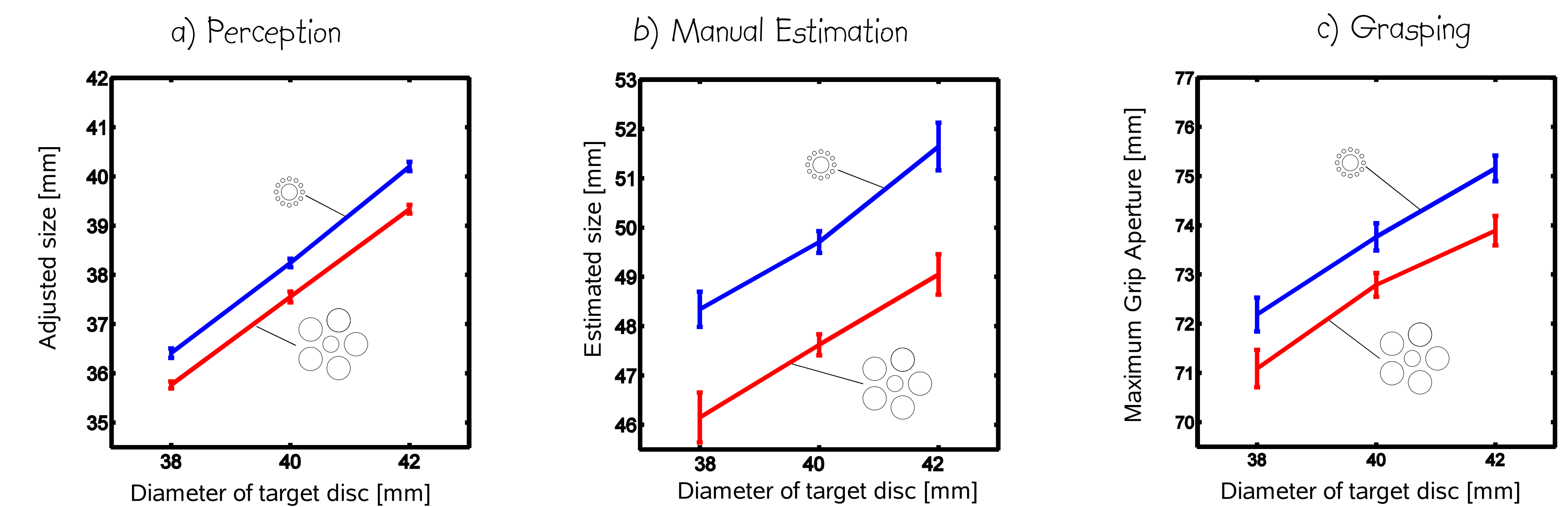
### Standard Perceptual Measure:

Participants adjusted a comparison disc until they perceived it to be of the same size as the target disc.

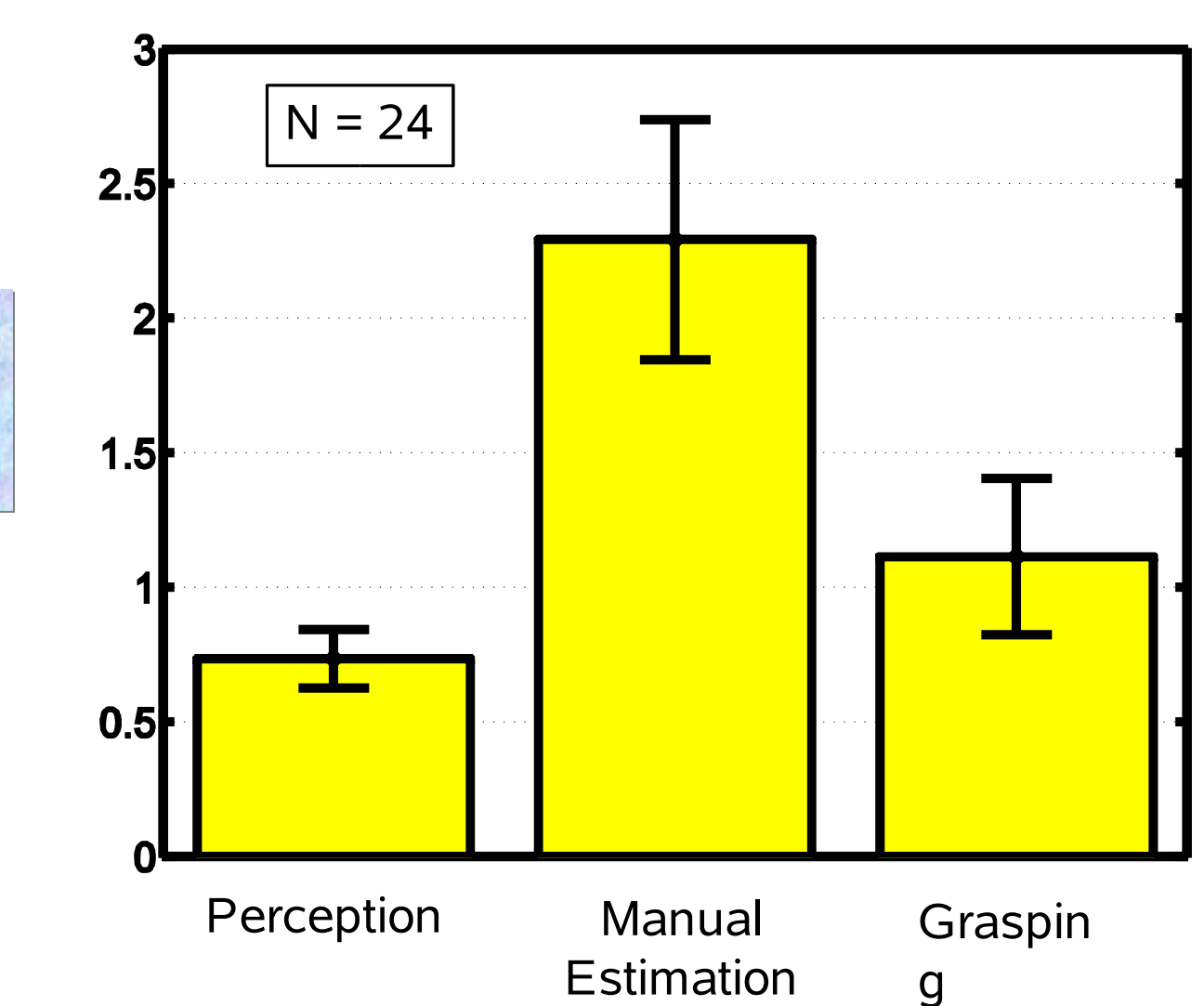
**Manual estimation:** Participants indicated the target size using their index finger and thumb without seeing them. (Subsequently, they grasped the target disc to get the same haptic feedback as in the motor task.)

**Motor task:** Participants grasped the target disc.

## Results

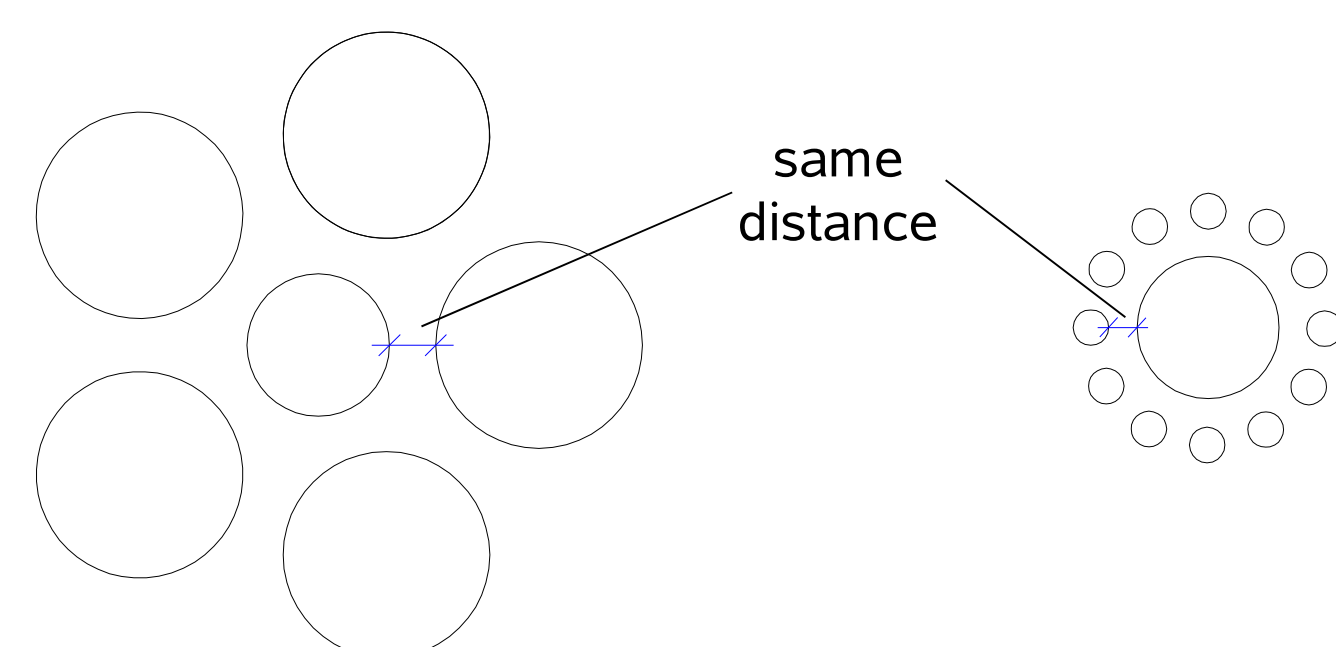


Main effects of the illusion



## Stimuli

“Ebbinghaus illusion”



Large context      Small context

## Conclusion

“Manual estimation” shows larger illusion effects than both, the standard perceptual measure as well as grasping. This raises doubt that this task can be used as a perceptual measure.

The results obtained with our virtual setup are comparable to results obtained while grasping real objects (compare Fig. a) and c) to results in Franz, 2000). This indicates that the virtual setup can be used to investigate human grasping movements.

## References

Aglioti, DeSouza, & Goodale (1995). *Size-contrast illusions deceive the eye but not the hand*. Current Biology, Vol. 5 No. 6

Franz, Gegenfurtner, Bülthoff, & Fahle (2000). *Grasping visual illusions: No evidence for a dissociation between perception and action*. Psychological Science, 11, 1, 20-25.

Franz (2001). *Action does not resist visual illusions*. TICS, Vol.5 No.11

Haffenden, & Goodale (1998). *The Effect of Pictorial Illusion on Prehension and Perception*. J. of Cognitive Neuroscience, Vol. 10 No.1