A new window into the interactions between perception and action.

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Introduction

Traditionally, viewing window paradigms, in which degraded images of objects are revealed within a user controlled window, have been used to evaluate perceptual features useful in object identification.

Despite their traditional role, viewing window tasks inherently require visuomotor processing[1-3], which can be manipulated to illuminate the interactions between the "*perception*" (ventral) and "*action*" (dorsal)[4] cortical visual streams.

Using the viewing window paradigm, one can individually manipulate perceptual and motor components of a task separately, assessing the unique contributions and interactions of the two visual streams.

Experiment 1

Purpose

To evaluate the viewing window as an experimental tool for use in visuomotor paradigms and object recognition.

Method

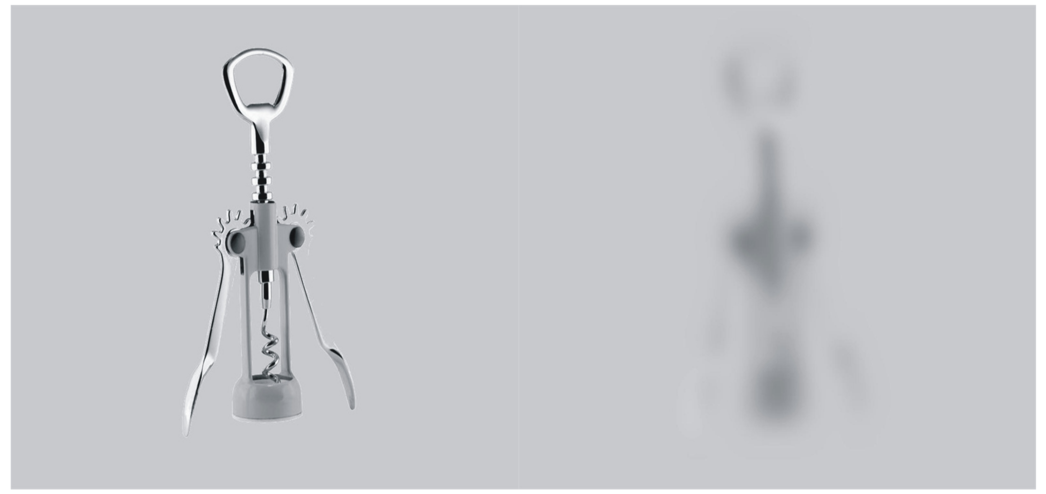
Participants

Twelve young adults (6M, 6F; Age Range 17-22 years old; Mean Age = 18.5) participated. Subjects were right-handed, with normal or corrected-to-normal vision.

Stimuli

Digital images were modified using a Gaussian blur algorithm. This procedure resulted in two distinct images of each object.

Example Images



Clear Image Blurred Image

The Viewing Window

The "window" is a circular region, controlled by a touchscreen monitor, which allows participants to move the window via a stylus held in their dominant hand.

Viewing Window Example

Procedure

Participants were instructed to identify the presented object as quickly but as accurately as possible.

Results

The response time (RT) data was separated into three categories:

1) The amount of time taken before movement of the focus-window (pre-Movement RT)

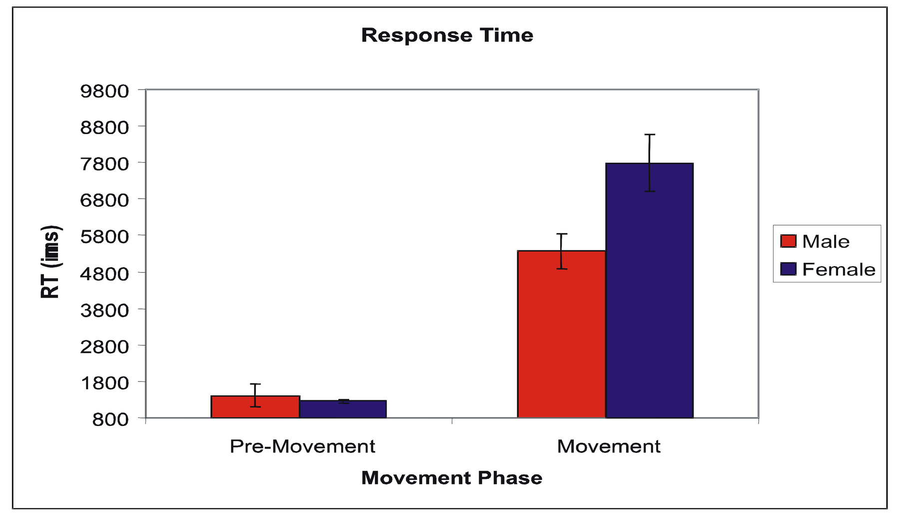
2) The amount of time spent moving the focus-window (movement RT)

3) The total amount of time required for identification of the object (Total RT = movement RT + pre-Movement RT).

A correlational analysis was performed ensuring pre-movement RT was not significantly correlated with movement RT.

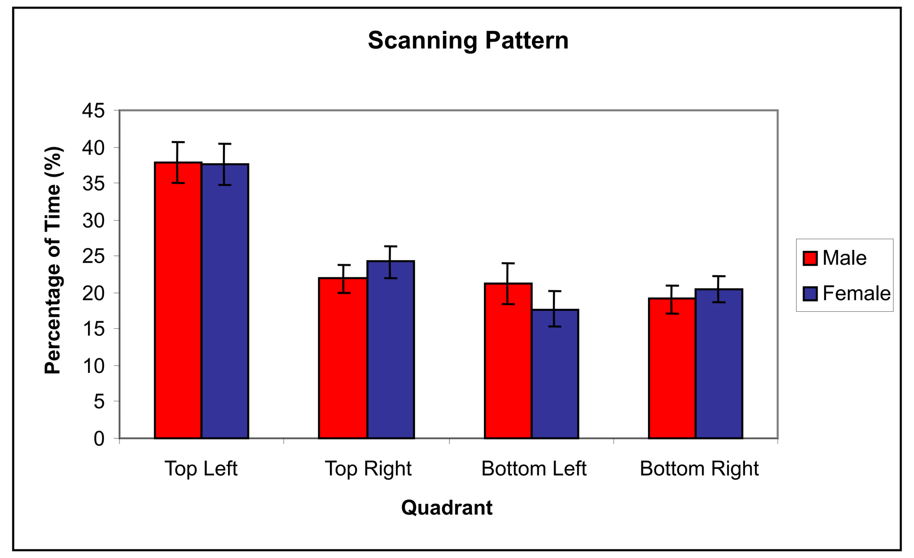
Response Times

The participant data was separated into two groups based on gender.

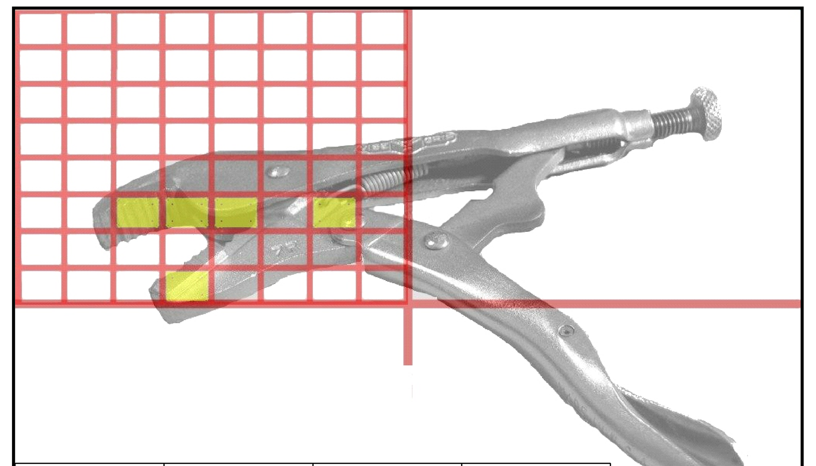


Scanning Pattern

No effect of gender was observed, and there was no gender by quadrant interaction. A significant main effect of quadrant was observed, with a greater proportion of time spent in the top-left quadrant.



Higher resolution analyses identified key features used in the identification of the presented object:



Component	Pre-Movement RT	Movement RT	Total RT
Vice grips	1236	12504	13740

The analysis of response time data and scanning pattern revealed the viewing window is able to:

1) Detect differences in two group's response times (indicated by a significant effect of gender).

2) Discriminate the scanning pattern used to identify individual objects.

Experiment 2

Purpose

To assess any dissociations in performance during four visuomotor "flip" conditions requiring a remapping of body movement on perceptual information.

Method

Participants

Fifty-six undergraduates (19M, 37F; Age Range 17-47 years old; Mean Age = 22.4) participated. Subjects were right-handed, with normal or corrected-to-normal vision.

Stimuli

The stimuli were identical to those used in Experiment 1.

Procedure

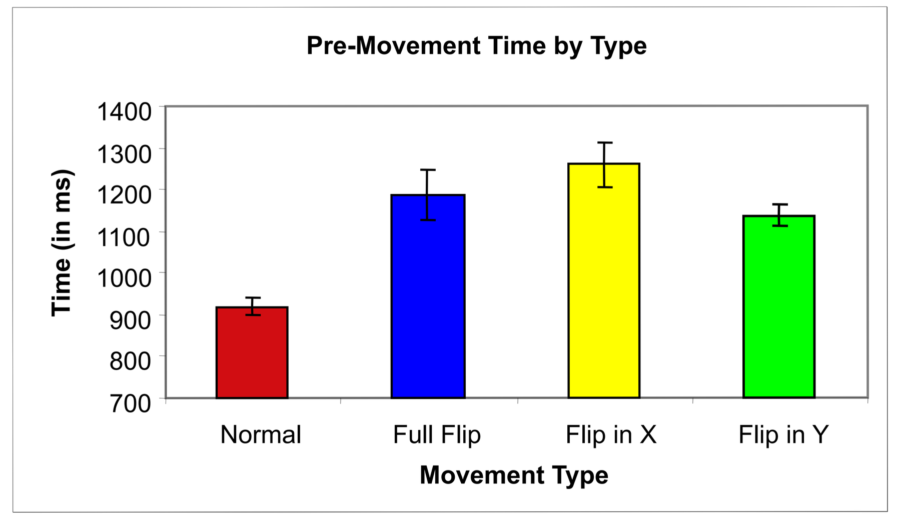
The procedure was similar to that used in Experiment 1, with the exception that three visuomotor "flip" conditions were created (Movement Type):

Movement Type	X-Axis Body Movement	Y-Axis Body Movement
Normal	Remains Veridical	Remains Veridical
Full Flip	Results in opposite on-screen movement	Results in opposite on-screen movement
Flip in X-Axis	Results in opposite on-screen movement	Remains Veridical
Flip in Y-Axis	Remains Veridical	Results in opposite on-screen movement

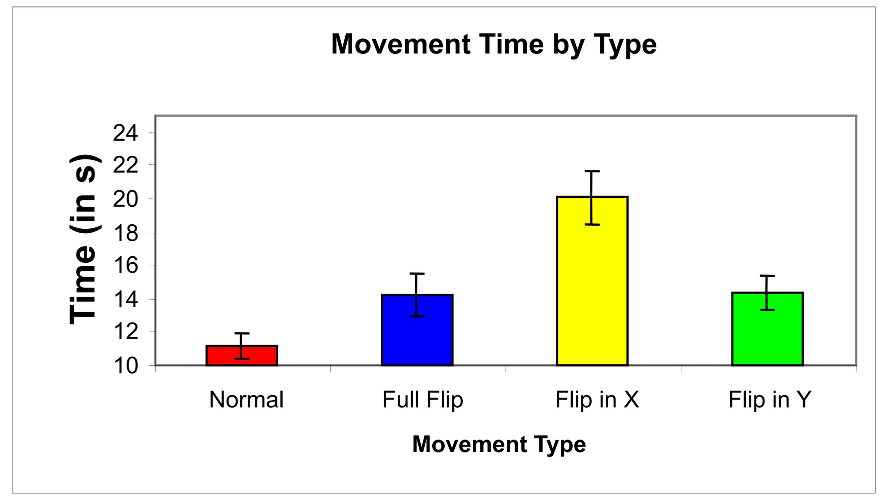
Results

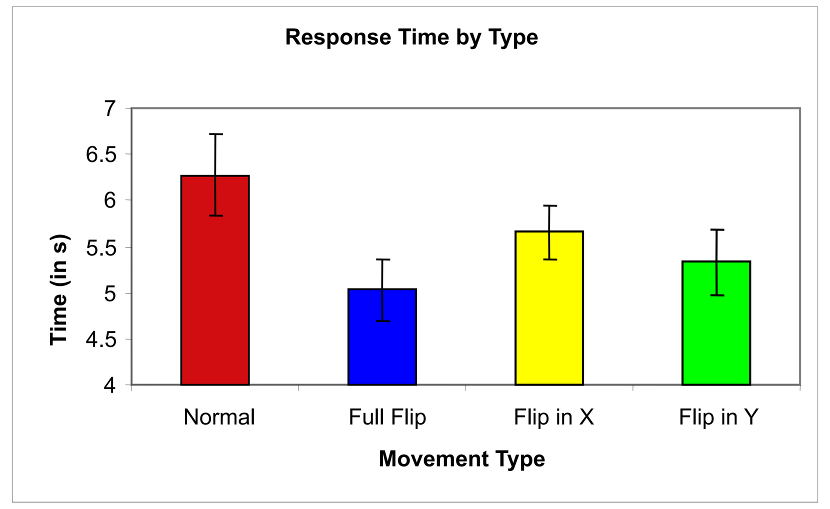
Response Times

A significant main effect of movement type was found for the pre-movement data, demonstrating that participants spent a longer period of time preparing to move the focus window when a visuomotor flip was required:



Participants spent the least amount of time scanning the image when no visuomotor transformation was required. A full flip and a flip in the Y-axis led to significantly longer scanning times, while a flip in the X-axis led to an even greater effect:





Planned comparisons revealed no significant effects of movement type on answer response time.

Conclusions

The viewing window task has been shown to be a useful tool for examining the interactions between perceptual and motor information. Importantly, our results indicate that the viewing window procedure has the ability to discriminate any gross asymmetries in a participant's visuomotor scanpath, scanning time, and response time associated with identifying these common objects.

Further, the results of Experiment 2 demonstrate a clear distinction between three types of visuomotor distorions in task performance. Specifically, our current data suggests that a remapping along the X-Axis is considerably more difficult than when no mapping is required, a remapping along the Y-Axis, and even a full visuomotor flip.

Implications

The methods suggested provide an affordable and informative way of assessing the contributions and collaborations of the two dominant cortical visual pathways in a number of different populations, addressing a wide range of contemporary issues in cognitive neuroscience.

References

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Acknowldegements

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