Effects of Physical Size on Visual Contour Integration and Global-Local Judgments of Hierarchical Forms

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Introduction

Recent human-computer interaction studies (including Tan 2004 ; Bakdash, Augustyn, and Proffitt 2006), have demonstrated the importance of perceived size and cognitive performance involving mental rotation and spatial navigation tasks. These findings are interesting because a traditional assumption of object recognition research is that object perception is invariant of spatial size when retinal image is held constant.

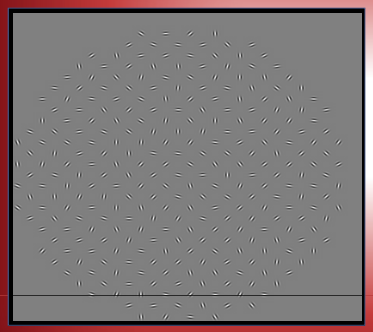
In the present study, we investigated whether spatial size differences could influence the perception of low-level visual processes. Using hierarchical arrays comprised of Gabor patches, we evaluated figural global and local orientation judgments as a function of screen size.

Methods

In the experiment subjects participated in 8 counterbalanced blocks of global and local judgments over small and large screen conditions. During the task participants were presented an image that contained either a "snake" or a "ladder" (e.g. Field, Hayes and Hess 1993), followed by a mask of randomly oriented Gabors. Following this, participants were made orientation responses using left and right mouse clicks.

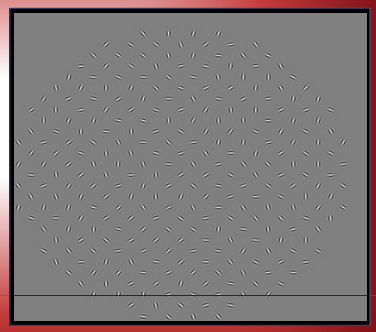
Stimuli

Snakes



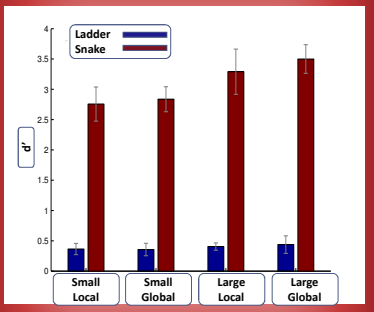
Global-local orientation congruent

Ladders



Global-local orientation incongruent

Results

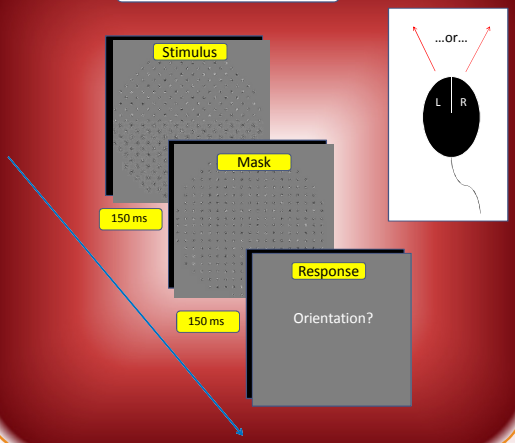


Main Effect of Stimulus: $F = (1,13)$, $p < .001$

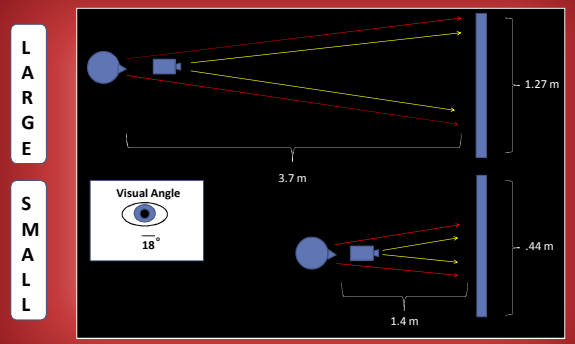
Main Effect of Screen Size: $F = (1,13)$, $p < .05$

Interaction Stimulus and Screen Size: $F = (1,13)$, $p < .05$

Task



Screen Sizes



Visual stimuli were generated using the GERT and Psychophysics Toolboxes for Matlab and were presented using a high resolution DLP projector.

Discussion

In the present study we found that both global and local snake orientation judgments were significantly easier for subjects than ladders and that task performances for both global and local judgments increased when subjects made judgments on the large screen. Although task performances increased, ladder judgments did not significantly improve, while snake judgments did.

These findings are potentially important for improving human computer interaction technology, as the use of large displays may enhance cognitive performances on tasks that rely on contour integration, shape recognition and visual semantic description.

The prospect of moderation of low level visual processes by perceived size warrants further exploration. In the future we plan to investigate the relationship between perceived size and higher level visual processes of shapes and faces.