

# Electrophysiological Evidence of Visual Attention in Apparent Depth



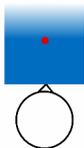
Nathan A. Parks and Paul M. Corballis

School of Psychology, Georgia Institute of Technology, Atlanta, Georgia 30332



## Introduction

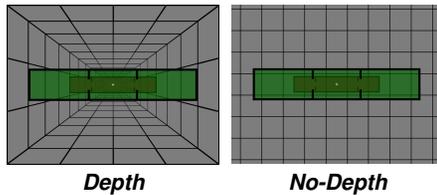
The configuration of visuospatial attention is often likened to a spotlight, which highlights important regions of the visual field for enhanced processing. Traditional accounts of the attentional spotlight are two-dimensional, assuming that selection occurs based on regions of the visual field. However, a small body of research suggests that visuospatial attention is not restricted to two-dimensions, but may also be distributed in depth (Andersen & Kramer, 1993; Downing & Pinker, 1985; Gawryszewski et al., 1987). Furthermore, results have indicated that the distribution of attention to depth is *viewer-centered*.



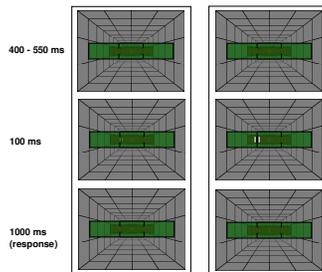
The purpose of the current experiment was to provide an electrophysiological correlate of visuospatial attention in depth. Pictorial displays were used to induce depth in order to avoid confounds present in stereoscopic displays

## Methods

In random blocks, subjects were presented with pictorial displays either rich in depth information (*Depth*), or with reduced depth information (*No-Depth*). In the *Depth* condition, two surfaces appeared to be separated by some distance in depth, whereas in the *No-Depth* condition these surfaces appeared to overlap close in space.



Identical tasks and target stimuli were used for both *Depth* and *No-Depth* displays. Subjects were assigned to attend either the *Near* or *Far* surface in the display. Horizontal and vertically oriented targets appeared to flash on either surface, but did so on the attended surface with higher probability (0.8). Subjects were required to make an orientation discrimination regarding the presented targets.



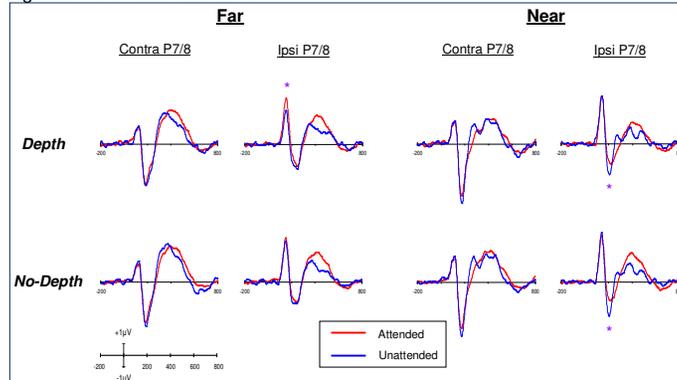
## Electrophysiology

- BioSemi ActiveTwo
- 32 channels + VEOG/HEOG
- Average Reference
- .16-30 Hz
- Ocular correction
- Artifact Rejection +/-100  $\mu$ V
- Segmented -200 to 800 ms
- Correct trials averaged

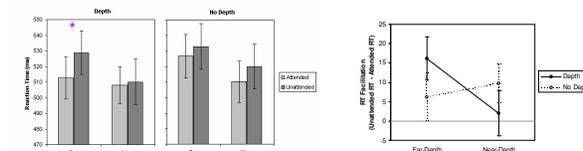
## Results

Planned contrasts were used to test attended/unattended differences in the P1 and N1 components for *Far* and *Near* targets in *Depth* and *No-Depth* Conditions.

- An attentional enhancement of ipsilateral P1 was present in the *Depth* condition but absent in the *No-Depth* condition.
- Contrary to a priori predictions, N1 amplitudes in both *Depth* and *No-Depth* were found to be greater for unattended stimuli.

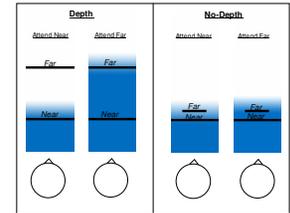


RT Data revealed the same trend present in the P1 component



## Conclusions

Effects present in the P1 component and RT data are consistent with a viewer-centered asymmetry in the distribution of attention to depth. That is, effects of attention were present when apparent depth separation was greatest.



The N1 effect cannot be accounted for in the current experimental design, but may relate to a mechanism of attentional capture.

## Literature Cited

- Andersen, G.J. & Kramer, A.F. (1993). Limits of focused attention in three-dimensional space. *Perception and Psychophysics*, 53, 658-657.
- Downing, C. & Pinker, S. (1985). The spatial structure of visual attention. In M. Posner & O. Martin (Eds.), *Attention and Performance XI* (pp. 171-187). Hillsdale, NJ: Erlbaum.
- Gawryszewski, L.D.G., Riggio, L., Rizzolatti, G., & Umiltà, C. (1987). Movements of attention in three dimensions and the meaning of "neutral" cues. *Neuropsychologia*, 25, 19-29.