Expression of Facilitation and Suppression in Visual Selective Attention in Adolescents

Jane W. Couperus, PhD
Hampshire College

Brittany Alperin
Hampshire College

Abstract
Selective attention modulates activity at early levels of visual processing, as is reflected in changes in the P1 event-related potential (ERP) component. Recent research suggests that the process of selection may involve both the relative enhancement of the signal of the attended stimulus as well as relative suppression of the unattended stimulus (e.g., Couperus and Mangun, 2010). However, while studies suggest facilitation is present even in young children (e.g., Hartner et al., 1989), the development of suppression in visual selective attention has not been deeply explored. This study examined these two processes in adolescents (11-17 years) using a spatial cuing paradigm. We examined target and distractor processing as a function of the expectancy of distractor presence versus absence. Participants were cued to the spatial location of a target (100% valid cues) as well as to the presence or absence of distracters in the opposite hemifield (70% valid cues). Analysis of distracter location of a target (100% valid cues) as well as to the presence or absence of distracters in the opposite hemifield revealed no significant differences. Participants were asked to attend to one side of the screen and press one button if the center row of circles was black on top and a different button if the center circles were white on top. ERP’s were analyzed for each condition at frontal leads (F3 and F4) following the cue for all displays and occipital leads (O1 and O2) following the target stimuli during bilateral displays.

Background
Selective attention modulates early levels of visual processing in adults. Specifically when cued to the attended location, processing is modulated both following the cue index by frontal components such as the Anterior Directing Negativity (ADAN) and during stimulus processing as indexed by occipital components such as the P100. This suggests that selective attention effectively using selective attention to perform the task. ERP data suggest that this may be an issue of power and waveforms suggest such an effect. For further information on projects in this lab visit the website at http://biciz.hampshire.edu/couperus/index.htm or contact the first author at jcouperus@hampshire.edu

Methods
Participants were asked to complete an attentional task while electrophysiological recordings were acquired.

Participants
14 Adolescents (7 Males, 7 Females, mean age = 14.28, SD = 1.81, 12 White, 2, Asian)
- Participants were recruited from the Pioneer Valley in Western MA.
- Participants were excluded from participation if they had visual impairments that could not be corrected with glasses/contacts, were current on psychotropic medications, or if they were born premature (less than 36 weeks).
- Participants received $10 - 20 for participation.

Electrophysiological Recordings
- ERPs were collected using a SYNAMP2 amplifier with SCAN recording software. Thirty-two channel ElectroCaps using a linked-mastoid reference were used with a sampling rate of 1000Hz and a filter of 0.1 to 100Hz. Additionally, recordings from VEOG and HEOG were collected to detect and exclude trials containing blink artifacts.
- Recordings from F3, F4, O1, and O2 were averaged by condition and analyzed.

Results
ADAN: Following the Cue Contralateral to the Direction of Attention
- No Significant Main Effects or Interactions

ADAN: Following the Cue as a Function of Distractor Presence
- No Significant Main Effects or Interactions

Discussion
Behavioral Data suggests that teenagers perform this task similarly to adults in previous studies, effectively using selective attention to perform the task.
- ERP data shows facilitation during stimulus processing contralateral to the attended target location as evidenced by significant increases at the P100 at O1 and O2 showing similar effects of selective attention to adult populations (e.g. Couperus and Mangun, 2010; Mangun and Hillyard 1991).
- However, no significant effects of suppression were seen during either processing following the cue or during stimulus processing. An important caveat is that facilitation was also not seen prior to stimulus onset although ERP data suggest that this may be an issue of power and waveforms suggest such an effect.

Further Information
For further information on projects in this lab visit the website at http://biciz.hampshire.edu/couperus/index.htm or contact the first author at jcouperus@hampshire.edu

Acknowledgements
This work was funded by a small grant from Hampshire College. Please send comments or questions to jcouperus@hampshire.edu