Development of Automatic and Voluntary Selective Attention: Evidence from a New Object Tracking Task

Anna V. Fisher (fisher49@andrew.cmu.edu)
Department of Psychology
Carnegie Mellon University
5000 Forbes Ave., Pittsburgh PA 15213

Selective attention is crucial for learning because it allows the learner a high degree of flexibility in attending to relevant information and filtering out information irrelevant to the task at hand. Research indicates that attentional selectivity is present from birth, such that newborns are not indifferent to what they attend to, and prefer to look at some visual stimuli over others (Fantz, 1963). However, this selectivity can be characterized as stimulus-driven or automatic, rather than participant-driven or voluntary. Research suggests that transition from stimulus-driven to person-driven selectivity takes place during the preschool years (Ruff & Rothbart, 1996), however the precise developmental course of voluntary selective attention remains unclear.

One of the challenges in investigating voluntary selectivity across a lifespan is developing a task that is sufficiently motivating and challenging to participants of different ages, so that changes in performance can be attributed to the development of attentional control, rather than to the differences in the level of motivation and engagement in the task (Ruff & Rothbart, 1996).

Another challenge is finding a task that will allow assessing automatic and voluntary selectivity within the same paradigm and can be performed by young children. Prior research in this area has been carried out using different experimental paradigms, thus making it difficult to compare results across tasks.

The goal of this research is to develop a task allowing investigation of automatic and voluntary selective attention with young children within the same paradigm. Overall, it was expected that voluntary selectivity should exhibit greater age-related improvement than automatic selectivity. This hypothesis was tested using a novel computer-based Object Tracking (OT) task in which participants are presented with a three by three grid and a Target object moving on the grid along a random trajectory. Participants are asked to visually track the Target and identify the grid location last visited by the Target before it disappears. The moving Target in this task can be accompanied by zero to eight Distracter objects, also moving along a random trajectory. Distracter-related manipulations are based on the classic pop-out effect (Triesman & Gelade, 1980). In the OT task the pop-out effect is achieved by varying the identity of distracters. It is expected that distracters that are identical to each other and different from the target will result in a pop-out effect and direct attention to the target automatically, whereas distracters that are different from each other will not result in a pop-out effect and will require voluntary allocation of attention to the target.
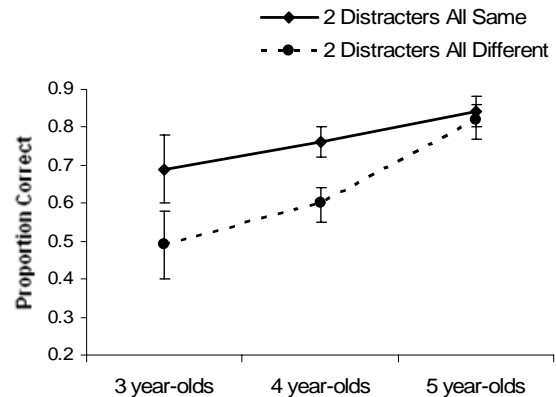

Figure 1: Mean Accuracy across age groups and conditions.

Participants in this study were 9 3 year-olds, 20 4-year-olds, and 16 5 year-olds. All participants were presented with the OT task in which the Target was accompanied by two distracters. The identity of distracters (All Same or All Different) was varied within participants, and the order of tasks was counterbalanced. Results are presented in Figure 1. As can be seen in the Figure, the condition in which all distracters were different (thus requiring voluntary selectivity) exhibited greater age-related improvements than the condition in which all distracters were the same (thus allowing for automatic selectivity).

Conclusions

Parametric variations of the OT task (i.e., variations in the number of distracters and speed of motion) can be used for the in-depth investigation of the developmental course of automatic and voluntary selective attention across a wide range of age groups. Potentially, it may also be possible to establish typical levels of performance for each age group and identify children who are at risk for developing attention disorders.

Acknowledgments

References

Fantz, R. L. (1963). Pattern vision in newborn infants. *Science*, 140, 296-297.

Ruff, H. A., & Rothbart, M. K. (1996). *Attention in early development*. New York: Oxford University Press.

Triesman, A., & Gelade, G. (1980). A feature integration theory of attention. Cognitive Psychology, 12, 97-136.