

Head and eye movements in a widespread stimulus comparative search paradigm

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From recent studies it is known that the capacity of visual working memory is very limited. This has been shown by research on a phenomenon called change blindness [1]. Also results of the block copying task [2] show that subjects performed additional eye movements to minimize memory demand. From this it follows that there is a trade-off between the use of working memory and eye movements based on their cost to optimize the visual performance. With this assumption increased costs for eye movements should lead to an increase of memory use.

To investigate this, we used a comparative visual search task (CVST) with stimulus size as independent variable. Widespread stimuli should induce larger gaze (head and eye together) shifts and therefore higher costs with regard to gaze movements. We performed experiments in a virtual reality environment and presented the visual stimulus on a curved, tilted, conical screen with a field of view of 150° in horizontal and 70° in vertical direction. The subjects sat in front of the projection screen (distance: 1.6m) with a head mounted, infrared light based eye tracker. Furthermore we measured head movements. 12 subjects participated to this experiment (age: 23-34 years).

For the CVST we presented two shelves, filled with colored objects. The subjects had to compare both shelves to find differences between the object constellations. We used three different constellations: zero targets (both shelves were identically), one target or two targets. To induce larger gaze movements, we used four different shelf distances in randomized order (30°, 60°, 90° and 120°).

For all four distance conditions, there were no differences in the error rate to detect the correct target amount. We found the same amount of fixation number for all four shelf distances. The fixation duration was significantly increased for larger stimulus size (from 246.7±151.8 to 267.6±190.5 ms) and we found a significant reduction of gaze shifts between the two shelves.

This results indicate the use of working memory if larger and thereby costlier gaze shifts are necessary.

- 1 Simons, D.J. and Levin, D.T. (1997). Change blindness. *Trends in Cognitive Sciences*, 1, 261-267.
- 2 Ballard, D.H., Hayhoe, M.M. and Pelz, J.B. (1995). Memory representations in natural tasks. *Journal of Cognitive Neuroscience*, 7, 66-80.