The role of the trade-off between locomotion and memory use in a block copying paradigm

G. Hardiess
Lab of Cognitive Neuroscience, University of Tübingen
gregor.hardiess@uni-tuebingen.de

K. Basten
Lab of Cognitive Neuroscience, University of Tübingen
kai.basten@uni-tuebingen.de

H. Liou
Lab of Cognitive Neuroscience, University of Tübingen
deaclis@gmail.com

H.A. Mallot
Lab of Cognitive Neuroscience, University of Tübingen
hanspeter.mallot@uni-tuebingen.de

When scanning for objects in a visual working memory (WM) task, observers may either decide to store the visual information in memory or simply refixate the object in the moment the information becomes necessary. The decision to use on of these two strategies may depend on the cost of each. These costs could be described in different ways: either in metabolic costs for storing information, costs for redirecting attention, or perceptual or attentional load. It was hypothesized, in the course of performing visual tasks, observers need to balance the use of each strategy to satisfy a set of such task constraints.

A broad field of scientific work has investigated this trade-off in relation to gaze movements. In a comparative visual search task Hardiess et al. (2008) found reduced gaze movement patterns for conditions where the costs for acquiring visual information were increased. It was argued that in such conditions the balance point of the trade-off between gaze movements and WM was shifted towards increased memory use.

In the actual study we tested the existence of such a trade-off related to costs for locomotion. Similar to the block copying task, introduced by Ballard et al. (1995), subjects had to copy a certain pattern of colored blocks provided in a model area to another place – the workspace area. To accomplish this task, subjects could pick up one block at a time from a third place – the resource area. All three areas were arranged in an equilateral triangle (see figure). As independent variables on the one hand the distances between all three areas were varied (i.e. 2.25m vs. 4.5m) to influence the costs for locomotion. On the other hand we varied the costs for WM load by using two complexities of the block models (i.e. simple vs. complex).

Our results reveal a strong modulation of the trade-off between walking distances and memory load dependent on the costs for locomotion and WM use respectively.

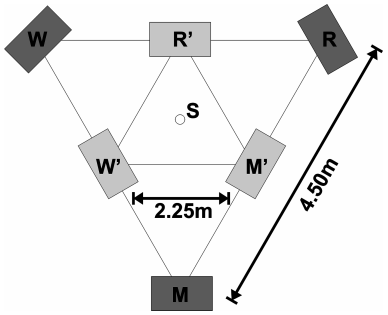

Figure: Spatial arrangement of the three areas (M – model, W – workspace, and R – resource) for the two distance conditions (letters without apostrophe – long distance condition, letters with apostrophe – short distance condition).

Ballard, D. H., Hayhoe, M. M., & Pelz, J. B. (1995). Memory representations in natural tasks. Journal of Cognitive Neuroscience, 7, 66-80.

Hardiess, G., Gillner, S., & Mallot, H. A. (2008). Head and eye movements and the role of memory limitations in a visual search paradigm. Journal of Vision, 8(1):7, 1-13.