

Does spatial interference affect spatial text processing in individuals with high mental rotation ability?

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Background

Some studies have shown that individual differences in spatial abilities play an important role in the comprehension of spatial descriptions (de Vega 1994; Haenggi et al. 1995; Pazzaglia and Cornoldi 1999). The mental rotation test (MRT, Vandenberg and Kuse 1978) is a rigorous measure of spatial ability that correlates with other spatial and visual abilities, and is also a good marker of spatial strategies (Casey 2003). Haenggi et al. (1995) found that mental rotation ability is correlated with the construction of a spatial mental model (Johnson-Laird 1983) derived from a narrative text. In recent years, a number of studies have investigated the cognitive processes, such as temporary memory functions, involved in the processing of spatial mental models. Some, using the Baddeley model of WM (1986), showed the specific involvement of visuo-spatial working memory (VSWM) in the processing of illustrated (Gyselinck et al. 2002) and spatial texts (De Beni et al. 2005; Pazzaglia et al. 2006). In the present study we investigate the relationship between MR ability and WM components in the processing of spatial and non-spatial texts.

Hypothesis

We expected: (1) the high MR group should have a better ability to process spatial text than low MR group; (2) if participants in the high MR group have more general VSWM ability, they might be less susceptible to spatial interference effects, while the low MR group might be impaired by spatial concurrent task.

Method

Dual-task methodology was used. The MRT and a reading-comprehension task were undertaken by 123 undergraduates. We selected two groups with different performance in the MRT (high and low) but similar in reading comprehension. Participants of each group listened to spatial and non-spatial texts while performing a spatial (spatial tapping) or verbal (articulatory) concurrent task; as control condition, no secondary task was performed. Text memorisation was tested by free recall and sentence verification tasks.

Results and conclusions

Analysis of variance showed that in the high MRT group, spatial text recall was not impaired by either spatial or verbal concurrent task; only recall of the non-spatial text was impaired by the articulatory task. In contrast, the low MRT group showed an interference effect of spatial and verbal concurrent tasks on recall of spatial text, and a verbal interference effect on recall of non-spatial text. The results of the latter group were analogous to those obtained by De Beni et al. (2005) and Pazzaglia et al. (2006), in that they show an involvement of not only verbal but also visuo-spatial components in processing spatial descriptions. The high MRT group has more VSWM ability in processing spatial descriptions, preserving this ability even when visuo-spatial WM is temporarily limited by spatial tapping.

Keywords Mental rotation ability • Working memory • Spatial descriptions • Individual differences

