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Difficulties in the control of irrelevant visuospatial information in children with visuospatial learning disabilities

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Abstract

This research tested the hypothesis that children's difficulties in visuospatial working memory (VSWM) may mirror difficulties found with verbal working memory tasks in other categories of children. Two experiments compared the number of correct responses and errors in groups of visuospatial learning disabled children (VSLD) and Controls who were engaged in an active task testing visuospatial working memory. Children were presented with sequences of positions on a 4×4 matrix and were subsequently asked to remember only the last position of each series. In the first Experiment, VSLD children showed greater difficulty in both recalling the last positions and avoiding the irrelevant non-final positions compared with Controls. In the second experiment children of different age groups (second-graders and fifth-graders) were also required to stress, by tapping on the table, the irrelevant positions whenever the experimenter pointed to a coloured cell. Results showed that the number of errors was greater in the VSLD children, and the pattern of errors differed with their grade. In particular, the increased activation of stressed locations produced an increase of correct responses, and a decrease of intrusion errors, except in the case of VSLD second-graders, who made a higher number of intrusions for stressed than for unstressed locations.

Results confirm that children with VSLD show a specific deficit in active VSWM, and in particular, in the ability to avoid intrusion errors. In general, the control of irrelevant information appears critical for a successful use of VSWM.

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1. Introduction

The working memory model proposed by [Baddeley \(1986\)](#) and [Logie \(1995\)](#) interprets memory not only as a system capable of retaining information, but also as a structure which is able to organise and manipulate materials retrieved from long-term memory as well as generated by sensory inputs. This model includes three main components, i.e. the central executive (attentional amodal component), the articulatory loop and the visuospatial component (modality specific components).

The study of specific impairments in the working memory components has helped to understand the nature of working memory. A large number of studies have examined articulatory loop impairments both in adults and children, however little attention has been devoted to specific impairments in the visuospatial component of children. This paper intends to show how the study of a specific clinical group of children with visuospatial learning disabilities may cover this aspect and offer support to the comprehension of the organization of visuospatial working memory (VSWM). The organization of VSWM has been differently explained: [Logie \(1995\)](#) described the visuospatial working memory system as independent of the central executive and the articulatory loop, and further divided it into two major components: the visual cache, which consists of a passive visual store, for processing visual materials, and an active rehearsal mechanism, the inner scribe, for processing spatial information and movement sequences. In the model, complex visuospatial mental operations were referred to the Central Executive. An alternative view developed by [Cornoldi and Vecchi \(2000, 2003; Cornoldi, 1995\)](#) comprises two fundamental dimensions: (1) the horizontal continuum, related to the different types of material (e.g. verbal, spatial, visual) which are thought to be processed semi-independently; and (2) the vertical continuum, related to the type of process, requiring more or less active elaboration and control of information ([Cornoldi & Vecchi, 2003](#)). According to the latter view, it is possible to distinguish between more passive processes (simple recall of previously acquired information) and different degrees of active processing (manipulation of information to produce an output different from the original inputs). Importantly, this model, predicts that subgroups of individuals can be found with difficulties associated with both a specific modality and a particular degree of control. This prediction is consistent with evidence suggesting that executive processes may also be modality specific (e.g. [Palladino, Mammarella, & Vecchi, 2003](#)). For example, by using a battery of verbal and non-verbal working memory tasks, [Cornoldi, Dalla Vecchia, and Tressoldi \(1995\)](#) tested a group of children with high linguistic and low visuospatial abilities and found that they failed only in active visuospatial tasks. In another study, [Cornoldi, Rigoni, Tressoldi, and Vio \(1999\)](#)

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