

# Allocation of attention and effect of practice on persons with and without mental retardation

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## Abstract

Persons with mild and moderate mental retardation and CA-matched persons without mental retardation performed a dual-task, “pencil-and-paper task” (Baddeley, Della Sala, Gray, Papagno, & Spinnler (1997). Testing central executive functioning with a pencil-and-paper test. In Rabbit (Ed.), *Methodology of Frontal and Executive Function* (pp. 61–80). Hove, East Sussex, UK: Psychology Press), which includes a memory span task and a tracking task. The memory span task loads onto phonological working memory and the tracking task loads onto visuo-spatial working memory. By comparing performance between single and dual-task, we assessed the characteristics of executive function, which allocates attentional resources between two tasks. Results indicate that there was no difference in the characteristics between the two groups, and there was no improvement in the characteristics with practice. Thus, we suggest that when persons with mental retardation perform a dual-task that have no interference in the sub-storage of working memory, their function of attentional allocation can work without impairment.

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Observation of work performance by persons with mental retardation in several real work situations indicates that their performance of dual-tasks is very poor. Though they can perform the tasks singly, they cannot perform them simultaneously. For example, they could hardly count the number of parts of products, while simultaneously assembling the products. In the case of persons without mental retardation, a performance decline in dual-task is also observed frequently

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(e.g. Navon & Gopher, 1979; Norman & Bobrow, 1975). It also seems that the ratio of dual-task to single-task performance in persons with mental retardation is lower than that for persons without mental retardation (Nugent & Mosley, 1987; Merrill, 1992). Why do persons with mental retardation experience difficulty in dual-task situations? The difficulty of dual-task performance has been discussed in the context of divided attention or attentional allocation (e.g. Kahneman, 1973; Navon & Gopher, 1979; Norman & Bobrow, 1975; Wickens, 1984). We assumed that persons with mental retardation have difficulty in attentional allocation to multiple tasks.

The relation between mental retardation and attention has been discussed since the 1960s. The first report on attention deficit in persons with mental retardation was the attention theory by Zeaman and House (1963). They suggested that a deficit of attention was the source of retardation, and that attention deficit in learning situations resulted in retardation. Since that initial study, the attention factor has been studied as an issue in the cause of mental retardation. However, for the past dozen years or so, research trends concerning attention and its relation to mental retardation have treated attention as only one type of functional deficit. That was because of the trend of the human information processing theory. Based on the dual storage model of memory (Atkinson & Shiffrin, 1968), Mosley (1980) suggested that the information process on each memory storage is controlled by attention, and persons with mental retardation have problems in the attention system, so persons with mental retardation show poor information processing. Nettelbeck and Brewer (1981) hypothesized that persons with mental retardation has poor central information processing function, so they cannot direct attention to information processing appropriately. There are a number of other studies about attention in persons with mental retardation: deficit of focused attention for persons with mental retardation (e.g., Cha & Merrill, 1994; Meador & Ellis, 1987; Merrill, 2005; Merrill & O'Dekirk, 1994; Merrill, Cha, & Moore, 1994; Whiteley, Zaparniuk, & Asmundson, 1987), and deficit of sustained attention for persons with mental retardation (e.g., Ware, Baker, & Sipowicz, 1962; Semmel, 1965; Kirby, Nettelbeck, & Bullock, 1978; Kirby, Nettelbeck, & Thomas, 1979; Tomporowski & Allison, 1988; Tomporowski, Hyden, & Applegate, 1990).

However, there is only the small number of studies on divided attention or attentional allocation. Stankov (1989) reviewed relationship between quantity of attentional resource and intelligence. But he did not examine the function of attentional allocation itself. Nugent and Mosley (1987) and Merrill (1990) noted the importance of studying the attentional allocation in persons with mental retardation. Nugent and Mosley (1987) and Merrill and Peacock (1994) indicated the impairment of attentional allocation in persons with mental retardation. Nugent and Mosley used a dichotic listening method. Participants were required to perform dual-task with a simple auditory detection task and an auditory vigilance task. The result showed that the performance of persons with mental retardation was lower than for persons without mental retardation. So, they concluded that persons with mental retardation cannot allocate attention well and have little spare attentional resources, compared with persons without mental retardation. Merrill and Peacock used a dual-task with a card-sorting task and an auditory signal detection task. The card-sorting task required discrimination based on card category. Participants were required to sort cards based on categories (basic level category or super-ordinate category). It was assumed that the basic level category (e.g., horse and hammer) was easier to discriminate than the super-ordinate category (e.g., animals and tools). The result was that participants without mental retardation indicated more interference from auditory signal detection in the super-ordinate category than in the basic level category, while persons with mental retardation did not indicate such interference. So, they considered that persons with mental retardation had impaired attentional allocation function. Both these studies indicated that the function of attentional

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