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Adults with developmental dyslexia show selective impairments in time-based and self-initiated prospective memory: Self-report and clinical evidence☆

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ABSTRACT

Background: Prospective memory (PM; memory for delayed intentions) would seem to be impaired in dyslexia but evidence is currently limited in scope.
Aims: There is a need, therefore, firstly, to explore PM under controlled conditions using a broader range of PM tasks than used previously and, secondly, to determine whether objectively measured and self-reported PM problems can be found in the same individuals with dyslexia.
Methods and procedures: The responses of 30 adults with dyslexia were compared with those of 30 IQ-matched adults without dyslexia on a self-report and a clinical measure of PM.
Outcomes and results: Dyslexia-related deficits were shown on the clinical measure overall and, more particularly, when PM responses had to be made to cues based on time rather than environmental events. Adults with dyslexia were also more likely to forget to carry out an intention under naturalistic conditions 24 h later. On the self-report questionnaire, the group with dyslexia reported significantly more frequent problems with PM overall, despite using more techniques to aid their memory. In particular, problems were identified with longer-term PM tasks and PM which had to be self-initiated.
Conclusions and implications: Dyslexia-related PM deficits were found under both laboratory and everyday conditions in the same participants; the first time that this has been demonstrated. These findings support previous experimental research which has highlighted dyslexia-related deficits in PM when the enacting of intentions is based on time cues and/or has to be self-initiated rather than being in prompted by environmental events.

What this paper adds

Prospective memory (PM; memory for delayed intentions) seems to be impaired in individuals with dyslexia but the evidence is currently limited. Experimental data from adults have shown dyslexia-related problems with PM but, since only

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time cues were used, it cannot be determined whether difficulties are specific to time-based PM or part of a more general deficit. Moreover, whilst self-reports of increased PM failure in dyslexia have also been found, it has not yet been established whether the self-reported deficits of people with dyslexia are reflected in the objectively measured PM performance of the same individuals. A self-report questionnaire and a clinical measure of PM were, therefore, administered to the same sample of adults with and without dyslexia. On the clinical measure, the PM performance of the group with dyslexia was worse overall and displayed particular difficulties when time cues were used. On the questionnaire, a greater overall frequency of PM failure in dyslexia was also self-reported. More specifically, adults with dyslexia identified problems with long-term, one-off PM tasks and those which required self-initiated remembering. Both the clinical test and the self-report questionnaire indicate that PM is impaired in dyslexia. A theme common to both measures was that performance relying on cues based on time or needing to be self-initiated appears to be adversely affected by dyslexia whilst performance in response to external cues seems unaffected. The findings suggest that specific areas of PM are affected by dyslexia. Future research should explore the cognitive mechanisms responsible for impairments and for identifying where support is needed for individuals with the condition.

1. Introduction

Developmental dyslexia (henceforth, dyslexia) is typically characterized by persistent problems with reading or spelling, or both (Lyon, Shaywitz, & Shaywitz, 2003; Siegel, 2006). These difficulties have been seen as part of a wider impairment in phonological processing (e.g., Castles & Friedmann, 2014; Vellutino, Fletcher, Snowling, & Scanlon, 2004). However, as well as affecting reading and spelling, the presence of dyslexia has also been found to have adverse effects on both short-term and working memory (e.g., Jorm, 1983; Palmer, 2000; Smith-Spark, Fisk, Fawcett, & Nicolson, 2003; Swanson, 1992, 1999). Whilst these problems are well-documented, the function of other memory systems in dyslexia has received considerably less scrutiny. The focus of the current paper was on prospective memory (PM), also known as memory for delayed intentions (e.g., Winograd, 1988). Successful PM allows individuals to defer to an appropriate point in the future a range of day-to-day activities such as returning telephone calls, posting letters, buying groceries, meeting work colleagues or friends, taking regular medication, and paying bills. Despite the importance of this memory system to everyday life, there is currently only a small body of research on PM in dyslexia. Self-report evidence has indicated that individuals with dyslexia consider themselves to experience more frequent failures of PM on a day-to-day basis (Khan, 2014; Smith-Spark, Zięcik, & Sterling, 2016a). Lowered PM accuracy has also been found in adults with dyslexia on a laboratory-based task (Smith-Spark, Zięcik, & Sterling, 2016b). However, this is the extent of the direct literature on PM in dyslexia to date. In order to gain a more comprehensive understanding of the effects of dyslexia on PM, a clinical measure of PM (the Memory for Intentions Test; MIST; Raskin, Buckheit, & Sherrod, 2010) was administered in the current paper. This has a number of scales designed to tap into a broader range of aspects of PM than previously explored in dyslexia. Self-reported deficits were also probed in more depth than previously, using a questionnaire dedicated entirely to PM (the Prospective Memory Questionnaire; PMQ; Hannon, Adams, Harrington, Fries-Dias, & Gibson, 1995). The present paper would thus shed light on whether PM difficulties could be identified in the same group of adults with dyslexia both under laboratory and everyday conditions. Such wide-ranging evidence in terms of both methodological approach and granularity of measurement would contribute substantially to an evidence base on which to argue for appropriate support for adults with dyslexia in both education and employment.

Stanovich (2009) presents a framework for cognition within which different levels are considered. The reflective level of cognition is argued to relate to goals, beliefs about those goals, and the choice of which action to take in order to fit best with these goals and beliefs. Given that the reflective level deals with typical, everyday performance, it is likely to be measured most effectively by self-reports of general performance over a protracted timeframe. The algorithmic level of Stanovich's scheme, on the other hand, corresponds to information processing mechanisms and is usually tapped by performance measures under laboratory conditions where optimal performance is required. To understand cognition under both typical and optimal conditions (e.g., Topiak, West, & Stanovich, 2013), both the reflective and algorithmic levels need to be studied. The study of PM is no different from any other area of cognition in this regard and, given the importance of PM to successful everyday function (e.g., McDaniel & Einstein, 2007), investigating both typical and optimal performance is even more necessary to understanding the range of difficulties experienced by people with dyslexia.

Two key cognitive components (e.g., Einstein & McDaniel, 1990, 1996) are required for PM to act effectively. The role of the prospective (or planning) component is to ensure that the intended behaviour is recalled at the appropriate point in the future. The retrospective component is responsible for making sure that the individual remembers the contents of the intention itself. Beyond this distinction, PM tasks can be either event-based (EBPM) or time-based (TBPM) in nature (e.g., McDaniel & Einstein, 2007). In the case of EBPM, an individual is required to respond to an event in the environment in order to perform the intended action; for example, seeing a colleague should act as a trigger to remember the intention to pass on a message to her. With EBPM, cues in the environment are able to "pop" out at the individual and remind him or her to perform the delayed intention. Time-based PM requires an individual to perform an intended action at a particular time in the future; for example, remembering to telephone a colleague for a discussion in 30 min' time. It has been argued that self-initiated mental processes are drawn upon more heavily when TBPM is required than when EBPM is needed (e.g., Einstein, McDaniel, Richardson, Guynn, & Cunfer, 1995). In the former case, the individual has to engage in more strategic, self-generated processes (such as free recall) to guide performance.

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