



## Emotional false memories in children with learning disabilities



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### ABSTRACT

Research has shown that children with learning disabilities (LD) are less prone to evince associative illusions of memory as a result of impairments in their ability to engage in semantic processing. However, it is unclear whether this observation is true for scripted life events, especially if they include emotional content, or across a broad spectrum of learning disabilities. The present study addressed these issues by assessing recognition memory for script-like information in children with nonverbal learning disability (NLD), children with dyslexia, and typically developing children ( $N = 51$ ). Participants viewed photographs about 8 common events (e.g., family dinner), and embedded in each episode was either a negative or a neutral consequence of an unseen action. Children's memory was then tested on a *yes/no* recognition task that included old and new photographs. Results showed that the three groups performed similarly in recognizing target photographs, but exhibited differences in memory errors. Compared to other groups, children with NLD were more likely to falsely recognize photographs that depicted an unseen cause of an emotional seen event and associated more "Remember" responses to these errors. Children with dyslexia were equally likely to falsely recognize both unseen causes of seen photographs and photographs generally consistent with the script, whereas the other participant groups were more likely to falsely recognize unseen causes rather than script-consistent distractors. Results are interpreted in terms of mechanisms underlying false memories' formation in different clinical populations of children with LD.

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## 1. Introduction

Memory illusions occur quite frequently in the laboratory as well as in real life, and their developmental trajectory depends on the nature of the illusion. When memory illusions stem from processing semantically related information (e.g., Deese–Roediger–McDermott (DRM) paradigm: Brainerd, Holliday, & Reyna, 2004; connected–meaning paradigms: Howe, 2006), typically developing children often demonstrate age-related increases in the frequency of memory errors (Brainerd, Reyna, & Ceci, 2008; Brainerd, Reyna, & Zember, 2011; but see Ghetti, Qin, & Goodman, 2002; Lampinen, Leding, Reed, & Odegard, 2006). The DRM paradigm involves the presentation of several lists of semantically related words (e.g., *sick, nurse, medicine*). Within each list, all words are associated to a single word not presented during encoding, the critical lure (in this

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example, *doctor*). At retrieval, adults and older children falsely recognize the critical lures almost at the same rate as target words. Younger children recognize the critical lures to a lesser extent than older children and adults, thus committing fewer memory errors. This developmental trend persists even when emotionally charged stimuli are used instead of neutral stimuli (Brainerd, Holliday, Reyna, Yang, & Toglia, 2010; Howe, 2007; Howe, Candel, Otgaar, Malone, & Wimmer, 2010, Experiment 2). However, it is unclear to what extent these observed trends may apply to memory for life events, as well as to special clinical populations.

Most of the available research on false memory formation in certain clinical populations of children primarily focuses on the implication of eyewitness memory or suggestibility in maltreated children (Howe, Cicchetti, Toth, & Cerrito, 2004), children within autism spectrum disorders (McCrorry, Henry, & Happè, 2007), or other severe developmental disabilities, such as intellectual disabilities (Brown, Lewis, Lamb, & Stephens, 2012; Henry & Gudjonsson, 1999, 2004; Young, Powell, & Dudgeon, 2003). The majority of these studies are aimed at evaluating the best way to administer a cognitive interview when children are either victims or witnesses of abuse and are required to provide allegations in the courtroom. However, little is known about the functioning of basic underlying memory processes in these populations. Furthermore, only a few studies have investigated memory accuracy and memory distortions in special populations of children with academic difficulties, such as children with reading comprehension difficulty (Mirandola, Del Prete, Ghetti, & Cornoldi, 2011; Weekes, Hamilton, Oakhill, & Holliday, 2008), children with attention deficit/hyperactivity disorder (ADHD; Mirandola, Paparella, Re, Ghetti, & Cornoldi, 2012), and children with general learning disabilities (Brainerd, Forrest, Karibian, & Reyna, 2006). Research conducted with the DRM paradigm (Roediger & McDermott, 1995) has shown that children with learning disabilities produce fewer memory errors than typically developing children (Brainerd et al., 2006; Weekes et al., 2008). This result has been associated with lower semantic processing abilities that prevent children with disabilities from relying on the gist of the wordlists, thus mimicking the pattern of errors found when comparing younger to older children. It must be noted that these studies focused specifically on memory errors, and it is unclear whether semantic processing difficulties associated with learning disabilities may influence the way in which children retain correct information as well. A paradigm specifically designed to investigate recognition memory and text-based detail recollection in adolescents with poor semantic text processing ability revealed an overall impaired recognition of sentences and related recollection (i.e., lower proportion of Remember judgments in association with correctly recognized target sentences) in these students, compared to a control group, despite both groups displaying similar recognition memory for isolated words (Mirandola et al., 2011).

The present study was designed to investigate memory accuracy and errors in two distinct groups of children with learning disabilities, namely children with nonverbal learning disability (NLD) and children with dyslexia. Children with dyslexia are characterized by poor reading decoding abilities and sometimes show reduced semantic processing abilities (Betjemann & Keenan, 2008), as confirmed by recent studies combining fMRI and ERPs (Schulz et al., 2008, 2009). Whereas children with dyslexia present both language and reading skills impairments, children with NLD have good verbal skills, but a neuropsychological profile characterized by impairments in nonverbal abilities (Rourke, 1995). One of the identifying features of NLD is a significantly higher performance on tasks measuring verbal intelligence than on those measuring visuospatial intelligence (Cornoldi, Venneri, Marconato, Molin, & Montinari, 2003; Johnson, 1987; Mammarella et al., 2009; Weintraub & Mesulam, 1983). A factor underlying this discrepancy is that children with NLD possess poor visuospatial and visuoconstructive abilities, which would explain their difficulties in a broad range of school and everyday life activities including, but not limited to, mathematics, drawing, and spatial orientation (Cornoldi, Dalla Vecchia, & Tressoldi, 1995; Cornoldi, Rigoni, Tressoldi, & Vio, 1999; Cornoldi & Vecchi, 2003; Mammarella & Cornoldi, 2005). Most important for the current purposes, children with NLD often manifest emotional and relational difficulties that prevent them from adequately processing emotional information (Petti, Voelker, Shore, & Hayman-Abello, 2003; Rourke, 1995; see also Worling, Humphries, & Tannock, 1999). Finally, it has been found that children with NLD suffer from several impairments in social problem-solving, suggesting a reciprocal influence between socio-cognitive factors, the development and maintenance of pathological symptoms, and adaptation to the environment (Galway & Metsala, 2010).

In summary, children with LD are an important population to be considered in the study of memory illusions. Several behavioral patterns could emerge from our research: one could expect a general poorer performance in recognition memory in these populations of children. Alternatively, memory performance, particularly memory illusions, may manifest differently within these unique groups of children with disabilities, depending on the purported mechanisms underlying the illusion.

## 2. The present study

In the present study, children with NLD, children with dyslexia, and typically developing children were administered a false-memory task adapted from a paradigm previously used with typically developing children (Lyons, Ghetti, & Cornoldi, 2010) and children with ADHD (Mirandola et al., 2012). This particular paradigm allows emotional false memories to be investigated in both children and adults (Mirandola, Toffalini, Grassano, Cornoldi, & Melinder, 2013). Participants first study photographs that depict common actions for a variety of commonplace daily scenes. For each script, participants view typical scene-appropriate actions, as well as photographs that depict the effect of an action whose cause is not presented in the episode. Specifically, this paradigm allows for the investigation of two types of memory errors: gap-filling and causal errors incurred when one falsely recognizes, respectively, scripted information that was not presented (e.g., eating some food at dinner), or causal information (recognizing a cause photograph, i.e., “knocking over a bottle of water on the table” when they only viewed the effect of that cause, i.e., “pieces of a broken bottle on the floor”).

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