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Forget-me, forget-me-not: Evidence for directed forgetting in preschoolers

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ABSTRACT

The present study challenges the view that directed forgetting is a late developing mnemonic skill. In two experiments preschoolers first learned a list of everyday objects, and were then asked to "empty their heads of these objects to make room for new ones" or to keep them in their minds. Then, a new list of unrelated objects was learned. After a short distractor phase, children were asked to recall the objects. In Experiment 1 (N = 52) children were asked to recall the first list of objects before the second list. No recall order was specified in Experiment 2 (N = 55) to limit potential output interference effects. In both experiments, children who had been instructed to forget the first list had difficulties recalling objects from this list and showed enhanced memory for the items from the other list compared to children who were told to remember. These results establish that young children are already capable of forgetting information that is labeled irrelevant, with positive effects on new learning. Mechanisms underlying costs and benefits of directed forgetting in preschoolers are discussed.

1. Introduction

Forgetting is not just a flaw of memory. It also prevents us from remembering information that is outdated, no longer useful or stands in the way of our emotional wellbeing (cf., Nørby, 2015; Hardt, Nader, & Nadel, 2013). To a certain extent, people can intentionally shape what to and what not to retrieve in the future. One paradigm that has been widely used to study this type of active memory control is list-wise directed forgetting (DF). Participants study a list of items and immediately afterwards are told to either forget them, because they were presented erroneously or just for practice, or to continue to remember them. Then, all participants are asked to encode and remember a second list. When subsequently asked to recall items from both lists, participants who were instructed to forget List 1 recall fewer items from that list (costs), but show enhanced memory for List 2 (benefits) in comparison to the remember group.

These effects have been replicated numerous times with adults (for a review, see Sahakyan, Delaney, Foster, & Abushanab, 2013), but are rarely observed in children younger than 10 years of age (Aslan, Staudigl, Samineh & Bäuml, 2010; Aslan, Zellner & Bäuml, 2010; Harnishfeger & Pope, 1996). Consequently, it has been suggested that DF reflects mnemonic skills that develop late (e.g., Aslan et al., 2010b). The retrieval inhibition account proposes that upon the forget cue participants initiate active inhibitory processes that suppress List 1 retrieval (Bjork, 1989; Geiselman, Bjork, Fishman, 1983), and the lack of DF in young children has been attributed to their poor ability to actively inhibit irrelevant information (Aslan et al., 2010a; Bjorklund & Harnishfeger, 1990; Wilson & Kipp, 1998). Evidence that effortful inhibition gradually improves over the elementary school years comes from other paradigms in which even 12 year olds often not display adult-like performance levels. For instance, performances in proactive interference tasks, item-

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wise directed forgetting tasks, the Hayling test (Howard, Johnson, & Pascual-Leone, 2014) and the Think-/No-Think task all show dramatic age-related improvements (Alonso, Ghetti, Matlen, Anderson, & Bunge, 2009). It is important to note that not all forms of inhibition are late developing. Automatic, unintentional inhibition, which occurs as a "by-product of effortful focus on task-relevant schemas" (Howard et al., 2014, p. 2/3) appears functional earlier as evidenced by adult-like performances of children 8 years of age and sometimes younger in retrieval-induced forgetting (Aslan and Bäuml, 2010; Lechuga, Moreno, Pelegrina, Gómez-Ariza, & Bajo, 2006; Price & Phenix, 2015), negative priming and flanker tasks (Howard et al., 2014). Importantly, DF is commonly assumed to rely on intentional, effortful inhibition (Bjork, 1989; Harnishfeger & Pope, 1996) and should therefore undergo substantial developmental changes during the elementary school years.

As an alternative to inhibitory explanations of DF, Sahakyan and Kelley (2002) assume that the forget cue after List 1 presentation triggers a mental context change. List 2 learning and recall then unfold in this new mental context, and the mismatch between the recall and List 1 encoding context complicates List 1 retrieval. Indeed, instructing people to change their mental context between list presentations (e.g., by imagining being back in their childhood home) has similar effects as the forget cue (Sahakyan & Kelley, 2002). Because contextual change strongly affects young children's memory performance (e.g., Bartlett, Burleson, & Santrock, 1982; Hala, Brown, McKay, & San Juan, 2013; Wilkinson, 1988; but see Aslan et al., 2010b), a mental context change should similarly affect retrieval in young children. However, there is only partial support for this assumption. Asking children to imagine being invisible between list presentations results in adult-like forgetting in first and fourth graders, but surprisingly not in kindergarteners (Aslan & Bäuml, 2008).

While the DF costs are attributed to retrieval difficulties, the benefits (better memory for List 2) are explained with enhanced encoding. Sahakyan and Delaney (2003) proposed that the forget cue causes participants to re-evaluate their encoding strategy, and to implement an alternative, more effective strategy for List 2. This involves at least two factors that mature late in development: (1) knowledge about the mnemonic benefits of specific encoding strategies (e.g., Joyner & Kurtz-Costes, 1997), and (2) spontaneous implementation of optimal encoding strategies (e.g., Bjorklund & Douglas, 1997). From this perspective, it is not surprising that benefits seem to emerge after 10 years of age (Aslan et al., 2010b). Alternatively, Pastötter and Bäuml (2010) suggest that the forget cue reduces memory load and resets encoding processes, which allows for more efficient encoding of (early) List 2 items. Since this reset of encoding is a consequence of list segregation processes which are not conceptualized as deliberate or strategic, even young children should benefit from the forget cue.

The scarcity of prior research and the opposing predictions that follow from the different theoretical accounts call for a reexamination of DF effects in preschool children. The aim of the present study is to assess whether DF results from effortful, strategic and therefore late developing processes or whether it is the consequence of shifting one's mental context, a basic cognitive process that is already functional in young children. Specifically, if costs reflect active and effortful inhibitory processes, they should gradually emerge during elementary school years, but they should be seen earlier if they are the consequence of mental context change. Benefits should not be consistently observed until the end of elementary school if they reflect the deliberate selection and implementation of elaborate encoding strategies, but could emerge earlier if the forget cue simply resets encoding processes. Knowledge about whether young children can be directed to forget outdated information and simultaneously improve retention of new information has important consequences for theories of DF and educational practice.

2. Experiment 1

The majority of DF studies has focused on verbal list learning. While these paradigms are effective methods in adult memory research, they may be inappropriate for young children because remembering word lists can be challenging for them. This shortcoming of verbal study material is reflected in the overall poor memory performance of preschoolers in DF studies (e.g., Aslan & Bäuml, 2008; Aslan et al., 2010b), which leaves little room for DF effects. In fact, studies involving children of different ages report age-related increases in memory for to-be-remembered items, but not age-related decreases in memory for to-be-forgotten items, thus casting doubt on the assumption that forgetting undergoes significant age-related changes.

In the present study, we used concrete everyday objects that are easier to remember for children (e.g., Cole, Frankel, & Sharp, 1971), and we simplified the forget instructions. Aslan et al. (2010a) found that first-graders showed forgetting when they were told that the first list was presented by mistake (high emphasis on forgetting), but not when they were simply instructed to forget the list because it would not be tested later (low emphasis). This illustrates that young children are sensitive to the specific wording of the forget instruction. In the present study, we explained that forgetting was necessary because it would "make room in their heads" for new items.

2.1. MethodsDesign & P3 Methods

2.1.1. Design & participants

Based on prior developmental DF studies (Aslan et al., 2010a,b; Harnishfeger & Pope, 1996), sample size for both experiments was targeted at $N = 20$ in each of the experimental conditions. Fifty-eight 4 and 5 year-old children were recruited from local daycare/preschool centers. After List 1 presentation, children were either told to forget or to continue to remember the objects in that list, or were presented with an instruction to change the mental context (see below). Children were randomly assigned to one of the three conditions. Data from 6 children were discarded from the final data set (2 in the forget group, 2 in the context change group, and 2 from the remember group) because children did not follow instructions, could not identify more than 50% of the objects or were diagnosed with autism spectrum disorder. The final data set contained data from 52 children (28 girls, 24 boys) between the ages of 4