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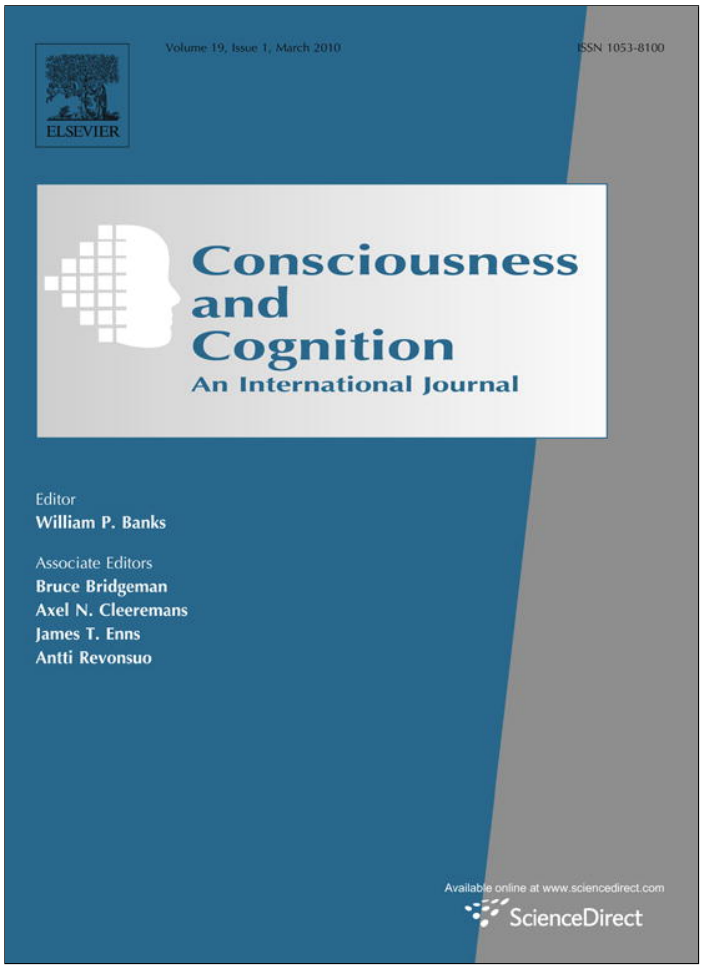

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Children's suggestion-induced omission errors are not caused by memory erasure

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ABSTRACT

We explored whether children's suggestion-induced omission errors are caused by memory erasure. Seventy-five children were instructed to remove three pieces of clothing from a puppet. Next, they were confronted with evidence falsely suggesting that one of the items had not been removed. During two subsequent interviews separated by one week, children had to report which pieces of clothing they had removed. Children who during both interviews failed to report that they had removed the pertinent item (i.e., omission error; $n = 24$) completed a choice reaction time task. In this task, they were presented with different clothing items. For each item, children had to indicate whether or not they had removed it. Significantly more errors were made for those removed items that children failed to report than for those they had not removed. This indicates that children's suggestion-based omission errors are not due to erasure of memories.

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1. Introduction

Studies have shown that suggestive information can result in *omission errors* (i.e., leaving out details) in both children and adults (e.g., Candel, Hayne, Strange, & Prevoo, 2009). So far, no study has examined whether suggestion-induced omission errors reflect a pure memory phenomenon (i.e., erasure of correct traces). The question we addressed in the current study is whether erasure of memory traces underlies children's omission errors.

Numerous studies have demonstrated that when exposed to suggestion both children and adults can develop false memories of events and details (e.g., Davis & Loftus, 2007; Otgaar, Candel, Merckelbach, & Wade, 2009; Sutherland & Hayne, 2001). Research also shows that such *commission errors* (i.e., false memories) are similar to veridical memories in terms of subjective ratings, and in their behavioral concomitants such as reaction times and food preferences (e.g., Bernstein, Laney, Morris, & Loftus, 2005; Geraerts et al., 2008; Lindsay, Hagen, Read, Wade, & Garry, 2004; Loftus, Donders, Hoffman, & Schooler, 1989; McNally et al., 2004). This indicates that commission errors are sustained by memory traces – albeit incorrect ones- and cannot be explained solely as manifestations of social pressure (e.g., conformity).

Few studies have examined how suggestion promotes *omission errors* in children. In one of the earlier studies on this topic (Pezdek & Roe, 1997), four- and ten-year old children were touched on their shoulder by the experimenter. In the omission condition, children were presented with false information stating that the event had not occurred. This manipulation did not increase the proportion of children denying that they been touched as compared to the no-suggestion control group. This led the authors to conclude that children's memories are largely immune to attempts of erasure by suggestion.

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Other authors, however, were more successful in their attempts of suggesting that perceived details were not presented. For example, Candel and colleagues (2009) examined how misleading information concerning details (i.e., falsely suggesting certain information was present or absent) would impact children's omission (i.e., failure to report) and commission errors. These authors found that omission and commission errors could be induced at a comparable rate (see also Williams, Wright, & Freeman, 2002; Wright, Loftus, & Hall, 2001).

Thus, it is possible to create omission errors with false suggestions. But do social phenomena (e.g., compliance with suggestions provided by adults) underlie these errors? Or are suggestion-induced omission errors the result of memory traces that have been erased or – to use a less dramatic description – have become inaccessible? The latter possibility comes close to concepts like repression and amnesia and it has drawn the attention of researchers interested in delayed disclosure of child abuse (e.g., Sjöberg & Lindblad, 2002). Meanwhile, as Wright and colleagues (2001, p. 481) write: "little empirical attention has been focused on the question of whether a perpetrator, or others, could act in such a way to make a memory less likely to be retrieved" (see also Wright & Loftus, 1998).

The current study sought to test whether memory erasure underlies children's omission errors. Seven-year old children were instructed to remove three pieces of clothing from a puppet. Next, an interviewer told children that they could not have removed one particular item and that their memory of this was incorrect. Specifically, they were provided with false evidence suggesting that they took off two pieces. During two follow-up interviews with a one week interval in-between, children had to indicate which pieces of clothing they had removed. After the second interview, children had to complete a choice reaction time task. During this task, different items of clothing were displayed, including the item that the child falsely denied to have removed (i.e., omitted item), items that were not removed, and items that the child admitted to have removed. For each item, children had to indicate whether it had been removed by pressing one of two buttons, one labeled yes and one labeled No.

One may safely assume that children in the present study had to make source monitoring decisions (Johnson, Hashtroudi, & Lindsay, 1993) in which they had to decide between an internal and external source (i.e., reality monitoring decisions). So, they had to choose whether they themselves removed the two pieces of clothing or whether the interviewer suggested it to them.

The rationale behind the choice reaction time task is that if the memory trace for removing the omitted item is erased or inaccessible, it should be processed identical to the items that were never removed. Given that they share the same response button (the no-button), no difference in behavioral data is expected between these types of items. If, on the other hand, behavioral data differ between items that have never been removed and omitted items, this indicates interference, meaning that the memory has not been erased. In that case, the omission errors must be attributed to other mechanisms than erasure such as compliance. Importantly, lying about removing two pieces of clothing would also result in behavioral interference.

2. Method

2.1. Participants

The current study included 75 elementary school children (M_{age} = 7.23, SD = 0.48, range 6–8). These children served as our omission-suggestion group. An extra group of 24 children was included as control group (M_{age} = 7.63, SD = 0.65, range 6–9). All children obtained informed consent from their parents and schools. All children were given a small present for their participation. The study was approved by the standing ethical committee of the Faculty of Psychology and Neuroscience, Maastricht University.

2.2. Materials

This study used an 80 cm tall puppet with pink-colored clothes like a hat, glasses, skirt, shoes, and pants.

2.2.1. Design and procedure

Children were individually interviewed two times with one week in-between. All interviews were recorded with a digital voice device. To reduce the effect of interviewer demands, three different female confederates interviewed the children at three different occasions. Thus, children were interviewed by two interviewers neither of whom had presented the false evidence (see below). The order of interviewers for the three different occasions was counterbalanced meaning that each child was randomly allocated to six possible orders of interviewers.

2.2.1.1. Omission suggestion. Children were told that we were interested in their memories. Then, children received the following instruction: "You are now going to another room to remove some pieces of clothing from a puppet named Lucy. When you are done, I will ask you what you remember of this." Next, confederate *A* told children to remove the skirt, hat, and shoes from the puppet and to put them next to the puppet on the table. The order of actions was counterbalanced across all children meaning that each child was randomly assigned to six possible orders of items. When they had removed the clothes, they were instructed to return to the interview room. During a baseline interview, confederate *B* asked them which pieces of clothing they had removed.

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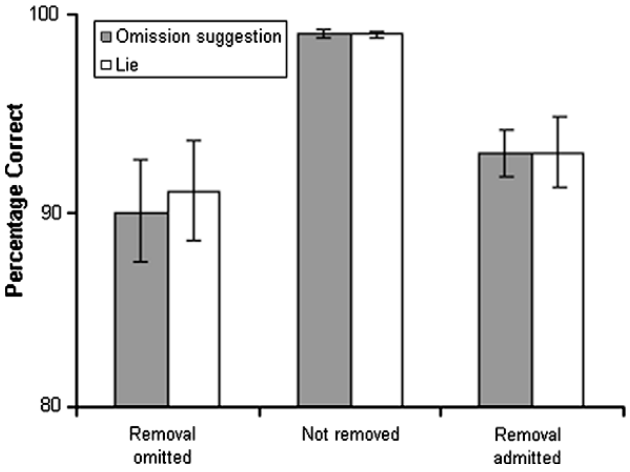

Fig. 1. Percentage correct responses of item type (removal omitted, not removed, removal admitted) of the omission-suggestion group and lie group (error bars represent standard error of means).

Next, confederate *B* told children that they could not have taken off one particular item and that their memory of this was wrong. This was always the second piece of clothing. To support this suggestion, confederate *B* took them back to the changing room. Before they came into the room, the pertinent piece of clothing that they had removed was placed back on the puppet. Children were then told that they must have misremembered the critical action, shown by the fact that the pertinent piece of clothing was on the puppet and not on the table.

Children received an immediate post-suggestion interview by confederate *C* about the actions they had performed (i.e., Interview 1). They were informed that confederate *B* had to leave and that, therefore, confederate *C* interviewed them. After one week, confederate *A* interviewed children about the pieces of clothing they removed (i.e., Interview 2).

2.2.1.2. Choice reaction time task. After the second interview, children had to complete a choice reaction time task. Children were presented with three types of pictures: the omitted pieces of clothing (removal omitted), pieces of clothing that they had not removed, and pieces of clothing that they admitted to have removed. For each piece of clothing, four different pictures were constructed. Not removed items were presented on 66% of all trials; removal admitted and removal omitted items were both presented on 17% of all trials. They were instructed to indicate whether they had removed the presented piece of clothing by pressing one button, and by pressing the other button when the presented item was a not removed piece of clothing. Furthermore, they were told to make their decision as fast and accurate as possible. The assignment of the yes- and no-button was balanced across children.

The task started with 48 practice trials intended to familiarize the children with the procedure. During these trials, children received feedback when they responded slowly (i.e., no response after 5000 ms) or incorrectly. After the practice trials, children were presented with 144 experimental trials divided into three blocks of 48 trials. Each trial began with the presentation of a picture of one of the items which remained on the screen until a response was made with a maximum of 5000 ms. Blocks were separated by a self-paced break.

2.2.1.3. Lie group. An additional group of children ($n = 24$; $M_{age} = 7.63$, SD = 0.65, range 6–9) participated in this study. These children did not differ from the children who were susceptible to the omission suggestion in terms of gender distribution ($p > .05$) or age ($p > .05$). The procedure for the lie group was similar to that described above except for the following. Instead of presenting them with the omission suggestion, confederate *B* asked them to lie that they removed only two pieces of clothing, and press the no-button for that particular item and complete the choice reaction time task as if they had removed only two pieces of clothing.[2] This group was included as a control group because we may assume that they have accessible memory traces of the pertinent item.

3. Results

To make sure that children's responses were only related to our omission suggestion and not due to other factors (e.g., forgetting), data from children who did not correctly report the removal admitted items were excluded from subsequent analyses (see also Otgaar, Candel, Smeets, & Merckelbach, in press). At Interview 2, 32% ($n = 24$) of the children failed to mention the pertinent piece of clothing and correctly indicated to have removed the other two pieces of clothing. Only these 24 children were of interest in the current study, therefore statistical analyses were restricted to this group and compared to the lie group.

[2] All children in the lie group assented to the manipulation and stated to have taken off two pieces of clothing.

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Table 1
Mean reaction times (ms; standard deviations in parentheses) of item type as a function of group.

Item type	Omission-suggestion group M (SD)	Lie group M (SD)
Removal omitted	709.84 (120.38)	901.94 (246.72)
Not removed	720.98 (112.24)	784.09 (148.67)
Removal admitted	808.98 (170.83)	872.21 (146.53)

Fig. 1 presents percentage correct responses during the choice reaction time task for both groups separately. Error rates were analyzed using a 3 (item type: removal omitted, not removed, removal admitted) × 2 (group: omission suggestion vs. lie) repeated-measures ANOVA. Greenhouse–Geisser correction was applied to *p*-values associated with multiple *df* repeated-measures. Both the interaction ($F(1.46, 67.17) = 0.32$, ns) and the main effect ($F(1, 46) = 0.05$, ns) involving group fell short of conventional levels of significance. However, a main effect of item type emerged ($F(1.46, 67.17) = 13.55$, $p < .001$, $\eta_p^2 = 0.23$). Follow-up multiple comparisons showed that all children made significantly more errors for the removal omitted items as compared to not removed items ($p < .001$). Removal omitted and removal admitted items did not significantly differ from each other.

Using a similar statistical approach, reaction times for correct responses were analyzed. Both the main effect of group ($F(1, 46) = 6.20$, $p < .01$, $\eta_p^2 = 0.12$) and the group × item type interaction ($F(2, 92) = 8.90$, $p < .001$, $\eta_p^2 = 0.16$) were significant.[3] Children in the lie group exhibited slower reaction times overall, but also displayed longer reaction times for the removal omitted items than for the not removed items ($F(2, 46) = 9.15$, $p_{rep} < .001$, $\eta_p^2 = 0.29$; see Table 1). When we analyzed reaction times in the omission-suggestion group, we found a main effect of item type ($F(1.21, 27.75) = 13.91$, $p < .001$, $\eta_p^2 = 0.38$). Pairwise comparisons revealed that children in the omission-suggestion group displayed similar reaction times to the removal omitted items as to the not removed items ($p > .05$).

4. Discussion

Research (e.g., Lindsay et al., 2004; Loftus et al., 1989) indicates that suggestion can create actual memory distortions such that people come to remember never-experienced details or events (i.e., false memories). This study demonstrates that suggestion-based omission errors belong to a different class. In more general terms, our findings suggest that source monitoring disruptions (Johnson et al., 1993) do not fully explicate suggestion-based omission errors. Source monitoring refers to the mechanisms involved in determining the sources of our memories. As already stated, in the present study, children had to make internal-external source decisions (e.g., "Did interviewer *X* tell me that or did I see it myself?"). However, our study implies that source monitoring disruptions operate in one direction. Misleading information may lead children to incorporate fiction as fact (Ceci & Bruck, 1993), but the opposite seems to be much more difficult.

Children made more errors when they were presented with removal omitted pieces of clothing than when they were presented with the not removed pieces of clothing. This implies that the presentation of the removal omitted items induced a response conflict (see Farwell & Donchin, 1991; Loftus et al., 1989; Meijer, Smulders, Merckelbach, & Wolf, 2007), apparently because memory traces of these items were still present and created interference. This specific pattern was also found for children in the lie group, where, obviously, the memory trace was still present.

Thus, the most plausible explanation of children's suggestion-induced denial of having removed the pertinent item is that it is driven by social factors (e.g., compliance) rather than memory erasure. Indeed, an impressive corpus of research shows that children are likely to show compliant behavior towards authoritative adults like interviewers (Ceci & Bruck, 1993). Our findings bear relevance to discussions about factors that are responsible for memory and delayed disclosure of abuse in children and adults. Some authors (Tessler & Nelson, 1994; p. 321) argue that "an experience not talked about (such as a secretive sexual abuse episode) may not be recallable by the child" and that "[t]his is one possible reason for poor memory for some such incidents". Other authors believe that impaired memory due to denial or threats would work against a full disclosure (Sjöberg & Lindblad, 2002). However, our results suggest that it is not easy to impair children's memory by providing them with suggestive information. Obstacles to disclosure of abuse might have more to do with social phenomena than with memory erasure.

We also found that reaction times in the omission-suggestion group for the removal omitted and the not removed items were similar, whereas in the lie group they differed. However, although one would theoretically expect to observe a response conflict in both error rates and reaction times, studies have shown error rates to be more sensitive to response conflicts (e.g., Huijding & De Jong, 2005). One likely possibility is that children in the omission-suggestion group were highly intrinsically motivated to masquerade their compliant behavior. In contrast to the lie group, children in the omission-suggestion group were *not* specifically instructed to report that they only removed two pieces of clothing. As such, this might have resulted in that these children were more motivated to uphold their verbal responses during the choice reaction time task. Therefore,

[3] A similar pattern is evident when the analysis (one-way ANOVA) is restricted to the 24 children of the omission-suggestion group who maintained that they did not remove the pertinent item.

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children who concurred to the omission suggestion might have been extremely willing to respond as fast as possible when they were presented with the removed omitted piece of clothing.

Of importance, although we did not find a response conflict in reaction times, we *did* find evidence of interference in error rates. Obviously, this indicates that memory erasure does not underlie children's suggestion-induced omission errors. The finding that, overall, the omission suggestion responded significantly faster than the lie group suggests that children in the omission-suggestion group were not lying that they removed two pieces of clothing. Clearly, future studies are needed to elucidate the response differences between the omission-suggestion group and lie group in terms of reaction times.

To conclude, our study is the first to demonstrate that children's suggestion-induced omission errors do not reflect memory erasure.

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