

## Development of false memories in bilingual children and adults <sup>☆</sup>

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### Abstract

The effects of within- versus between-languages (English–French) study and test on rates of bilingual children's and adults' true and false memories were examined. Children aged 6 through 12 and university-aged adults participated in a standard Deese–Roediger–McDermott false memory task using free recall and recognition. Recall results showed that: (1) both true and false memories increased with age, (2) true recall was higher in within- than between-languages conditions for all ages, and (3) there were fewer false memories in between-languages conditions than within-language conditions for the youngest children, no differences for the 8 and 12 years old, and by adulthood, there were more false memories in between-languages than within-language conditions. Recognition results showed that regardless of age, false recognition rates tended to be higher in between-languages than within-language conditions. These findings are discussed in the context of models of false memory development.

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Past studies using the Deese–Roediger–McDermott (DRM) paradigm (Deese, 1959; Roediger & McDermott, 1995) have demonstrated that young children may be less susceptible to false memories than adults (Brainerd, Reyna, & Forrest, 2002; Howe, 2005, 2006, *in press*; Howe, Cichetti, Toth, & Cerrito, 2004; but see Ghetti, Qin, & Goodman, 2002). Theoretical explanations such as

fuzzy-trace theory (FTT) have attempted to account for these findings by suggesting that both verbatim and gist traces are encoded during list presentation (Brainerd & Reyna, 2005). These traces are qualitatively different from each other where the former is concerned with item-specific surface information and the latter with meaning-based information. It is this gist trace that is thought to be responsible for false recall in the DRM paradigm. Although young children are capable of extracting these types of traces, the ability to do so improves with age and cognitive development into later childhood and early adulthood (Brainerd & Reyna, 2005).

An alternative, associative-activation model (e.g., Howe, 2005, 2006, *in press*) argues that developmental trends in false memories occur not just because of

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correlated changes in children's meaning extraction skills (i.e., growth in knowledge base) but also because of increased automaticity in the activation and accessibility of those concepts and associations in the child's knowledge base. These increases in automaticity are brought about by additional exposure and proficiency using these concepts as well as the associations between related concepts. As exposure and proficiency increases, so too does the automaticity of activation of concepts and their associative links, making false memory production more and more adult-like, occurring without conscious effort or awareness (Howe, 2005).

Although these models have been contrasted in other forums (Howe, 2005, 2006, *in press*), a key test of these positions can be found by considering the development of bilingual memory. Bilingual children may be able to use meaning more effectively if they can access semantic representations through two different lexical forms. However, this may come at a cost as increased processing of meaning in young children may increase their levels of false recollection. This is exactly what has been found in studies with bilingual adults. Specifically, when adults study a list in one language (e.g., English or Spanish) and are asked to recall or recognize those items in the other language (i.e., English  $\Rightarrow$  Spanish or Spanish  $\Rightarrow$  English), true memory performance is reduced and false memory performance is enhanced relative to within-language study-test conditions (i.e., English  $\Rightarrow$  English or Spanish  $\Rightarrow$  Spanish). For example, Marmolejo, Diliberto-Macaluso, and Altarriba (2003) found that for Spanish-English bilinguals, there was lower true recall and higher false recall in between-languages study and test conditions than in within-language conditions. Similar findings were reported by Wakeford, Carlin, and Toglia (2005) with English-Spanish bilinguals using both recall and recognition measures. Using a 2(Acquisition: English, Spanish)  $\times$  2(Test: English, Spanish) design, Wakeford et al. (2005) found that veridical recall and recognition rates were lower in between-languages conditions than within-language conditions. Using a similar design, Sahlin, Harding, and Seamon (2005) found false recognition increased in between-languages as opposed to within-language conditions for English-Spanish bilingual adults. However, as additional study-test trials were provided, participants' false recognition rates decreased as they came to rely more on language-specific lexical representations rather than on the conceptual representations used initially. Finally, Cabeza and Lennartson (2005), who used a paradigm similar to the previous ones but testing English-French bilingual adults, found that false recognition was robust in both within-language and between-languages conditions, but more correct recognition of "old" items occurred

in the within-language than between-languages conditions.

All of these findings with bilingual adults have been attributed to increased meaning processing in the between-languages study-test conditions than in the within-language conditions (e.g., Cabeza & Lennartson, 2005). Consistent with this is the finding that as the number of study-test trials increases, participants' reliance on meaning decreases because stronger cue- or language-specific representations are available, and both of these events are associated with lowered false recollection (Sahlin et al., 2005). Taken together, these findings have been seen by some as support for FTT (Brainerd, Forrest, Karibian, & Reyna, 2006). The argument is that presentation of a list of words in one language (e.g., English) and requiring output (recall, recognition) in a different language (e.g., French, Spanish) makes it (a) less likely that bilingual adults will be able to access verbatim traces to support true memories, (b) less likely that bilingual adults will be able to access verbatim traces to suppress false memories, and (c) more likely that bilingual adults will access gist traces that support false memories. Because of the dual effect of decreases in verbatim memory (a and b), coupled with increases in gist processing (c), false memories are more likely in between-languages than within-language study-test conditions.

However, these outcomes with adult participants do not provide necessary and sufficient support for FTT. This is because these results are also consistent with predictions from associative-activation models (e.g., Howe, 2005; Hutchison & Balota, 2005). Like FTT, these latter models predict that increased meaning processing, along with decreased discriminability of the original stimulus, both circumstances that pertain to between-languages conditions but not within-language conditions, will lead to fewer true memories and more false memories. These theories do, however, make different predictions when we consider the *development* of false memories in bilingual children.

To see how these theories can be distinguished, first consider what FTT predicts about bilingual children's false memories. If FTT is correct, relative increases and decreases in children's true and false memories depend on the extent to which between-languages study-test conditions prompt bilingual children to increase gist processing at the expense of verbatim memory. Specifically, according to FTT, the development of children's false memories is related to their increased ability to extract gist. To the extent that between-languages memory tasks increase gist processing and decrease reliance on verbatim memory, FTT predicts that bilingual children should produce more false memories in between-languages study-test conditions than within-language ones. Of course, whether this task increases children's gist processing depends on the development and organization

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