



Familiarity and recall memory for environments: A comparison of children and adults



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ABSTRACT

To date, very little research has examined developmental reversals in false memory outside of the word list paradigm. The purpose of this study was to investigate whether knowledge of, and familiarity with types of environments influenced the quantity, accuracy, and errors recalled by children (4- to 6- year-olds) and adults. Using images and open recall questions, the findings of the present study support the predicted reversal in false memories (i.e., developmental variability), supporting a cross-over effect of age and false memories. Children performed better than adults through providing less relevant errors (i.e., commission or semantic-based errors) about environments that were more familiar to adults. These findings support the predicted developmental reversal in false memories. The findings are discussed within the context of fuzzy trace theory and semantic knowledge structures. Implications for the applied eyewitness context are examined.

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There are many crimes, such as domestic violence and child abuse, in which a child may be a central witness to the event (Carter, Weithorn, & Behrman, 1999; Zajac & Karageorge, 2009). While some eyewitness research investigates children's accuracy when recalling the details of the event (Ceci & Bruck, 1995) and the appearance of a perpetrator (e.g., Pozzulo & Warren, 2003), far less work has examined the importance of children's memory of the surroundings in which the crime occurred. An eyewitness' memory of crime environment is important because it provides information that may help investigators form a more complete understanding of the crime event. Moreover, errors made by eyewitnesses about the environment may suggest an erroneous memory for the event.

Children may witness a crime in an environment that is less familiar to them, such as a bank, or in an environment that is more familiar, such as a park. For example, in the United States, a national survey revealed that more than 25% (Finkelhor, Turner, Ormrod, Hamby, & Kracke, 2009) of children witnessed violence in the previous year, including violence in the home. Similarly, in 1999, Statistics Canada reported that more than 400,000 children witnessed the assault of a parent, usually their mother, in a familiar environment that they have much knowledge about—their home (Dauvergne & Johnson, 2001). It is not yet fully understood whether recalling details from a more familiar versus a less familiar type of environment will influence a child's recall memory. Recalling a familiar type of environment may not only increase the number of accurate descriptors provided, but it may also increase memory errors (Leichtman & Ceci, 1995). The purpose of the present

research is to develop a better understanding of how familiarity with, or knowledge of, a type of environment influences the accuracy of children's and adults' recall memory for objects in those environments. An extensive amount of literature has examined developmental variability in memory errors (i.e., false memories) using word lists (e.g., Anastasi & Rhodes, 2008); however, the present study seeks to extend this research using object-cued recall tasks.

Recall memory and age

Research examining children's performance in free recall tasks has found that the amount of information provided tends to increase with age, such that young children typically recall quantitatively less information than older children and adults (Fivush, 1997; Lepore, 1991; Pozzulo & Warren, 2003). Research also suggests that, when compared to adults, young children (3-year-olds) recall information in a very general manner, without much detail (e.g., Fivush, 1997; Hudson & Nelson, 1986; Quas et al., 1999). Although children recall less information, the information reported by children, as young as four years old, has been found to be proportionately as accurate as the information recalled by adults (Cordon, 2004; Jones & Krugman, 1986; Poole & White, 1991; Pozzulo & Warren, 2003). For example, Ceci and Bruck (1993) conducted a review of 18 developmental studies on memory and concluded that, when recalling information for forensic purposes, children are capable of recalling important and accurate information.

Memory for objects

When witnessing a crime, there are several different components of memory that an eyewitness can recall: The appearance of a perpetrator,

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the events that took place (i.e., the crime sequences), and the presence of any significant objects within the crime environment (e.g., presence of a weapon; what was stolen). There is considerable research focusing on memory for objects and the influence that prior knowledge can have on memory for objects (e.g. Brewer & Treyens, 1981). Dirks and Neisser (1977) examined how a change in the layout of objects in a toy scene, typically familiar (i.e., encountered frequently) to children, would influence their recall and recognition memory. It was found that younger children (first graders) were more likely to make memory errors (i.e., report inaccurate changes in the picture) than older children (third and sixth graders). Given the research in this area, it remains unclear how increased exposure influences memory for objects within the context of a larger environment.

Therefore, the present study compared children's and adults' recall memory for objects (including descriptions of objects) located in more familiar or less familiar environments. Given that research suggests that adults report more detailed information than children (e.g., Lepore, 1991), it was predicted that adults would recall quantitatively more information than children across all conditions. However, given that increased exposure has been found to be related to more detailed recall of information (e.g., Brewer & Treyens, 1981), it was hypothesized that, for each age group, recall would be higher when recalling more familiar environments compared to less familiar types of environments. Also, it was hypothesized that environments that are more familiar would result in a higher proportion of accurate recall when compared to less familiar environments, given that schema research suggests that increased exposure results in more meaningful, detailed schemas for a stimulus (Bartlett, 1932; Brewer & Treyens, 1981).

Memory errors

When a person recalls an event, it is possible that they will "remember" details about the crime that did not occur, or "remember" seeing an item that was not actually present. There is a substantial amount of research examining inaccurate memories in an eyewitness context. Commonly referred to in the literature as *false memories* (Brainerd & Reyna, 2005; Fiedler, Walther, Armbruster, Fay, & Maumann, 1996; Toglia, Neuscgatz, & Goodwin, 1999), the present research examined intrusion errors, known more broadly as *errors of commission*. Commission errors are the recalling of memory details (e.g., an object) that were not present during an event. Under normal circumstances, errors of commission are harmless. While errors are mistakes, Brainerd, Reyna, and Ceci (2008) argue that they "still preserve the meaning of the target materials" (p. 345). However, if a witness is asked to provide information to the police about a crime, commission errors can have significant consequences.

A framework for understanding how memory errors can differ across ages is fuzzy trace theory (FTT). FTT is opponent-processing theory of "two minds," put forth by Reyna and Brainerd (1995, 2002) proposing that memory is comprised of two levels of information processing that work in opposition to each other throughout the entire process of encoding, storing, and retrieving (Brainerd, Forrest, Karibian, & Reyna, 2006, 1998a, 1998b, 1998c; Brainerd & Reyna, 1998a, 1998b; Reyna & Brainerd, 1995). The first level is the processing of the surface information, termed *verbatim* traces (i.e., "true" part of memory; what actually happens) and the second level is the processing of the meaning attributed to the information, termed *gist* traces (i.e., "fuzzy" part of memory; semantic memory or the individual level of understanding assigned to the event).

FTT is based on five principles to explain memory and recollection. Using these five principles, FTT draws explanations and makes predictions on three trends related to memory errors: A decrease in errors, an increase in errors, and age differences in these trends. Of those five principles, two are essential in understanding the relations among age, semantic knowledge structures, and memory errors. The first relevant

principle that FTT proposes is that memory errors are the result of the relative strength of the two opposing processes involved in memory: Verbatim and gist traces (Brainerd, Reyna, & Ceci, 2008; Reyna & Kiernan, 1994). Reyna and Brainerd (1995) suggest that verbatim and gist traces are encoded and stored separately and influence the retrieval of the information differently. It is at the level of encoding and retrieval of information where these two traces have the capability to either increase or decrease the accuracy of recalling information. Gist traces are based on semantic representations and, as a result, are hypothesized to support memory errors in certain situations because relying on gist traces reduces detailed information and may create a sense of familiarity with a target and, therefore, can result in more "filling in" (Brainerd & Reyna, 2008, 2010; Brainerd, Yang, Reyna, Howe, & Mills, 2008; Reyna & Brainerd, 1995; Reyna & Kiernan, 1994). On the other hand, verbatim traces represent detailed memory of a specific event. As a result, verbatim traces are thought to have the ability to suppress memory errors by neutralizing the sense of familiarity supported by gist traces (Brainerd & Reyna, 2007).

There has been considerable support for a FTT explanation of memory errors using methods such as word-list recall, connect-meaning studies (e.g., Brainerd, Yang, Reyna, Howe, & Mills, 2008), and most significantly, the Deese–Roediger–McDermott (DRM) paradigm (e.g., Odegard, Holliday, Brainerd, & Reyna, 2007). All of these methods examine the strength of gist traces in relation to verbatim traces during memory tasks by using semantic relations (i.e., or developing an understanding or meaning) between objects and events, thereby increasing the likelihood of memory errors (Brainerd, Yang, Reyna, Howe, & Mills, 2008). These studies have generally concluded that as the semantic grouping or meaning between stimuli increases, commission errors also increase (Payne, Elie, Blackwell, & Neuschatz, 1996; Experiment 3; Toglia et al., 1999).

Nature of errors

There are different types of memory errors than can be reported (De Beni & Palladino, 2004) and the type of memory errors made have been found to be related to exposure to a stimulus. Recalling a non-present, but usually-present item in an environment is the most common error made by children when recalling details from a repeated experience (Powell, Roberts, Thomson, & Ceci, 2006; Powell & Thomson, 1997). On the other hand, when recalling information about an environment in which they have had a one-time exposure, children are more likely to recall information that is not normally representative of that environment (i.e., atypical; Powell et al., 2006; Wickelgren, 1965). The present study examined whether knowledge with environment was related to the nature of errors recalled by each age group.

Memory errors and age

The second relevant principle of FTT is that developmental variability exists in both the use and strength of these two processes (Brainerd & Reyna, 2005). FTT proposes that an individual's ability to store, retain, and retrieve gist and verbatim traces improve with age; however, gist development is more significant during later stages of development as it reflects the onset of a child's ability to attribute and connect meaning between two pieces of information (Brainerd & Reyna, 2002, 2005). Unlike theories and their supporting literature that propose that the recalling of memory errors decreases from childhood into adulthood, FTT proposes that susceptibility to memory errors maps onto this trend and increases with age (Brainerd & Reyna, 2005).

Recently, evidence has been gathered to support FTT's prediction that children may be less susceptible to errors of commission due to an underdeveloped gist trace memory (i.e., developmental reversal in false memory; Brainerd, Yang, Reyna, Howe, & Mills, 2008; Brainerd et al., 2006; De Beni & Palladino, 2004; Holliday, Reyna, & Brainerd, 2007). DRM research by Dewhurst and Robinson (2004), for example, examined the influence of exposure and semantic relation and found

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