The Role of Familiarity and Stereotypes in Recall Memory for Environments: A comparison of Children and Adults

by

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Abstract

The purpose of the study was to investigate whether familiarity with types of environments and stereotypes about these environments influenced the quantity, accuracy, and errors recalled by children (4- to 6- year-olds) and adults. Using images and open recall questions, results revealed that environment familiarity resulted in increased quantity and accuracy of children's recall, but also resulted in more memory errors. Familiarity was also related to an increase in recall for adults, but it did not influence accuracy. Familiarity appears to affect children and adults' reporting of memory errors in different ways. Adults made relevant errors, suggesting that they are 'filling in the gaps' using semantic connections to recall information; whereas children's errors were less relevant to the environment and, thus, are not likely based on semantics, but instead, may be related to social pressure to report information. These findings are discussed within the context of fuzzy trace theory and semantic knowledge structures and implications for the applied eyewitness context are examined.

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Table of Contents

Abstract ii

Acknowledgements iii

List of Tables vi

List of Figures vii

List of Appendices viii

Introduction 1

Eyewitness Recall Memory and Age 4

Quantitative Recall Performance. 5

Accuracy of Recall. 5

Memory for Objects 7

Memory Errors 8

Errors of commission. 9

Semantic Knowledge Structures: Schemas 10

Stereotypes 13

Familiarity 18

Fuzzy Trace Theory 26

Overview of the Present Study 32

Hypotheses 32

Method 34

Results 38

Pilot 40

Main Study 43

Quantity of Information Recalled 50

Accuracy of Information Recalled 55

Memory Errors ... 57
Memory Errors: Relevant versus Irrelevant ... 59
Discussion ... 62
References ... 80

List of Tables

Table 1. Pilot: Frequency reported visits to environment 42

Table 2. Frequency reported visits to environment 45

Table 3. Inter-rater Reliability Scores 48

Table 4. Quantity, Accuracy, and Errors by Age and Picture 53

Table 5. Quantity, Accuracy, and Errors by Age and Condition 55

Table 6. Relevant and Irrelevant Errors by Age and Image 61

List of Figures

Figure 1. Number of Descriptors: Age and Image Environment 51

Figure 2. Proportion of Accurate Descriptors: Age and Image Environment. 56

Figure 3. Number of Memory Errors: Age and Image Environment 59

Figure 4. Number of Relevant and Irrelevant Errors: Age and Image Environment. 61

List of Appendices

Appendix A: Instructions 98

Appendix B: Description Form 99

Appendix C : Parental Consent Form 100

Appendix D : Informed Consent Form 102

Appendix E : Demographic/Familiarity Questionnaire : Child 103

Appendix F : Demographic/Familiarity Questionnaire : Adult 105

Appendix G : Written Debriefing Form : Adult 107

Appendix H : Debriefing Form : Child 109

Appendix I: Inter-rater Reliability Scores: Pilot 110

Appendix J: Age/Gender Effects 111

Appendix K: Nature of Memory Errors: Bank 112

Appendix L: Nature of Memory Errors: Park 114

Appendix M: Errors Relevancy Form 116

Appendix N: Debriefing Story: Child 117

Appendix O: Materials 122

Appendix P: Coding Manual 124

The Role of Familiarity and Stereotypes in Recall Memory for Environments: A comparison of Children and Adults

Eyewitness reliability refers to a witness' ability to provide accurate testimony and/or evidence and, by implication, the witness' ability to observe, encode, retrieve, and communicate information about the observed event (Cassel, 1993). In the past, lay people and criminal justice professionals viewed children's memory as unreliable and, therefore, children were not considered reliable as witnesses (Cassel, 1993). Even in the academic community, past research often concluded that children's recall memory is unreliable due to their vulnerability to suggestion (see Ceci, Ross, & Toglia, 1989). These conclusions have led to the perception that children are poor at remembering. Since then, a series of high-profile court cases in the United States have fuelled an increase in developmental research suggesting that children are capable of encoding and recalling important information regarding an event (e.g., Ceci & Bruck, 1993). Despite these advancements in understanding developmental changes in memory, the extent to which social and/or cognitive factors influence the accuracy of memories remains unclear. For example, it is not clear whether increased levels of familiarity with a type of environment, and stereotypes about that type of environment, influence children's memories compared to adults' memories. The purpose of the present research was to determine how these factors influenced children's and adults' recall memory for different environments.

There are many crimes, such as domestic and child abuse, in which a child may be a central witness to the event (Carter, Weithorn, & Behrman, 1999; Zajac & Karageorge, 2009). In 2003, for example, the Public Health Agency of Canada estimated that there were 135,573 incidents of child abuse (sexual, physical, and emotional) and neglect across Canada

(Trocmé et al., 2005). As a result, understanding children's ability to accurately recall a crime is an important focus in the eyewitness literature (Zajac & Karageorge, 2009). While some eyewitness research investigates children's accuracy when recalling the appearance of a perpetrator (e.g., Pozzulo & Warren, 2003), the literature overlooks the importance of children's memory of the surroundings in which a crime occurs. An eyewitness' memory of crime environments is important because it provides information that helps researchers and 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.

When witnessing a crime, children may be exposed to two different types of situations. First, the child may witness a crime an environment that is less familiar to them, such as a bank or a restaurant. Second, the child may witness a crime in an environment that is more familiar to them, such as a toy store or a park. It is not yet 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 increase the number of accurate descriptors provided, but it also may increase memory errors (Leichtman & Ceci, 1995). While research has demonstrated that increased exposure to a target influences memory (e.g., Brimacombe, Jung, Garrioch, Allison, 2003), no research has specifically examined how environment familiarity influences recall memory. Understanding how familiarity with specific types of environments influences recall memory is important because it may have implications for how accurate other components of a witness's memory may be, such as the crime event. As a result, it is important to understand whether the familiarity of an environment influences the accuracy of information recalled.

Another factor that may influence a person's recall of an environment is stereotypes about the environments and items that are present within the environments. Stereotypes have been defined as uninformed expectations that a person has about his/her environment that function as a way to organize and structure an experience (Leichtman & Ceci, 1995). Some research has suggested that stereotypes can influence how information is encoded and recalled, leading to the recollection of additional information that was not actually perceived (e.g., Leichtman & Ceci, 1995). For example, when walking into a toy store, a person is likely to have pre-existing expectations about what should be found in a toy store and will use these expectations to reflect upon their most recent visit. When recalling a crime in a toy store, a child witness also may need to recall items that were present in the environment, including those items that may be atypical to that environment, such as a knife at a toy store.

Despite the fact that stereotypes have been found to influence recall memory, there has been minimal research examining how these factors interact with environment familiarity and eyewitness age to influence recall memory for witnessed events. As a result, it is important to examine how the presence of stereotypical and atypical items influences a child's ability to recall information about an environment, such as a crime environment.

The constructs of familiarity and stereotypes have important theoretical and applied implications in the areas of forensic decision-making. From an applied perspective, witnesses often observe a crime that occurs in a familiar place or is committed by a perpetrator that is familiar to the witness (e.g., in the park/at home; committed by a family member; Trocmé et al., 2005). In these circumstances, it is important to understand how an increased level of familiarity influences a witness' ability to report what they see. For example, when police ask a witness to recall a crime or event, familiarity or stereotypes regarding an experience can result in the witness unknowingly recalling inaccurate information. From a theoretical perspective, both stereotypes and familiarity are understood as knowledge structures that develop as a function of experience (Cordon, 2004). Knowledge structures are a simplified semantic network that is comprised of a series of interrelated facts about a specific topic (Merril, 2000). As a result, the theoretical implications of these knowledge structures on memory can be examined using the theoretical constructs of memory trace strength (i.e., how the information is stored and retrieved) and semantic knowledge structures (how the information is organized).

In the following sections of this paper, general developmental patterns in memory are discussed in relation to eyewitness memory performance. Following this is a discussion of variables that are empirically and theoretically relevant to recall memory: stereotypes and familiarity. Next, fuzzy trace theory (Brainerd & Reyna, 1998b), the main theoretical framework used to generate hypotheses, is presented in detail. After the presentation of background information, the hypotheses and method for the study are outlined in detail, followed by the results and discussion of findings.

Eyewitness Recall Memory and Age

Eyewitness memory is a specialized area of applied cognitive (and social) research that focuses on understanding memory of faces, events, and items that are present during a criminal event. Some of the past research on developmental trends in eyewitness memory concluded that children are unreliable as witnesses and their memories are highly susceptible to inaccurate and distorted recollections (Brainerd & Reyna, 2008; Ceci, Ross & Toglia, 1989; King & Yuille, 1987). In the early nineties, a series of American criminal cases, involving children as either a bystander or a victim, boosted interest in understanding how accurate and reliable child witnesses are when providing information in court (e.g., Bruck & Ceci, 1995; Bruck & Ceci, 1999; Quas, Quin, Schaaf & Goodman, 1997). This research has shown that witness recognition memory for faces can be accurate and that people are able to make positive identifications approximately 80% of the time (see Pozzulo & Lindsay, 1998 for a review; Pozzulo et al., 2011). Although eyewitness recognition memory is an important component in understanding eyewitness memory as a whole, the present study focused on the other component of eyewitness memory: recall memory.

Quantitative Recall Performance. One common method of evaluating recall performance is through the use of free recall tasks, or the use of open-ended questions with no specific prompts (e.g., "Tell me everything you can remember about the picture"; Cassel, 1995). 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). In addition, some research shows that when presented with cued-recall questions (i.e., providing prompts relating to what needs to be remembered), young children (3- and 4-year-olds) are able to recall more information than with free-recall, but still recalled less than adults (e.g., Perlmutter & Ricks, 1979). 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, Goodman, Bidrose, Pipe, Craw, & Ablin, 1999).

Accuracy of Recall. While children recall less information, the information they do recall is, generally, accurate. The majority of research has found that the information reported by children, as young as three years old, is proportionately as accurate as the information recalled by adults (Cordon, 2004; Pozzulo et al., 2011; Jones & Krugman, 1986; Pozzulo & Warren, 2003). Early research by Nelson (1978) and colleagues (Nelson & Gruendel, 1981) first suggested that preschool and school aged children (ages 3- to 8- years-old) are capable of having well-organized memories for events that he/she personally experience (e.g., going for lunch at McDonalds or baking a cake). Since then, research on the development of recall memory has been conducted and found evidence suggesting that children are capable of recalling accurate information about experienced events. 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. Likewise, Poole and White (1991) examined the influence of repeated questioning on recall memory and found that regardless of age (4-, 6-, 8-year-olds or adult), the information reported during free recall tasks was accurate across multiple repetitions when non-suggestive questioning was used. However, a smaller number of studies have found the opposite: adults reported more accurate and inaccurate information than children (Goodman & Reed, 1986; Marin et al., 1979; Poole & White, 1991).

Research suggests that age matters when recalling information—particularly regarding a person's ability to draw meaning and connections between stimulus items and the ability to subsequently encode this information using these conceptual frameworks (Connolly & Price, 2006). The fact that developmental differences exist in the quantity of information recalled cannot be overlooked. Reasons for these differences between children's performance and adults' performance on free recall have been examined in the literature. Some research suggests that this may be due to young children having a less developed vocabulary to use when reporting their memories (i.e., language development; Pozzulo &

Warren, 2003). Other reasons for the gap focus more on cognitive-social factors, such as adults having an advantage of higher exposure with the targets/environments due to their increased age, thereby increasing their knowledge of specific places or events and facilitating recall performance (Nelson & Greundel, 1981). The problem with comparing many of these studies with the present research is that they often measure recall accuracy using information about the identity of a perpetrator (i.e., person descriptors) or about the crime events. The present study examined whether similar trends are found when witnesses of different ages are asked to recall features of an environment.

Memory for Objects

When witnessing a crime, there are several different 'components' of memory that an eyewitness can recall: the appearance of a perpetrator, 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). The present study focused on memory for objects within specific environments. Research is required to understand how memories for objects in an environment vary across age and which factors may influence this type of recall performance.

Exposure and object memory. There is considerable research focusing on memory for objects and the influence that stereotypes and familiarity can have on memory for objects. Tanaka and Gauthier (1997), for example, discuss how some people may be more sensitive to the presence of certain objects if they encounter them frequently. However, other research shows that when recalling common objects (i.e., an object that generally has high exposure to people), people are not able to recall details with much accuracy. Nickerson and Adams (1982), for example, conducted a study that asked participants to draw the design that appears on common objects that they have regular contact with—e.g., an American penny. This study found that, when asked to recall and draw the appearance, participants were not very accurate and, thus, increased exposure does not necessarily denote accuracy. Although this study speaks to memory for recalling a small portion of an object, it does not indicate a person's ability to identify the item as a whole—which is the focus of the present study.

In addition, 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 (1st graders) were most likely to make memory errors (i.e., report inaccurate changes in the picture) than older children (3rd and 6th graders). Given that only a small amount of research has examined this, it is not clear how exposure influences memory for entire items, particularly within the context of a larger environment. Therefore, the present study compared children's and adults' recall memory for entire objects (including descriptions of objects) located in specific environments.

Memory Errors

When an eyewitness recalls a crime, 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. This research is comprised of various subcomponents examining inaccurate memories in a developmental framework. These subcomponents have included child suggestibility (e.g., Powell, Roberts, Thomson, & Ceci, 2006), misleading questions (Perry, McAuliff, Paulette, Claycomb, & Flanagan, 1995), suggestive instructions (Quas et al., 1999), memory intrusions (Brainerd, Reyna, & Ceci, 2008) and false memories (Brainerd

& Reyna, 2005; Fiedler, Walther, Armbruster, Fay, & Neumann, 1996; Toglia, Neuschatz, & Goodwin, 1999).

This concept of recalling inaccurate information is commonly referred to in the literature as *false memories* or *false information* (e.g., Brainerd & Reyna, 1997; 2005). False information can be understood as the result of a variety of memory-related errors that can occur when an eyewitness is asked to recall an event (Brainerd & Reyna, 2005). The present research focuses on memory fallibility, or errors that are not based on deceptive intent, but inaccurate recollection (Brainerd & Reyna, 2005). Therefore, despite the fact that many researchers use the term false memories to describe this concept, perhaps a more appropriate term for the present research is *memory errors*, as 'false' can imply intent (*false: deliberately made or meant to deceive,* The New Oxford American Dictionary, 2011). As false memory is often referenced to describe unintentional recall errors, the present review presents the term false memory as it is used in the original research; however, when drawing conclusions, the broader term of memory errors is used.

Errors of commission. The specific type of memory errors that is of concern to the present research is errors of commission. Errors of commission have been described in the literature as: (a) the intrusion of once relevant items (i.e., the recalling of an item that would, in any other situation, belong in that specific environment; or, (b) the intrusion of irrelevant items, the act of recalling an unrelated item that does not ordinarily 'fit' with the immediate environment (De Beni & Palladino, 2004). 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). For example, when a person recalls eating spaghetti for dinner last Wednesday when it was actually penne, the error does not have any serious consequences. On the other hand, there are situations when memory errors may have significant consequences, such as when a person is asked to provide police with details or evidence in order to assist in a criminal investigation. For the present study, memory errors were defined as the recollection of any single item (as opposed to a description) that was likely not *misremembered,* but instead was a commission error. In other words, recalling an item incorrectly (e.g., such as recalling a stuffed dog, when a stuffed teddy bear was in the picture) was not an error, but reporting an item that was clearly not present in the picture was considered to be an error (e.g., recalling an ATM machine in the bank when none were present).

The present study examined whether the nature (i.e., relevant or irrelevant errors) and quantity of memory errors varied by age and familiarity with the image environment. Multiple theoretical frameworks can be used to determine the circumstances that facilitate memory errors and whether the frequency of errors varies throughout development. The first framework used in the present study to understand and predict when memory errors occur is semantic knowledge structures: more specifically, schema theory.

Semantic Knowledge Structures: Schemas

Schema Theory. Schema theory is a semantic knowledge theory that has dominated cognitive understanding of memory over the past 60 years. In 1947, for example, Piaget used schema theory to propose that memory is not stored in precise detail, but rather is a process of encoding information to a pre-existing cognitive operating system or a schema (Brainerd & Reyna, 2005). Schema theory puts forth a model of information organization that influences how information is perceived, processed, and organized (Lepore, 1991). The theory emphasizes the importance of previous experience and prior knowledge in memory

(Smith & Cohen, 2008). Specifically, the theory suggests that memory is influenced by what we already know; the information we have is organized into a series of 'schemas,' or knowledge structures, that are based on general knowledge about the objects and related environments, situations, or events (Smith & Cohen, 2008). In simple terms, a schema is a hypothesized, cognitive construct proposing that the way information is processed and organized has the ability to influence how we perceive and understand the world around us.

Schema theory can be applied in a developmental context given that research has documented age-related trends in semantic knowledge structures. Early work by Bjorklund (1978), for example, found evidence that young children (5- year-olds) organize recalled information into categories. Work by Lucariello and Nelson (1985) was one of the first of many studies to reveal evidence that children (3- and 4-year-olds) use schemas to organize and recall their memories. Although young children are capable of organizing information based on semantic similarity, research has found that older children recalled more information using semantic groupings than younger children (Ceci & Howe, 1978). Similarly, Nelson, Fivush, Hudson and Lucariello (1983) found that there are age-related increases in the length and complexities of schemas, such that older children and adults have more complex, developed schemas than young children. Therefore, the developmental research suggests that younger children have less developed schemas than adults and, as a result, children may be less able to organize and recall memories using these schemas.

Schemas represent all kinds of knowledge, ranging from understanding the basic structure of a letter to more complex notions such as biology. Schemas that organize our information may be linked together into related groups or sets of information (Smith & Cohen, 2008). For example, when looking at a children's outdoor play structure, there may be a connection between schemas for 'slides' and schemas for 'swings.' However, schemas can also be used to provide our memories with basic information (Smith & Cohen, 2008), leading us to draw connections between two schemas for different objects and for different environments—even when no connections exist. Continuing with the previous example, when viewing a picture of a park, seeing a 'slide' may activate schemas for 'slides' but may also activate related schemas, such as 'monkey bars.' Therefore, even though monkey bars were not in the picture, it is possible they will be misremembered as present.

Schema theory suggests that new experiences are not simply 'copied' and transcribed into memory—rather, memory is the result of a process that constructs memories by integrating pre-existing information from a schema with new information. It is through this integration process that the theory proposes schemas are able to influence memory—particularly, by influencing what information is stored (i.e., what information is relevant) and the adjustment of information to 'fit' with individual interpretation of 'normal' (Alba & Hasher, 1983). This process of *normalization* has been described as the potential for schema organization to distort memories to 'fit' in with prior expectations in order to be consistent with existing schemas.

According to Schema Theory, previous expectations play an important role in how our memories are organized and how accurate those memories are. Previous expectations are analogous to the construct of *stereotypes*, given that stereotypes are semantic knowledge structures that provide the foundation of 'previous expectations' that can ultimately influence memory (Bartlett, 1932). In addition, the strength or ability of stereotypes to influence memory may be related to the level of previous exposure to, or familiarity with, the relevant targets. Therefore, by focusing on the relationship between stereotypes and familiarity, we can develop a better understanding of what factors influence recall memory for different environments.

Semantic Knowledge Structures: Organizing Memory using Stereotypes and Familiarity

Stereotypes

Stereotypes are a form of schema (Cordon, 2004) and can be understood as naïve understandings based on personal experiences that provide a framework to organize and structure new experiences, as well as provide us with expectancies on what should exist in a certain situation and how to interpret these situations (Leichtman & Ceci, 1995). For example, as a child, many people frequented fast-food restaurants such as McDonalds. As a result of repeated exposure to these similar environments, one develops a stereotypes or a series of expectations of what should happen in the restaurant (e.g., order at counter, pay for food, sit and eat) and what objects should be found in the restaurant (e.g., play structure, toy display, tables, and chairs). Now, as an adult, one can use this frame of reference to guide what you notice and remember seeing in new fast-food environments, and whether to judge what you see as normal (e.g., seeing a wine glass in a fast-food restaurant would likely not fit with what you expect).

Within the study of stereotypes, there are conflicting perspectives on the source of stereotypical thoughts. Some researchers identify stereotypes as a socially constructed organization, understanding, or beliefs attributed to a given situation or individual (e.g., Lippman, 1992). Other researchers recognize stereotypes as a cognitive-based information-processing tool (e.g., Pozzulo & Weeks, 2006). What is consistent throughout this research, however, are that stereotypes can have both negative and positive effects on a person's memory.

Stereotypes can be a redeeming cognitive process that compensates for our brain's limitations. In a world full of stimulation and information, the brain requires methods, or 'short cuts,' to make sense or understand the world around us (Peters, Jelicic, & Merckelbach, 2006). Pozzulo and Weeks (2006) describe how stereotypes are a method of information processing that allows us to organize and simplify our everyday experiences. Similarly, Fiedler, Walther, Armbruster, Fay, and Naumann (1996) discuss how stereotypes are a method of encoding information about our experiences into existing cognitive schemas. It is generally agreed upon in the literature that using schemas and stereotypes is an effective method of processing the vast amount of information in our everyday lives.

Though stereotypes can be a tool to perceive and comprehend the world around us, they can also lead to several problems in memory—particularly recall memory. One possible problem is that stereotypes can lead to overgeneralization and inappropriate conclusions regarding an experience (e.g., Allport & Postman, 1947; Cohen, 1981; Rothbart, Evans, & Fulero, 1979). In an eyewitness context, a potential problem is that an eyewitness can generalize about a perpetrator or a crime scene which, in turn, can lead to faulty investigations and wrongful convictions (see the case of *Juan Tirrell Curtis v. State of Florida*). Eyewitnesses may use stereotypes in order to recall the events that took place (Pozzulo & Weeks, 2006). For example, if a bystander to a bank robbery expected a weapon to be present, it could cause him/her to recall seeing a weapon despite it not actually being present. Research by Allport and Postman (1947) examined the role of racial stereotypes when recalling an image. The image contained a white and a black male, with the white male holding a razor and the black male not holding anything. After participants viewed the image, they were asked to report what they saw to another individual. This pattern continued until the last person received the report about what the image looked like. When the last person was asked to recall the image, it was often reported that the black male was holding the razor, when in fact it was the white male. Although racial stereotypes examined in this study may not directly compare with situational stereotypes, it nevertheless, provides an illustration of how stereotypes can influence what information we recall seeing.

More recently, a study by Spiker (1984) examined whether stereotypes about gender roles would influence children's (first- and third- graders) recall memory. Using pictures of a male or female actor engaging in either traditional or non-traditional activities, the researchers found that traditional photographs (e.g., a female vacuuming) were more accurately recalled than non-traditional. These studies demonstrate how stereotypes can influence what information we recall. Although these studies describe stereotypes as they related to people, the findings may be relevant to a context concerning recall memory for different environments.

Stereotypes and memory. A prominent topic in the literature is how stereotypes are able to influence memory. The influence of stereotypes on recall has been documented across the entire process of memory: encoding, framework, retrieval, and communication (Brewer & Treyens, 1981). Some research suggests that people 'filter out' information that is inconsistent with their stereotypes and report more information that is consistent with their stereotypes (Allport & Postman, 1947; Pozzulo & Weeks, 2006). For example, Brewer and Treyens (1981) examined whether stereotypes influenced recall memory for an office environment and found that expectations about the environment caused participants to recall seeing items that were not present (i.e., memory error). In addition, the study concluded that objects that were moderately schema-consistent were more frequently recalled (e.g., stapler), while objects that were highly schema-consistent (e.g., wall, floor) and low schema-consistent were not always recalled.

In a similar recognition study, Lampinen, Copeland, and Neuschatz (2001) manipulated an office environment by presenting items that were typical (i.e., stapler in an office) and atypical (i.e., toy car in an office). It was found that participants reported a significantly higher level (56%) of false reporting of schema-consistent (or typical) objects than of schema-inconsistent (atypical) objects (6%). Interestingly, this study found that providing participants with clear instructions about their upcoming task had no effect on the amount of false information recalled. This research on typical and atypical items in an environment (e.g., Brewer & Treyens, 1981) not only revealed the complexities of environment recall, but also reveal evidence for schema-induced errors—namely, that participants recalled seeing objects that, in another circumstance, would have likely been seen in an office environment (i.e., stereotype-consistent items).

The influence of stereotypes on recall memory has also been documented in the developmental literature. Memon, Holliday and Hill (2006), for example, examined whether presenting participants with information about a target prior to the study (i.e., pre-event stereotypes) would influence young children's (5- year- olds) memory of an adult male who visited their school. The results revealed that when presented with information that was correct or incorrect, children were more likely to accept incorrect information if the (mis)information was consistent with the children's pre-existing stereotypes about how one should behave in a school environment. For example, when children were presented with a story describing the visitor in a negative, clumsy manner, children were more likely to recall the visitor dropping his toy on the ground and getting it dirty, despite it never actually occurring. This study suggests that children may use their existing schemata or knowledge of familiar behaviour in a specific setting, such as a school, to recall information. In a similar study, Leichtman and Ceci (1995) presented children with a stereotype regarding a stranger's character (i.e., nice versus bad) who was going to be visiting them. It was found that the induced stereotypes affected young children's (3- to 4- year-olds) recall memory, leading them to accuse the stranger of doing something that never happened. Older children (5- to 6-year-olds) were less likely to report false behaviour. On the other hand, children in the control condition (i.e., no stereotype information) did not report any false accusations of the visitor. These studies show that young children's recall memory is highly vulnerable to being influenced by stereotypes.

There are numerous explanations of how stereotypes are able to influence memory and at what level of the memory process. One explanation of how stereotypes are able to influence memory is by schema activation speed. Research suggests that some schemas are more quickly activated in certain situations, thereby making these schemas more accessible during memory storage and retrieval (Brewer & Treyens, 1981). Another explanation is that when details of an event are insufficient to determine the origin of a memory, people rely on top-down processes of knowledge, such as stereotypes (Kleider, Goldinger, & Knuycky, 2008; Kleider, Pezdek, Goldinger, & Kirk, 2008). In addition, some researchers argue that stereotypes can influence memories because stereotypes may induce imagery during recall, inadvertently creating feelings of familiarity for details that were initially based on stereotypical expectations (Brainerd & Reyna, 2005; Kleider, Goldinger, & Knuycky, 2008).

Despite the varying explanations of how stereotypes influence memory, a commonality through all of them is that the length of exposure, or familiarity with the stimuli, plays a large role in how stereotypes influence memory.

Familiarity

In the majority of the developmental, eyewitness experiments, children are tasked with identifying or recalling the appearance of a previously unknown perpetrator (e.g., Davies et al., 1989; Pozzulo, Dempsey, & Crescini, 2009). In addition, there has been some recent work examining children's ability to identify and/or recall the appearance of a perpetrator who is familiar to them (e.g., Pozzulo et al., 2011). Although memory of familiar and unfamiliar faces provides crucial information during criminal investigations, there is another aspect of eyewitness memory that familiarity can influence: memory of a familiar type of crime environment and what was present in it. In 1999, Statistics Canada reported that more than 400,000 children witnessed the assault of a parent, usually their mother, in their home (Dauvergne & Johnson, 2001). These statistics reveal that children often witness crimes in a familiar environment. As a result, it is important to understand how the level of familiarity with a type of environment influences a witness' ability to recall accurate information about a crime. The present study sought to address the research gap by examining the relationship between age, environmental familiarity, and recall memory.

Familiarity and developmental recall memory

Familiarity has been defined as repeated exposure (Fuvish & Hudson, 1990). The level of exposure to a specific object or target has been shown to influence recall accuracy in pre-school and school aged children (e.g., Fivush & Mandler, 1985). Some research has found that increased familiarity or exposure to a target can have a positive effect on recall memory (e.g., Brimacombe, Jung, Garrioch, Allison, 2003; Rudy & Goodman, 1991). Schneider et al. (1993), for example, examined the effects of increased exposure to the game of chess on memory for children and adults. The study found that children with previous exposure to the game performed better (i.e., improved quantity and accuracy of information recalled) on a recall task when compared to adults who were categorized as chess novices (i.e., minimum prior exposure). Likewise, Ricci and Beal (1998) examined the link between recall accuracy and recognition accuracy when children (5-year-olds) were exposed to an event in both a familiar and an unfamiliar environment. The results suggest that young children did not perform better when identifying a perpetrator (i.e., recognition task), but performed with increased accuracy when recalling information about an event in a setting that was familiar to the child (e.g., birthday party), rather than an unfamiliar setting.

On the other hand, other research has found that repeated exposure to a target can have detrimental effects on recall memory and lead to memory errors (Brainerd & Reyna, 2010; Powell et al., 2006). This is because increased exposure can result in feelings of familiarity that, in turn, influence our beliefs regarding how similar an experienced target is to another, non-experienced target (i.e., leads to a high level of detail integration from other events; Moreland & Zajonc, 1980; Powell et al., 2006). When witnessing a crime in a familiar environment, for example, a witness may incorrectly recall a stereotypical item as present during the event (e.g., recalling Coke instead of Pepsi; Brainerd & Reyna, 2005). Recalling a non-present item that is commonly found in that type of environment is the most common error made by children when recalling details from a repeated experience (Powell et al., 2006; Powell & Thompson, 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 information; Powell et al., 2006; Wickelgren, 1965). The present study examined whether the memory errors made during recall differ in terms of relevancy to each environment (i.e., familiar or unfamiliar environments) and whether errors differ by age.

Understanding familiarity. There are theoretical and empirical frameworks that have been used to understand the phenomenon of familiarity and memory. Kalakoski and Saariluoma (2001), for example, propose that previous knowledge in an area (i.e., increased familiarity) allows for easier encoding into a task-specific, long-term memory system, and thereby increasing accessibility to the information during memory tasks. Other researchers suggest that familiarity may be a distinct cognitive process from recollection (Yonelinas, 2002; Hintzman, et al., 1998). To illustrate, Hintzman and colleagues (1998) used information from response-signal experiments to suggest that familiarity and recall are separate retrieval processes in the brain. Specifically, Hintzman and colleagues (1998) describe that memory is comprised of two separate processes in episodic memory—one based on familiarity that processes quickly, and another based on recall that processes comparatively more slowly. Moreover, Yonelinas (2002) holds that familiarity can be of use when learning new situations, but is not beneficial in situations where a witness must differentiate between similar targets. This could suggest that when identifying something new about a familiar environment, previous experiences (i.e., familiarity) can be beneficial to recall memory; however, when being asked to find distinctions between two similar environments, familiarity can be detrimental to recall memory. Thus, for the present study, it is possible that recall memory for a familiar environment with atypical items may be more accurate than recall memory for familiar environments containing stereotypical items.

Although these theoretical processes provide ways to understand the role that familiarity has on how information is observed and retrieved, familiarity theories center mainly at the level of encoding information but overlook how information is cognitively organized or retrieved. Therefore, in order to better understand how familiarity influences memory at all levels, information about how familiarity influences memory was used in combination with schema theory.

Schema and Familiarity

Schank and Abelson (1977) describe how schema organization is greatly influenced by familiarity and much of the stereotype research has been dedicated to understanding this relationship between schemas and familiarity. For example, repeated exposure (i.e., familiarity) and knowing what happens at a restaurant, influences how memories for an event in a restaurant are organized. When examining the literature, there have been three general findings with respect to how schemas are influenced by familiarity.

The first finding is that schema-driven processes (e.g., stereotypes) can enhance memory when recalling a familiar environment (Brown, 1976; Wickelgren, 1965). If an environment is familiar to us, the objects, the people, and the sounds we associate with them are learned through increased exposure with the environment and, as a result, we are likely to develop a detailed memory schema for that environment (Brainerd & Reyna, 2005). The items we are frequently exposed to in a specific environment become part of our schema, and thus, receive more attention and are more likely to be a part of that recalled memory. Research examining this has found that people are better able to recall information that is consistent with schemas (i.e., stereotypical items) than schema-inconsistent information (i.e., atypical items). For example von Wright, Gebhard, and Karttunen (1975) examined the influence of semantic relation of objects to environment (i.e., does it belong?) on recall memory of participants aged 5-, 8-, 12-, and 18-years. It was found that participants of all ages recalled more objects with increased accuracy when they were presented in a related or relevant context (e.g., clown presented in a circus environment) than when the objects were unrelated to the context. Similarly, research by Cohen (1981) suggests that people have a tendency to report more information about an experience that is consistent with stereotypes, rather than information that is inconsistent with stereotypes.

A similar trend is seen in the developmental literature. List (1986), for example, compared recall memory for information that was schema-consistent (e.g., a young woman stealing cosmetics) and schema-inconsistent (e.g., a young woman stealing a television), and found that participants of all ages (children and adults) performed with more accuracy when recalling information from the schema-consistent scenarios. More recently, Peters et al. (2006) found that stereotypes reduce cognitive strain on memory, and trying to suppress stereotypes can lead to increases in memory errors. Thus, some research suggests that stereotypes can improve both the quantity and accuracy of information recalled. However, this is not always the case.

The second finding is that schema-driven processes, such as stereotypes, can be counter-productive when recalling a familiar environment. In particular, relying on stereotypes can result in *content borrowing*, which is defined as when memories for an event contain details that are 'borrowed' from separate events (Bower, Black, & Turner, 1979; Lampinen et al., 2001; Memon, Holliday, & Hill, 2006). Some research has put forward the notion that stereotypes can alter memories in favour of schema-consistent details (errors of commission) over schema-inconsistent items (errors of omission; Lepore, 1991). In other words, people may sometimes erroneously incorporate typical items into their memory, despite the fact that it was not directly experienced. As previously described, the study conducted by Brewer and Treyens (1981) found that expectations about what an office environment should contain was related to a decrease in recall accuracy, such that some stereotypical, non-present items were reported to be present in the office. Similarly, Roediger and McDermott (1995) found that when recalling word lists, the schema-consistent grouping led to expectancies, thereby reducing recall accuracy. These studies show the influence that stereotypical schemas can have on memory recall-error, particularly errors of commission.

In contrast, the third finding diverges from the above. Some research suggests that when familiar environments contain items that are atypical (schema inconsistent or unusual items), these items may become the focus of attention and therefore, are more likely to be accurately recalled (Bower et al., 1979; McDaniel, Delosh, & Merrit, 2000). This phenomenon has been referred to as the *distinctness effect of memory* (i.e., the superior memory for isolated or unusual items; Geraci & Rejaram, 2004). A study by Lampinen and colleagues (2001), for example, examined the influence of schemas on memory for an office environment and found that participants were more accurate when remembering objects that were inconsistent (e.g., toy top in an office) than consistent with stereotypes. This research suggests that these atypical items may act as "tags" to the schema, increasing attention and focus on them; therefore, increasing the likelihood of recalling the item (e.g., a cat in a bank; Brainerd & Reyna, 2005; Pezdek, Whetstone, Reynolds, Askari, & Dougherty, 1989). Given that increased cognitive effort may be needed to process atypical information (i.e., inconsistent with stereotypes; Pozzulo & Weeks, 2006), some research suggests that, if a person has increased length of exposure to the stimuli, the presence of atypical information may increase the accuracy of recall compared to stimuli containing only stereotypical information (Rojahn & Pettigrew, 1992).

It is not clear whether increased familiarity with an environment will influence the recall of stereotypical versus atypical objects in that setting. The present study adds to the existing literature by providing more information to the ongoing debate about the role of semantics and recall memory.

Single Processing Theories: Findings and Limitations

While schema and familiarity theories can explain these complex relationships to a certain degree, limitations do exist. Schema theory proposes that when there is a lack of detailed information or 'voids,' existing schemas about an environment (or stereotypes) are used to fill the 'voids'. Using schemas or stereotypes to fill the 'voids' may increase the chances of recalling information that was not actually observed (Minsky, 1975). The problem with this interpretation of memory is that it assumes that stereotypes are used for memory retrieval only when there is an absence of specific, observed details. However, research shows that this is not always the case; stereotypes can influence memory recall even when correct information was observed (e.g., Lampinen et al., 2001). Another limitation of schema theory is that it predicts that if information is normal, typical, relevant, or consistent with stereotypes, it should be better remembered than information that is unexpected, irrelevant or inconsistent with stereotypes (Cohen & Conway, 2008). Some research has found evidence to support this theory (e.g., Brewer & Treyens, 1981). However, some found the opposite— atypical objects are recalled frequently and accurately (e.g., Brewer & Treyens, 1981; Lampinen et al., 2001).

A more significant limitation of semantic processing theories, such as schema theory, is that they do not adequately explain age-related changes in the interaction between familiarity, stereotypes, and memory. Schema-related theories assume a correlation between accurate and inaccurate memory across the age span, overlooking developmental variation in memory and recall errors (Brainerd & Reyna, 2005). More specifically, these theories assume that schemas are formulated on the basis of repeated, long-term exposure, suggesting that adults will be more apt to define experiences around schemas than children and, as a result, children are more likely to make errors in recollection (e.g., Nelson et al., 1983; Bjorklund & Muir, 1988). However, research has shown that this is not always the case (e.g., Odgard, Holliday, Brainerd, & Reyna, 2007). In order to understand these developmental variations in recall memory errors, the present study used a more inclusive theoretical framework, fuzzy trace theory (Brainerd & Reyna, 1998b), in conjunction with semantic knowledge theories (i.e., stereotypes and familiarity) to develop a more comprehensive understanding of the relationship between age, memory, familiarity, and stereotypes.

Dual-Process Theories of Memory: Trace Strength Theory

Dual-process model is a term used to describe a set of theories, all with slight variations, that explain memory as a function of trace strength (Yonelinas, 2002). A memory trace can be understood as the processing activities that occur when stimuli information is encoded (Qin, Quas, Redlich, & Goodman, 1997). At the basic level, dual-process theories propose that recall memory involves two forms of memory processing, one consisting of vague feelings of association to the memory, while the other consists of specific details regarding the memory (Brainerd & Reyna, 2005). Dual process models provide a basis in which hypotheses about the effect of semantic knowledge structures (e.g., stereotypes and familiarity) can be applied to memory performance. However, not all dual-process theories of memory are able to map onto the development of memory over time. In order to apply semantic processing theories to a developmental context, a specific, dual-processing theory was used: fuzzy trace theory.

Fuzzy Trace Theory

Fuzzy trace theory (FTT) is an 'expanded' dual-process theory of cognitive semantics, put forth by Reyna and Brainerd (1995; 2002). More specifically, FTT is opponent-processing theory of "two minds" in that it proposes the existence of two levels of information processing involved in memory. FTT proposes that these two processes work in parallel and rarely, if ever, integrate throughout the entire process of encoding, storing, and retrieving memory (Brainerd & Reyna, 2005). What makes FTT different from other dual-processing theories of memory is that FTT proposes that each of these two processes uniquely influence memory by working in opposition to each other (Brainerd & Reyna, 1998; Reyna & Brainerd, 1995). The first level is the processing of the surface information, termed *verbatim* traces (i.e., 'true' part of memory; episodic memory or 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).

Fuzzy Trace Theory and Memory Errors

FTT is based on five principles to explain memory and recollection. Of those five principles, two are essential in understanding the relationship between age, semantic knowledge structures, and memory errors. The first important principle that FTT proposes is that memory errors/inconsistencies are the result of the 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, thus, represent two different processes, each with the ability to influence the retrieval of the information. It is at the level of encoding and retrieval of information where these two traces have the capability to either increase or decrease accuracy of recalling information. More specifically, gist traces are based on semantic representations of meaning and they represent individual interpretation of the information. As a result, they are hypothesized to support memory errors because relying on gist traces reduces detailed information and may create a sense of familiarity with a target and, therefore, may result in more 'filling in' (Brainerd et al., 2008; Reyna & Kiernan, 1994). In other words, if inaccurate information shares similar features with other information, it can result in a sense of familiarity and the ultimate acceptance of the inaccurate information as accurate. 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).

The other relevant principle of FTT is one that proposes developmental variability in both the use and strength of these two processes (Brainerd & Reyna, 2005). Although preceding theories suggested the number of memory errors made when recalling information decreases from childhood into adulthood (Brainerd & Reyna, 2005), FTT presents an alternative developmental pattern for schema-related memory. Specifically, FTT postulates that there are changes to both the storage and retrieval of verbatim and gist traces throughout the life span, therefore, memory errors also are proposed to change across the life span. FTT proposes that gist memory improves with age and, as a result, it is likely that the susceptibility to memory errors maps onto this trend and therefore increases with age (Brainerd & Reyna, 2005). This developmental component of FTT makes it a superior theoretical framework to apply to semantic knowledge structures in order to understand the development of recall memory.

Connecting Theories: Fuzzy Trace and Semantic Knowledge Structure

FTT provides a good framework in which to understand the effects of familiarity and stereotypes on memory across the lifespan, and to predict which situations will likely result in increased memory errors. Semantic knowledge structures, such as stereotypes and familiarity, fit well within the framework of FTT, particularly in relation to the gist traces. This is because gist traces represent the processing of semantic or meaning-based information (Brainerd & Reyna, 2005). According to FTT, gist traces may support memory errors by increasing the accessibility of semantic knowledge structures, such as stereotypes, which are further propagated by feelings of familiarity with a target (Brainerd & Reyna, 2010; Reyna, 1992; 1995). This phenomenon is commonly referred to as *episodic over-distribution,* or when a related distracter, due to its subjective feeling of familiarity, is attributed indiscriminately across possible contexts (Brainerd & Reyna, 2008). In other words, a person may mistakenly recall a stereotypical object in a familiar environment, regardless of whether or not it was present. As a result, familiarity plays a large role in the application of semantic knowledge structures (i.e., stereotypes) to the FTT. Although FTT does not propose a specific relationship between semantics and memory errors, this relationship has been examined in the literature using different methods.

Semantics and errors. The relationship between semantic theories and FTT has been examined in the literature using different methodologies. Early research by Wickelgren

(1965), for example, used word lists to investigate the frequency of memory errors in short-term word recall. Another method to examine the relationship between semantic theories and FTT is connect-meaning studies. Connect-meaning studies are described by Brainerd and colleagues (2008) as studies examining procedures that enhance the strength of gist traces in relation to verbatim traces during memory tasks. This is done by creating semantic relations—or developing an understanding or meaning—between objects and events, thereby increasing the likelihood of memory errors (Brainerd et al., 2008). Connect-meaning research has frequently found that semantics have a negative effect on memory for adults. Brainerd and Reyna (1998a), for example, describe how an increase in surface similarity (semantic relationship) between two items makes it more difficult to discriminate present from non-present items, leading to errors of commission. Research has found that pre-existing beliefs influence commission errors (e.g., Fiedler et al., 1996). For example, Payne, Elie, Blackwell, and Neuschatz (1996; Experiment 3), examined the effects of pre-existing bias on memory and found that commission errors increased when participants were asked to recall a list of related words (semantic-related) than when asked to recall a list of unrelated words.

Another, and the most common, (Pezdek & Lam, 2007) method of research that has been used to examine errors of commission across different ages is the Deese-Roediger-McDermott (DRM) paradigm. In short, the DRM paradigm was developed using recall and recognition tasks involving familiar words that either shared meaning (e.g., bed, rest, awake, tired, dream) or did not share meaning (e.g., bed, banana, shower). Unlike past research that has found that errors decrease with age (Bruck & Ceci, 1999; Ceci & Bruck, 1995), most DRM research (with the exception of a few, such as Ghetti, Qin, & Goodman, 2002) has found that memory errors increase with age (e.g., Odgard, Holliday, Brainerd, & Reyna, 2007). An example of DRM research is a study conducted by Toglia, Neuschatz, and Goodwin (1999) that examined the effects of semantic grouping and the length of word-lists. It was found that increased semantic processing (i.e., items that are theme consistent) led to an increase in commission errors, suggesting that commission errors may arise from cognitive memory tasks related to semantic processing. However, these findings suggest no clear answers on the relationship between age and memory errors (Brainerd & Reyna, 2008).

Errors and Age

FTT proposes that age variations in recall errors are the result of the developmental improvement seen in both types of memory traces — the gist memories that support errors and the verbatim memories that suppresses errors (Brainerd & Reyna, 2005). Using this framework, the occurrence of memory errors made by a child witness depends on his/her ability to store, retrieve, and preserve both the gist traces and the verbatim traces.

Evidence has been gathering in the literature to support FTT's prediction that children may be less susceptible to errors of commission due to an underdeveloped gist trace memory (e.g., Brainerd, Forrest, Karibian, & Reyna, 2006; Brainerd et al., 2008; Bruck & Ceci, 1995; Holliday et al., 2007; Howe, 1990; Mitchell, Johnson, & Mather, 2003). Different types of research, including connect-meaning studies, have found that the ability to process and attribute meaning to a stimulus improves with age (Brainerd & Reyna, 2005; Cordon, 2000). Research by Bjorklund and Muir (1988; as cited in Brainerd & Reyna, 2005), for instance, found that the use of verbatim and gist memories increased from young childhood to early adulthood, but improve independently from each other. Similarly, Ceci, Papierno and Kulkofsky (2007) presented a set of three objects to young (4-year-olds) and older children

(9-year-olds) participants and found that errors increased with age when a semantic relationship was found between items, but decreased when there was a phonological relationship between items. In addition, Connolly and Price (2006) examined the influence of suggestions (i.e., biases) on free recall with 4- and 5-year-old children and found that the stronger the semantic relation (shared meaning) between the accurate information and inaccurate information, the higher the memory intrusion rate during recall tasks.

Additionally, DRM research by Dewhurst and Robinson (2004) examined the influence of exposure and semantic relation on the amount of information recalled by children in three age groups: 5-, 8-, and 11-year-olds. It was found that, for young children (5-year-olds), errors were more likely to be words that were phonologically related (i.e., rhymed), while for older children (11-year-olds) errors were more likely to be words that had shared meaning. Furthermore, research has found evidence of an age-related increase in errors of commission, such that older adults made more commission errors than younger adults (Brainerd et al., 2006; De Beni & Palladino, 2004). Brainerd and colleagues (2006) examined age-related differences using the DRM paradigm and found that children recalled fewer memory errors because children were less likely to create semantic relationships between the target words than adults. Interestingly, the type of commission errors made (relevant or irrelevant errors) did not differ by age category (Brainerd et al., 2006). Overall, this research provides support for the existence of age-related development in semantic processing (gist traces according to FTT) and an increase in memory errors.

In general, the existing research suggests that children may depend more on the memory process that records what actually happens (verbatim traces), compared to the part that records the meaning of what happened (gist traces; Brainerd & Reyna, 2007). Children may not be able to 'connect meaning' between two targets (using gist traces) when encoding and recalling memories until early adolescence; thus, they may be less susceptible to false memories (Brainerd & Reyna, 2007). Therefore, it appears that the number of memory errors reported is directly related to age, such that as one ages, more memory errors should be reported. Although this research provides an excellent foundation for understanding when and why memory errors may occur, the findings have limited use in understanding how recalling information for an environment may influence errors. For that reason, the present study examined whether developmental variability exists in the nature and quantity of memory errors when recalling information about different environments.

Overview of the Present Study

The present research investigated the recall abilities of children (4- to 7- year-olds) and adults when presented with various environment stimuli that were related to different levels of semantic processing (i.e., more or less familiar types of environments; containing stereotypical or atypical objects). Using theories related to semantic knowledge structures (i.e., familiarity and stereotypes) and FTT, hypotheses regarding memory performance were developed.

Hypotheses

Quantity of Information Recalled

1. 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.
2. 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.

3. Given that some previous research has found that the presence of stereotypical items increased recall performance (e.g., Brewer & Treyens, 1981) it was hypothesized that, for both age groups, more information will be reported when recalling a stereotypical environment than an atypical environment.

Accuracy of Information Recalled

4. 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).
5. Stereotypical environments were hypothesized to result in a higher proportion of accurate recall for both age groups, given that stereotypes have been shown to activate schemas about environments (e.g., Brewer & Treyens, 1981).

Memory Errors

6. Given the extensive support for a developmental increase in verbatim and gist processing (e.g., Brainerd & Reyna, 1998a; Brainerd & Reyna, 2007; Holliday et al., 2007), it was hypothesized that adults would make more memory errors than children, overall.
7. Given that increased semantic processing appears to be related to an increase in memory errors (e.g., Brainerd & Reyna, 2005; Roediger & McDermott, 1995), it was hypothesized that more memory errors would be made in more familiar environments than less familiar environments, relative to each age group.

8. It was hypothesized that more memory errors would be reported when recalling a stereotypical environment than an atypical environment.

Relevant and Irrelevant Errors

9. Given the extensive support for a developmental increase in verbatim and gist processing (e.g., Brainerd & Reyna, 1998a), it was hypothesized that more relevant errors would be made in more familiar environments than less familiar environments, relative to each age group; however, children's overall reporting of relevant errors would be higher than adults' when recalling a less familiar environment.

Method

Participants

Participants included children ($N = 106$) ranging in age from 4 to 7 years ($M = 5.37$, $SD = .71$; males = 57; females = 49; See Appendix J for breakdown of ages) who were recruited from pre-kindergarten/ kindergarten classes in schools in Eastern Ontario. Participants also included undergraduates ($N = 90$) ranging in age from 18 to 63 ($M = 21.48$, $SD = 6.33$; males = 36; females = 54) recruited from the Department of Psychology's electronic participation system, SONA. An apriori power calculation assuming a moderate effect size (.70; Faul et al., 2009) revealed that an n of approximately 35 would be needed to obtain statistical power (critical $F = 1.37$).

Stimulus Materials

Situation Images: All participants in the pilot study were shown a series of six images that depicted three environments typically associated (familiar) with adults (i.e., restaurant, library, and bank) and three environments typically associated (familiar) with children (i.e., park play structure, pet store, and toy store). After testing the images, these six images were reduced to four images (i.e., child-familiar: park and toy store; adult-familiar: bank and formal restaurant). The four images were selected based on reported number of visits to each environment in the pilot study. For the main study, all participants were shown these four images on a computer screen for the duration of seven seconds per image[1]. From these four images, two final images were selected based on three proxy measures of familiarity: frequency of visits, relevancy of environments, and identification accuracy of the images (see Familiarity of Images section). Each image contained no people, identifiable logos, or controversial items. All atypical items added into the images were selected using independent agreement of which items would be 'low expectancy items' for that place depicted in the image (i.e., items low in schema-consistency) and to correspond with atypical items used in previous research (e.g., Brewer & Treyens, 1981; Nemeth & Belli, 2006). In addition, given that it was not possible or ethical to include images that represented a negative context, all images used in the study denoted a positive environment that was not likely to elicit negative connotations for participants.

Research Protocol

A structured research protocol was created that outlined data collection instructions. See Appendix A for instructions for researchers and participants.

Description forms

Free recall. After viewing each photograph, participants were asked to recall what they remembered about the image orally and their responses were recorded in writing by the experimenter. Adult participants recorded their own answers (see Appendix B). In addition,

[1] The time length of 7 seconds was chosen based on exposure time in previous research (e.g., Belli et al., 1992; 1994).

for the study, all participants were asked three questions regarding each specific environment to determine if they could identify each environment shown.

Demographics/Familiarity Assessment Questionnaire. Before the start of any research, each participant was provided with an informed consent form (Appendix C/D) that outlined the purpose and details of the study. In addition, participants were also provided the Demographics/ Familiarity Assessment Questionnaire (Appendix E/F) that was used to identify a baseline level of familiarity that each participant had with each environment (i.e., how familiar the participant is with a bank/restaurant/play structure/toy store). Included in the second form were questions pertaining to how much time per month the participant spent in each environment, how relevant each type of environment was, as well as questions pertaining to basic demographic information of the participant (i.e., age, gender, primary language).

Procedure

Child. Parents of the children at the various schools participating were provided with the consent form and a copy of the *Demographics/Familiarity Assessment Questionnaire*. Parents were asked to return the consent form and questionnaires to the teacher. Only children with consent were invited to participate in the study. Upon entering the classroom, the researchers introduced themselves as visitors from Carleton University doing a project on remembering. Children with consent were invited to help/participate and were informed that they could change their minds at any time and not get into trouble. The researchers monitored the children for fatigue, anxiety, and stress and were prepared to stop the study if a child demonstrated any signs of distress or if the child indicated that he/she did not want to continue.

In order to create a level of comfort with the children, the researchers worked with the children as a group on crafts. If the children informed the researchers that they needed a break (i.e., washroom; Kleenex), the researchers brought the child back to the teacher to ensure that regular procedures were maintained. For the children who received parental consent to participate but indicated that they did not want to play, the researcher would ask the child, "Okay, can I ask you again a little bit later/another day?" If they responded with 'yes,' returning to the school was arranged with the teacher. If they answered 'no,' the child was not asked further.

Following the group craft, two or three female experimenters began testing the children with consent individually. While monitoring the children for fatigue, anxiety, and stress, each child was told that he/she would be looking at some pictures of different places they may have visited. The child was told to pay attention because, after looking at the picture, they would be asked some questions. Next, the experimenter showed the child the first image on a computer monitor for seven seconds. Following the seven-second viewing time, the experimenter asked each child one free recall question about what they remembered about the picture (for a description see Appendix B). Following a response, the experimenter asked a, non-specific, probing questions, such as, "Do you remember anything else about the picture?" If the child offered no response to the initial question, the experimenter repeated the probing question one last time. After recording (in writing) the information provided by the child, the procedure was repeated for the additional three images. Once each child completed the individual part of the study, he/she was invited to return to the group craft activity. The facilitator was responsible for entertaining the children waiting for testing. The children were provided with crafts, Play-Doh, and puzzles for entertainment for the duration of the study.

Following the end of the study, as a group, the children were debriefed (Appendix H) by reading a story explaining why a child is able to remember some things better when they see them more often (Appendix N). Following the story time, the children were thanked and given a small token (e.g., crayons and colouring book). In addition, the researchers answered any questions that the children may have had. While not many questions were asked, some reoccurring questions pertained to why they can remember some people but not others.

Adult. Upon entering the laboratory, each participant was provided a consent form that explained that they would be participating in a study about memory (Appendix D). Next, the experimenter showed the participant the first image on a computer monitor for seven seconds and then the participants were provided with the free recall questionnaire and were asked to write down as much detail as they could remember about the photograph (Appendix B). Once this was complete, this process was repeated until all four images were viewed and the subsequent questionnaires answered. Upon completion, each participant was provided with the Demographics/Familiarity Assessment questionnaire to determine his/her familiarity and level of contact with the generic locations depicted in the images (Appendix F). Next, the participants were debriefed (Appendix G) and thanked for their participation.

Results

Scoring of the Item Descriptors

All the information collected was scored based on quantity, accuracy, and errors. A coding scheme was used to allow each descriptor to be categorized in a consistent way with similar, past research (e.g., Pozzulo & Warren, 2003). A coding manual was created to identify correct descriptors (see Appendix P). When designing the coding manual, an acceptable range of accuracy was determined, taking into account various descriptors for any single item (e.g., crimson vs. red as a colour descriptor for a single item). In cases where two or more adjectives were used as a descriptor (e.g., dark, wooden frame) each adjective was scored separately. Any descriptor that exceeded the acceptable range was coded as incorrect. The coding manual was updated as new descriptors were reported that were not initially considered. The recalled information that was recorded (in writing) was transferred and scored on the following variables:

1. Number of descriptors reported
2. Number and proportion of correct descriptors
3. Number of memory errors (i.e., errors of commission). Memory errors were defined as the recollection of any single item (as opposed to a description) that was likely not a *misremembered item (*i.e., recalling an item incorrectly, such as recalling a stuffed dog, when a stuffed teddy bear was in the picture*)*, but instead was likely a "commission error" in recall (i.e., an item that was clearly not present in the picture, such as recalling an ATM machine in the bank, when none were present). Inter-rater agreement for the identification of memory errors was examined at the same time as the other scoring categories.
4. Error relevance. In order to understand the nature of the memory errors made by each age group, each memory error was coded as relevant or irrelevant in relation to the environment from which it was recalled. Errors were scored as relevant or irrelevant based on inter-rater agreement that was established using a panel of seven independent

raters (see Appendices K and L). The most common score (relevant or irrelevant) was accepted as correct.

Statistical Analysis

All data were analyzed using SPSS (IBM, 2011). For each participant, each free recall response was scored and entered into the software.

Pilot

A pilot study was conducted with 14 children ranging in age from 4 to 6 years (M_{age} = 5.29 years, *SD* = .90) and 12 adults ranging in age from 19 to 48 years (M_{age} = 24.33, *SD* = 8.53). The pilot study was conducted to determine: (a) how well both age groups understood the procedure; (b) establish inter-rater reliability using the coding manual; and, (c) determine which four of the six environments were more frequently visited by each age group (i.e., establish familiarity).

Procedure Comprehension

All child and adult participants were able to understand the procedure and materials without any difficulty. Therefore, no changes to the language of the questions were required.

Rater reliability

To establish inter-rater reliability on numerical scores, intra-class correlation coefficients (ICC) were used to demonstrate the degree of consistency among rater's measurements of each scoring category. Previous research with similar sample sizes commonly reports establishing inter-rater agreement using a randomly selected subsample that ranges from 7% (10 out of 136; Kiewara & Frank, 1986) to 10% of the sample (Kiesler & Hinds, 2004; Kiewara & Frank, 1986). Therefore, a similar proportion was used for the present study. Prior to attempting agreement, each rater collaborated and worked using the coding manual to agree upon coding criteria. Next, participants' answers were coded/scored independently. Of the 26 participant descriptions, all were initially scored and then the independent rater randomly scored 14 of these descriptions using the coding manual. Discrepancies between raters were discussed and a decision was reached on how to code the items. This process continued until inter-rater reliability was established and the ICC values (Cronbach's Alpha) for each participant's scores were high (i.e., have low variation between raters) and fell within the acceptable range of 0.8 to 1 (Pozzulo & Warren, 2003). The correlations ranged from 0.97 to 1.00. See Appendix I for the correlations for the pilot study (given as ICC's together with their 95 per cent confidence limits).

Familiarity of Images

The pilot study examined six images (i.e., bank, restaurant, library, toy store, pet store, and park) in order to determine which four of the six environments were more frequently visited by each age group. Using a self-report (or parental report) scale (see Appendix E), it was reported that more children visited parks and toy stores more frequently than adults, while more adults reported visiting banks and restaurants more frequently than children. See Table 1 for means and standard deviations by Age and Picture for the pilot study.

Table 1

Frequency (sample size) and total % of reported visits to each target environment: Pilot.

	Bank	**Restaurant**	**Park**	**Toy Store**	**Pet Store**	**Library**
Child (n=14)						
0	.71 (10)	.00 (0)	.01 (1)	.14 (2)	.57 (8)	.64 (9)
1-2	.14 (2)	.64 (9)	.16 (16)	.79 (11)	.43 (6)	.29 (4)
3-5	.07 (1)	.21 (3)	.10 (10)	.00 (0)	.00 (0)	.07 (1)
6-10	.07 (1)	.07 (1)	.21 (22)	.00 (0)	.00 (0)	.00 (0)
10-15	.00 (0)	.00 (0)	.13 (13)	.00 (0)	.00 (0)	.00 (0)
15+	.00 (0)	.00 (0)	.41 (42)	.00 (0)	.00 (0)	.00 (0)
Total Percent Visit	28	100	99	85	43	36
Adult (n=12)						
0	.08 (1)	.00 (0)	.67 (8)	.58 (7)	.42 (5)	.33 (4)
1-2	.42 (5)	.17 (2)	.25 (3)	.33 (4)	.25 (3)	.42 (5)
3-5	.33 (4)	.42 (5)	.00 (0)	.00 (0)	.17 (2)	.08 (1)
6-10	.17 (2)	.33 (4)	.00 (0)	.08 (1)	.17 (2)	.08 (1)
10-15	.00 (0)	.08 (1)	.00 (0)	.00 (0)	.00 (0)	.08 (1)
15+	.00 (0)	.00 (0)	.08 (1)	.00 (0)	.00 (0)	.00 (0)
Total Percent Visit	92	100	50	42	58	67

Grouped responses (e.g., 1-2; 3-5) were coded as a likert-type scale from 1-6, with 1 representing the lowest frequency response selection and 6 representing the highest. A repeated measures ANOVA was conducted to determine if frequency of visits varied by each age group. When examining children, the frequency of visits to the environments significantly differed from each other, F (3, 306) = 192.78, $p < .001$. Post hoc analyses revealed that children visited a park (M = 4.69, SD = 1.25) significantly more than banks, F (1, 13) = 84.11, $p < .001$, pet stores (M = 1.38, SD = .51), F (1, 13) = 130.98, $p < .001$, restaurants (M = 2.46, SD = .66), F (1, 13) = 75.81, $p < .001$, toy store, F (1, 13) = 86.35, $p < .001$, and libraries (M = 1.46, SD = .66), F (1, 13) = 48.61, $p < .001$. When examining adults, the frequency of visits to the environments significantly differed from each other, F (5, 7) = 10.52, p =.004. Post hoc analyses revealed that adults visited banks (M = 2.58, SD = .90) significantly more than libraries (M = 2.17, SD = 1.27), F (1, 11) = 5.21, p = .04, toy stores (M = 1.58, SD = .90), F (1, 11) = 33.00, $p < .001$, and parks (M = 2.50, SD = 3.03), F (1, 11) = 4.84, p = .05. No other combinations were significantly different. As a result of the reported frequencies and statistical results, the park and toy store environments were selected as the 'child familiar/relevant' materials, while the bank and restaurant environments were selected as 'adult familiar/relevant'. These images will be further reduced to one 'child familiar' image and one 'adult familiar' image using the study participants.

Young Children's Identification of Items in Materials

A separate pilot was done with 12 children (M = 74 months; 6.20 years) to examine how well children were able to identify all the items added to the atypical conditions (four items per picture; 16 items in total). 100% of children were able to accurately identify each of the added items. Thus, the study commenced as planned using the tested materials.

Main Study

Familiarity of Images

Three measures were used to assess familiarity of the images. A self-reported (or parental report) measure of: (a) how often each participant visits each type of environments; and, (b) how relevant each environment is to the participant's daily life. When measuring familiarity of an environment, amount of time exposed to that type of environment has been used in the literature as an indicator of familiarity (e.g., Lehnung et al., 2003). In addition, in order to overcome these possible limitations with self-report indices of familiarity (e.g., inaccurate responding), a "free elicitation" measure (Kanwar, Olson & Sims, 1981) of identification accuracy was assessed for each environment (i.e., what was that place in the picture?). Accuracy was determined by scoring three questions using inter-rater agreement. See the coding manual (Appendix P) for responses coded as correct.

1) **Frequency.** A self-report (or parental report) measure of how frequently the participant visited each type of environment (e.g., how many times per month do you visit a bank?) was examined. Children more frequently visited parks and toy stores than adults, while more adults reported visiting banks and restaurants more frequently than children (See Table 2). Grouped responses (e.g., 1-2; 3-5) were coded on a likert-type scale from 1-6 (1 = lowest frequency response; 6= the highest). A series of t-tests were used, with a Bonferroni corrected alpha of $p = .013$, to compare responses for each age group. For children, it was reported that parks were visited more frequently ($M = 4.48$, $SD = 1.51$) than toy stores ($M = 2.07$, $SD = .70$), $t\,(103) = 14.79$, $p < .001$. For adults, a bank was not visited more than a restaurant, $t\,(89) = 1.07$, $p = .29$; however, it was reported that banks were visited more frequently by adults ($M = 2.60$, $SD = .82$) than children ($M = 1.56$, $SD = 0.96$), $t\,(191) = 8.03$, $p < .001$. On the other hand, parks were visited more frequently by children than by adults ($M = 1.69$, $SD = .99$), $t\,(191) = 14.94$, $p < .001$.

Table 2

Frequency (sample size) and total % of reported visits to each target environment.

	Bank	**Restaurant**	**Park**	**Toy Store**
Child (n=103)				
0	.50 (52)	.20 (21)	.01 (1)	.18 (19)
1-2	.41 (42)	.59 (61)	.16 (16)	.62 (62)
3-5	.07 (7)	.20 (21)	.10 (10)	.18 (19)
6-10	.02 (2)	.01 (1)	.21 (22)	.03 (3)
10-15	.00 (0)	.00 (0)	.13 (13)	.00 (0)
15+	.00 (0)	.00 (0)	.41 (42)	.00 (0)
Total Percent Visit	50	80	99	82
Adult (n=88)				
0	.03 (3)	.10 (9)	.55 (48)	.66 (58)
1-2	.48 (42)	.53 (47)	.30 (26)	.27 (24)
3-5	.38 (33)	.22 (19)	.10 (9)	.07 (6)
6-10	.08 (7)	.07 (6)	.03 (3)	.00 (0)
10-15	.03 (3)	.03 (3)	.01 (1)	.00 (0)
15+	.00 (0)	.03 (3)	.01 (1)	.00 (0)
Total Percent Visit	97	90	45	34

2) **Relevancy.** A self-report (parental report) of how relevant (i.e., important) each type of environment was to the participant's daily life was examined using a series of t-tests and a Bonferroni corrected significance of $p = .013$. Participants indicated an appropriate choice that was scored on a scale of 1-10. When looking at child participants, it was reported that a park was significantly more relevant ($M = 7.86$, $SD = 2.21$) than toy stores ($M = 3.93$, $SD = 2.43$), $t\,(104) = 16.58$, $p < .001$. When looking at only adult participants, a bank ($M = 6.57$, $SD = 2.71$) was significantly more relevant than a restaurant ($M = 4.67$, $SD = 2.60$), $t\,(89) = 5.90$, $p < .001$. It was reported that a bank was significantly more relevant to adults than to children ($M = 1.56$, $SD = .96$), t (192) = 17.62, $p < .001$. On the other hand, parks were significantly more relevant to children than to adults ($M = 3.18$, $SD = 2.46$), $t\,(192) = 13.96$, $p < .001$.

3) **ID accuracy.** The participants' identification (ID) accuracy of each environment image were scored as correct or incorrect and examined using a series of Chi-square analyses. For children ($N = 105$), there were no significant differences in the ID accuracy between the bank and restaurant condition, $\chi^2\,(1) = 2.44$, $p = .12$, or between the park and toy store images, $\chi^2\,(1) = 0.12$, $p = .75$. Similarly, for adults ($N = 90$), there were no significant differences between the bank and restaurant, given that all adults correctly identified the restaurant. In addition, there were no significant differences between the park and toy store images, $\chi^2\,(1) = .20$, $p = .659$. However, adults were able to correctly identify the bank (adult: 82/90; child: 9/106), $\chi^2\,(1) = 104.38$, $p < .001$, and the restaurant (adult: 86/90; child: 95/105), $\chi^2\,(1) = 9.04$, $p < .01$, more often than children. There were no age-related differences in the ID accuracy of the park (adult: 86/90; child: 105/106, χ^2

(1) = 2.40, p = .12) and toy store images (adult: 90/90; child: 95/106, χ^2 (1) = 1.83, p = .18).

Selection of Image

In order to accurately compare recall performance of children and adults using environment types that are more familiar and less familiar to each age group, the four images were further reduced to the two images that differed most by each age group on the three familiarity measures (i.e., frequency, relevancy, and identification accuracy). Specifically, parks were visited significantly more often and were significantly more relevant to children than adults, while the bank was visited significantly more often, more relevant, and identified more often by adults than children. Therefore, the two images selected were the bank environment to represent the *adult familiar environment* and the park to represent the *child familiar environment.*

Rater reliability

Inter-rater agreement was established using the same process previously described in the pilot study. One rater scored 40 participant descriptions and an independent rater randomly selected and scored 24 of the 40 on the variables previously indicated using the coding manual. Discrepancies between raters were discussed and a decision was reached on how to code the images. High inter-rater reliability was established and the ICC values (Cronbach's Alpha) ranged from 0.99 to 1.00. Table 3 shows the correlations (given as ICC's together with their 95 per cent confidence limits).

Table 3

Intraclass correlation coefficient (ICC) for inter-rater reliability of all scored variables.

		ICC (Absolute Agreement)	95% CL
Park			
	Number of Descriptors Recalled	0.99	0.96-0.99
	Number of Correct Descriptors	0.99	0.93-0.99
	Number of Memory Errors	1.00	n/a
Bank			
	Number of Descriptors Recalled	0.99	0.99-1.00
	Number of Correct Descriptors	0.99	0.99-1.00
	Number of Memory Errors	1.00	n/a
Overall		$M = 0.99$	

Note. CL = Confidence Limits.

Design

The study design is a mixed repeated measures design with Age as the between participant measure (young child vs. adult), Picture as the repeated measure (child-familiar/park vs. adult-familiar/bank) with Condition nested within picture (stereotypical vs. atypical). Thus, the design is not fully-crossed as participants saw either a stereotypical park or an atypical park but not both (bank follows this pattern). The nesting of Condition within

Picture resulted in participants seeing either two atypical, two stereotypical or one atypical and one stereotypical images. Data were examined for age and gender effects. Given the non-significant age and gender effects (see Appendix J) males and females were combined and the 4- to 7-year-old children were categorized as a single group.

Three dependent variables (DV) were analyzed and results are presented separately for each DV. The three DVs are number of descriptors recalled, proportion accuracy recalled, and errors of commission. Given that the study's design was not fully crossed (i.e., participants did not see all images), where needed, data are collapsed across either Picture or Condition depending on analysis. In addition, although the images were presented randomly, order effects were tested to ensure that differences in responding are not attributed to the presentation method. Therefore, each DV included a series of three mixed, repeated-measures ANOVAs that tested for: (a) order effects; (b) main effect of Age, main effect of Picture, and an interaction between the two; and, (c) main effect of Condition and an Age x Condition interaction. If significant interactions were found, simple effects analysis were conducted (using Fisher's protected LSD tests) to examine the effect of one IV at individual levels of another IV. In addition, an additional DV, error relevance, was analyzed using MANOVAs.

Data Accuracy and Descriptive Statistics

Statistical assumptions were tested and the independence, normality and homogeneity assumptions were met. Participants included adults (N = 90) ranging in age from 18 to 63 (M_{age}= 21.48, SD = 6.33; males = 36; females = 54) as well as children (N = 106) ranging in age from 4 to 7 (M_{age} = 5.37, SD = .71; males = 57; females = 49). Means and standard deviations on key dependent variables are presented in Tables 4 through 6. Table 4 presents the means and standard deviations of all DV's for each level of IV. Table 5 presents the means and standard deviations of all DV's as a function of Age and Condition (i.e., stereotypical or atypical). Table 6 presents the means and standard deviations of the number of relevant and irrelevant errors recalled as a function of Age and Picture (Child-familiar/park; Adult-familiar/bank).

Order Effects

Order effects were tested at two levels. First, a series of three repeated-measures ANOVAs tested whether significant differences were found for each DV due to the order in which the images were presented (i.e., whether the participant saw the Adult-familiar/bank or Child-familiar/park first). No significant Picture order effect was found for the number of descriptors recalled, $F\,(1, 188) = 2.74, p = .52$, for the proportion of correct descriptors, $F\,(1, 185) = .09, p = .76$, or for the number of errors reported, $F\,(1, 188) = .26, p = .61, \eta^2_p = .00$. Second, a series of three repeated-measures ANOVAs tested whether differences were found for each DV due to Condition order (i.e., whether the participant saw the stereotypical or atypical image first). No significant Condition order effect was found for the number of descriptors recalled, $F\,(1, 105) = .001, p = .97$, for the proportion of correct descriptors, $F\,(1, 102) = .06, p = .82$, or for the number of errors reported, $F\,(1, 105) = .43, p = .51$.

Quantity of Information Recalled

Age and Picture. It was predicted that adults would recall quantitatively more information than children across all conditions (i.e., hypothesis 1), and that, for each age group, recall would be higher when recalling more familiar environments compared to less familiar types of environments (i.e., hypothesis 2). In order to test these, a mixed-design ANOVA was used, with a within-subjects factor of Picture (Child-familiar/park, Adult-familiar/bank) and a between-subject factor of Age (young child, adult). When examining the within-subjects effect, there was no significant main effect of Picture, F (1, 188) = .07, p = .76, η^2_p = .00, such that the number of descriptors reported in the Adult-familiar condition (i.e., bank; M = 6.83, SD = 4.78) were similar to the number of descriptors reported in the Child-familiar condition (i.e., park; M = 7.01, SD = 3.95). In support of hypothesis 1, there was a significant main effect of Age, F (1, 188) = 188.66, $p < .001$, η^2_p = .50, such that adults (M = 9.99, SD = 3.88) reported more descriptors than children (M = 4.32, SD = 2.70). However, this effect was qualified by a significant Picture x Age interaction, F (1, 188) = 25.82, $p < .001$, η^2_p = .12. A graph for the significant two-way interaction (Age x Picture) was constructed, and the patterns were examined (see Figure 1). Familiarity with the image appeared to be related to an increase in recall.

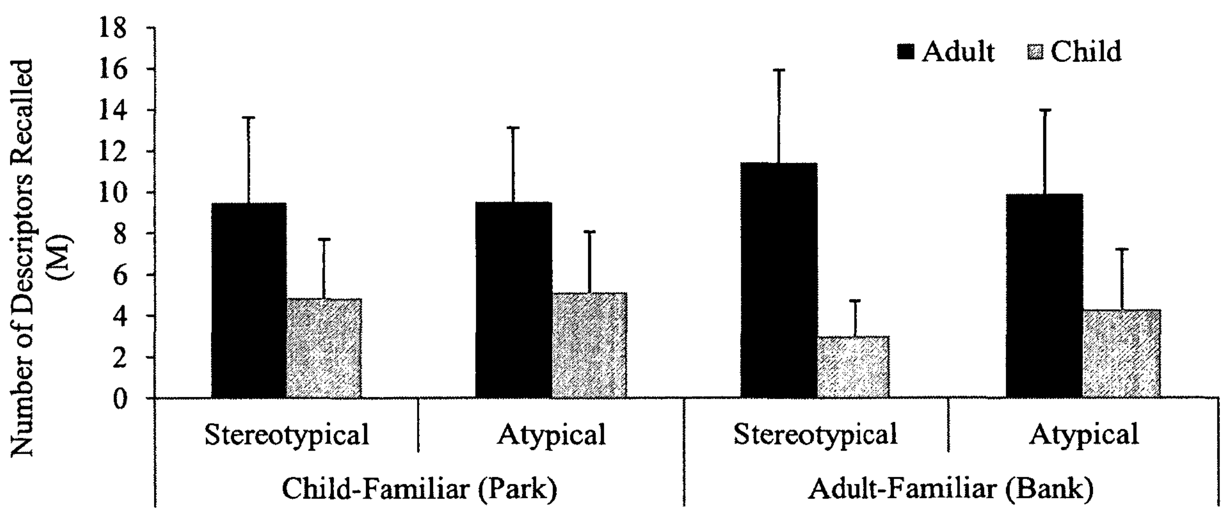

Figure 1. Mean number of descriptors reported as a function of Age, Picture, and Condition. Error bars represent standard deviation.

To examine the significant two-way interaction, simple effects analyses were performed comparing Age with the number of descriptors recalled for each Picture. In support of hypothesis 2, children reported significantly more descriptors for the Child-familiar image (park) than for the Adult-familiar image (bank), $F(1, 188) = 15.26, p < .001$, $\eta^2_p = .08$. On the other hand, adults reported significantly more descriptors for the Adult-familiar image than for the Child-familiar image, $F(1, 188) = 10.47, p = .001, \eta^2_p = .05$. Therefore, as hypothesized, reporting was higher when recalling the Picture that was more familiar with each respective age group. See Table 4 for means and standard deviations by Age and Picture.

Table 4

Mean Number of Descriptors, Proportion Accuracy, and Number of Errors Recalled by Age

	Quantity		Accuracy		Errors	
Children						
	M	*SD*	*M*	*SD*	*M*	*SD*
Adult-familiar	3.67	2.51	.90	.20	.21	.52
Stereotypical	2.98	1.73	.88	.23	.19	.53
Atypical	4.27	2.91	.93	.15	.24	.51
Child-Familiar	4.97	2.89	.93	.14	.32	.69
Stereotypical	4.83	2.85	.92	.15	.35	.78
Atypical	5.12	2.95	.94	.12	.29	.58
Adults						
	Quantity		Accuracy		Errors	
	M	*SD*	*M*	*SD*	*M*	*SD*
Adult-familiar	10.66	4.35	.96	.06	.24	.63
Stereotypical	11.41	4.51	.96	.06	.36	.78
Atypical	9.88	4.08	.96	.07	.12	.39
Child-Familiar	9.48	3.87	.93	.10	.37	.79
Stereotypical	9.47	4.16	.93	.10	.30	.67
Atypical	9.50	3.61	.94	.11	.43	.90

Note: Means are calculated based on entire sample (*N*= 190)

Age and condition. It was hypothesized that, for each age group, more information will be reported when recalling a stereotypical image than an atypical image (i.e., hypothesis

3). In order to test this, a mixed-design ANOVA was used, with a within-subjects factor of image Condition (Stereotypical, Atypical) and a between-subject factor of Age. When examining the within-subjects effect, there was no main effect found for Condition on the number of descriptors recalled, $F\,(1, 105) = .06, p = .80, \eta^2_p = .00$, such that the number of descriptors recalled was similar across Stereotypical ($M = 6.93$, $SD = 5.15$) and Atypical Conditions ($M = 6.93$, $SD = 4.27$). Again, in support of hypothesis 1, a significant main effect of Age was found, with adults reporting more than children, $F\,(1, 105) = 119.53, p < .001, \eta^2_p = .53$; however, this effect was qualified by a significant Age x Condition, $F\,(1, 105) = 5.26, p = .02, \eta^2_p = .05$. A graph for the significant two-way interaction was constructed, and the patterns were examined (see *Figure 1*). It appears that adults and children reporting may differ by Condition.

To examine the significant two-way interaction, simple effects analyses were performed, comparing Age with the number of descriptors recalled for each Condition. Contrary to hypothesis 3, no significant difference was found in reporting across the two conditions for children, $F\,(1, 105) = 2.37, p = .13, \eta^2_p = .02$; however, a marginal effect was found for adults, $F\,(1, 105) = 2.89, p = .09, \eta^2_p = .03$, such that adults reported more in the stereotypical condition than the atypical condition. Therefore, the presence of stereotype had a marginal influence on the quantity of information recalled by adults, but had no effect on children's recall. See Table 5 for means and standard deviations by Age and Condition.

Table 5

Mean Number of Descriptors Recalled, Proportion Accuracy, and Number of Errors Recalled as a function of age and image condition.

		Quantity		Accuracy		Errors	
		M	*SD*	*M*	*SD*	*M*	*SD*
Children							
	Stereotypical	3.77	2.66	.93	.16	.17	.59
	Atypical	4.47	2.93	.92	.17	.28	.56
Adults							
	Stereotypical	10.96	4.75	.93	.08	.34	.67
	Atypical	10.09	3.58	.94	.11	.30	.69

Note: these means were calculated in the mixed-factorial ANOVA design using an $N = 107$ (Child = 60; Adult = 47).

Accuracy of Information Recalled

Age and picture. It was hypothesized that environments that are more familiar would result in a higher proportion of accurate recall when compared to less familiar environments (i.e., hypothesis 4). In order to test this, a mixed-design ANOVA was used, with a within-subjects factor of Picture and a between-subject factor of Age. When examining the within-subjects effect, there was no significant main effect of Picture, F (1, 185) = .02, p = .89, η^2_p = .00, such that the proportion of correct descriptors reported in the Adult-familiar condition (i.e., bank) (M = .93, SD = .15) were similar to the number of descriptors reported in the Child-familiar condition (i.e., park) (M = .93, SD = .12). There was a significant main effect of Age on the proportion of accurate descriptors reported, F (1, 185) = 4.05, p = .05, η^2_p =

.02, such that adults (M = .95, SD = .08) reported proportionately more accurate descriptors than children (M = .92, SD = .17). However, these effects were qualified by a significant Age x Picture interaction, F (1, 185) = 4.47, p = .04, η^2_p = .02. A graph for the significant two-way interaction (Age x Picture) was constructed, and the patterns were examined (see Figure 2). Familiarity with Picture appeared to be related to accuracy of recall only for children.

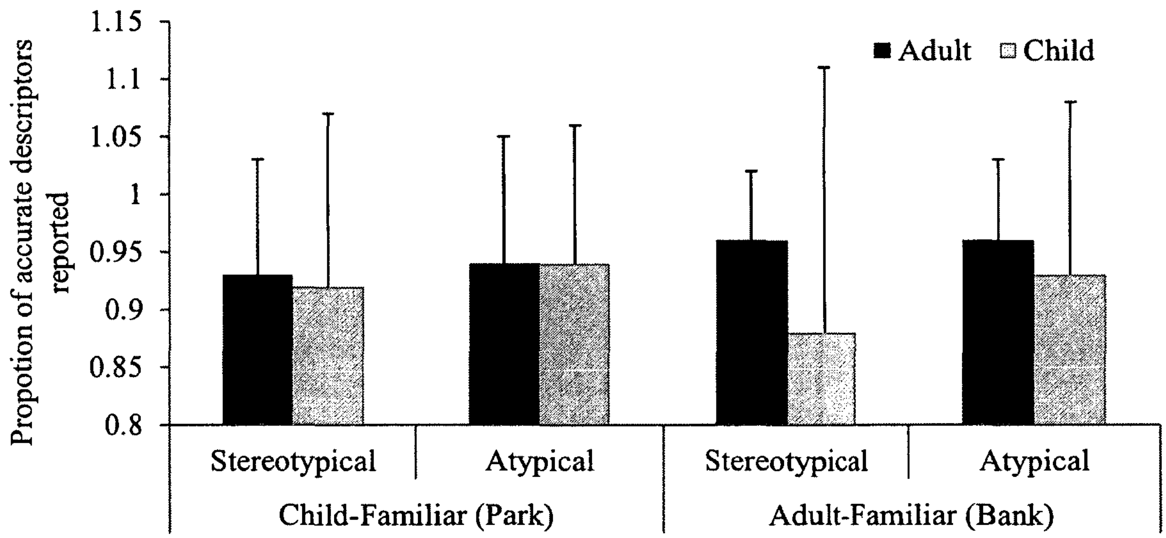

Figure 2. Proportion of accurate descriptors reported as a function of Age and Image environment. Error bars represent standard deviation.

To examine the significant two-way interaction, simple effects were performed comparing Age with the proportion of correct descriptors recalled for each Picture. In partial support of hypothesis 4, when children were less familiar with the picture (i.e., Adult-familiar image/bank) they were less accurate than adults, F (1, 185) = 7.09, p = .008, η^2_p = .04. However, contrary to hypothesis 4, when children were more familiar with Picture (i.e., Child-familiar image/park), children were proportionately as accurate as adults, F (1, 185) = .00, p = .99, η^2_p = .00. There was no significant difference in proportion correct across the two pictures for children, F (1, 185) = 2.74, p = .10, or for adults, F (1, 185) = 1.81, p = .18. Therefore, children were less accurate than adults when recalling a less familiar with the environment; however, when recalling more familiar with the environment, accuracy of children's recall was similar to adults'. See Table 4 for means and standard deviations by Age and Picture.

Age and image condition. Stereotypical environments were hypothesized to result in a higher proportion accuracy of recall for both age groups (i.e., hypothesis 5). In order to test this, a mixed-design ANOVA was used, with a within-subjects factor of Condition (stereotypical, atypical) and a between-subject factor of Age. Contrary to hypothesis 5, there was no main effect for Condition on the proportion of accurate descriptors reported, F (1, 102) = .03, p = .88, η^2_p = .00, such that the accuracy was similar across the stereotypical condition (M = .94, SD = .13) and the atypical condition (M = .93, SD = .15). In addition, there was no significant main effect of Age, F (1, 102) = .59, p = .45, η^2_p = .01. There was also no significant Age x Condition interaction, F (1, 102) = .12, p = .73, η^2_p = .00. Therefore, the presence of Stereotypical or Atypical items did not influence the proportional accuracy of children's and adults' reporting. See Table 5 for means and standard deviations by Age and Condition.

Memory Errors

Overall, 65 participants made a total of 104 memory errors, 42 (children = 22, adults = 20) errors occurred when recalling the Adult-familiar image (i.e., bank) and 62 (children =

33, adults = 29) errors occurred when recalling the Child-familiar image (i.e., park). See Appendices J and K for the type and relevancy of memory errors made by each age group.

Age and picture. It was hypothesized that adults would make more memory errors than children, overall (i.e., hypothesis 6). In order to test this, a mixed-design ANOVA was used, with a within-subjects factor of Picture (Child-familiar/park, Adult-familiar/bank) and a between-subject factor of Age. Contrary to hypothesis 6, no main effect of Age was found for the number of memory errors reported, $F(1, 188) = .26, p = .61, \eta^2_p = .00$, such that adults ($M = .31, SD = .71$) reported a similar number of memory errors as children ($M = .27$, $SD = .60$). Surprisingly, when examining the within-subjects effect, there was a marginally significant effect of Picture, $F(1, 188) = 3.56, p = .06, \eta^2_p = .02$, such that more memory errors were reported in the Child-familiar picture (i.e., park) ($M = .34, SD = .74$) than in the Adult-familiar picture (i.e., bank) ($M = .23, SD = .57$). It was also hypothesized that, overall, more memory errors would be reported when viewing an environment that is more familiar than one that is less familiar, relative to each age group (i.e., hypothesis 7). The results do not support this hypothesis because the Age x Picture interaction was not significant, $F(1, 188) = .03, p = .87, \eta^2_p = .00$. Therefore, the number of memory errors reported did not depend on age and, overall, more memory errors were made when recalling the Child-familiar image (i.e., park) than the Adult-familiar image (i.e., bank). See Table 4 for means and standard deviations by Age and Picture.

Age and condition. It was hypothesized that more memory errors would be made in more familiar environments than less familiar environments for each age group (i.e., hypothesis 8). In order to test this, a mixed-design ANOVA was used, with a within-subjects factor of image Condition (stereotypical, atypical) and a between-subject factor of Age.

Contrary to hypothesis 8, there was no main effect of Condition on the number of memory errors made, $F\,(1, 105) = .22, p = .64, \eta^2_p = .00$, such that the number of errors reported in the Stereotypical condition ($M = .24$, $SD = .63$) was similar to the Atypical condition ($M = .29$, $SD = .61$). Again, contrary to hypothesis six, there was no significant main effect of Age, $F\,(1, 105) = 1.07, p = .30, \eta^2_p = .01$. There also was no significant Age x Condition interaction, $F\,(1, 105) = 1.00, p = .34, \eta^2_p = .01$ (see Figure 3). Therefore, the presence of Stereotypical or Atypical items did not influence the number of memory errors reported by children or adults. See Table 5 for means and standard deviations by Age and Condition.

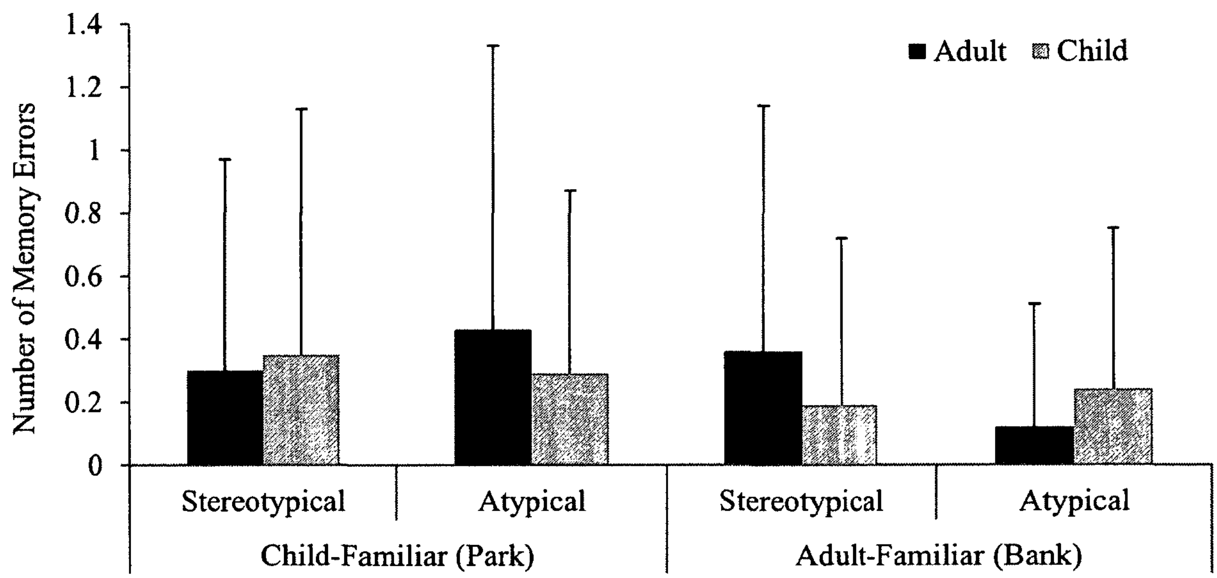

Figure 3. Mean number of memory errors reported as a function of Age and Image environment. Error bars represent standard deviation.

Memory Errors: Relevant versus Irrelevant

It was hypothesized that more relevant than irrelevant errors would be reported when recalling a more familiar environment for each age group; however, children would report more irrelevant errors than adults when recalling a less familiar environment (i.e., hypothesis

9). In order to test this, two MANOVAs were conducted with the number of relevant and irrelevant errors as the DV and Age as the IV. Given the missing data presented throughout (i.e., not everyone made memory errors for both images), data were analyzed separately by picture. When examining the Adult-familiar image (i.e., bank), the first MANOVA revealed a main effect of Age on the composite DV, $\lambda = .42$, $F(1, 27) = 5.45$, $p = .01$, $\eta^2_p = .30$. To examine this effect, a series of ANOVAs were conducted for each DV. In support of hypothesis 9, children ($M = .47$, $SD = .72$) reported significantly less relevant errors than adults ($M = 1.38$, $SD = .87$), $F(1, 28) = 9.95$, $p = .004$, $\eta^2_p = .26$, and children ($M = .82$, $SD = .73$) reported significantly more irrelevant errors than adults ($M = .15$, $SD = .38$), $F(1, 28) = 9.10$, $p = .005$, $\eta^2_p = .25$. However, when examining the Child-familiar image (i.e., park), the second MANOVA revealed no main effect of Age on the composite DV, $\lambda = .96$, $F(1, 38) = .70$, $p = .50$, $\eta^2_p = .04$.

In order to further test hypothesis 9, a series of *t* tests were conducted to examine the nature of errors within each picture (see Figure 4). While there was no Age difference in the Child-Familiar image (i.e., park), both children, $t(44) = 3.23$, $p =.002$, and adults, $t(34) = 4.15$, $p <.001$, reported more relevant than irrelevant errors. Therefore, as hypothesized, children and adults reported more relevant than irrelevant errors when recalling environments that are more familiar to them. In addition, adults also were more likely to report relevant errors in environments they were less familiar with, while children were more likely to report irrelevant errors in less familiar environments. See Table 6 for the mean number of relevant and irrelevant errors recalled as a function of Age and Picture.

Table 6

Mean Number of Relevant and Irrelevant Errors Recalled as a function of Age and Picture.

	Relevant		Irrelevant	
Child				
	M	*SD*	*M*	*SD*
Adult-familiar	.87	.90	.53	.68
Child-familiar	1.04	.71	.39	.66
Adult				
	M	*SD*	*M*	*SD*
Adult-familiar	1.38	.87	.15	.38
Child-Familiar	1.33	.84	.28	.67

Note: Means are calculated based on entire sample (*N*= 190).

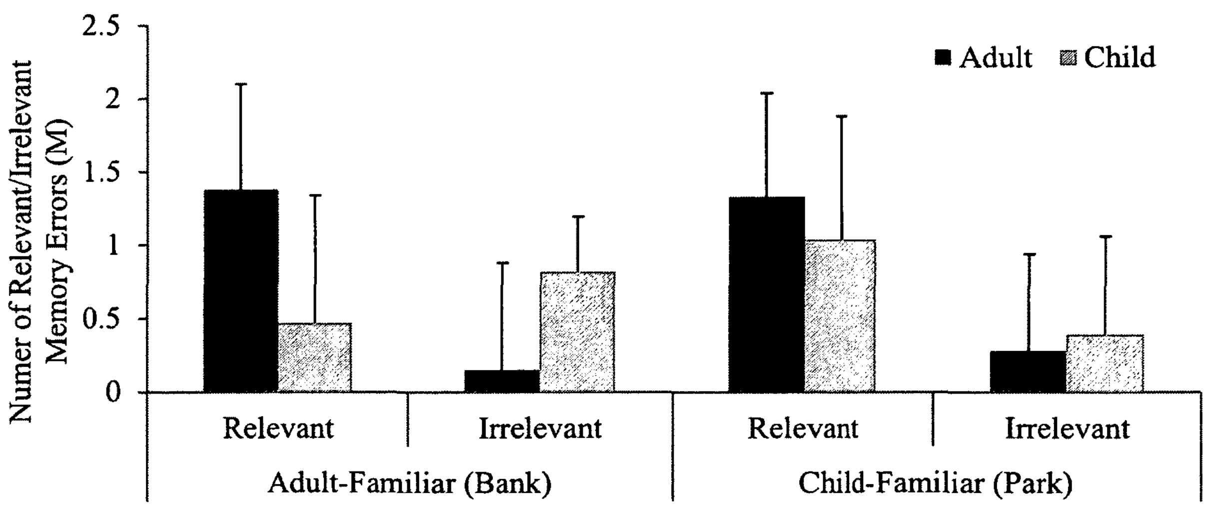

Figure 4. Mean number of relevant and irrelevant errors reported as a function of Age and Image environment. Error bars represent standard deviation.

Discussion

The present study investigated the recall abilities of children (4- to 7- year-olds) and adults when presented with various environmental images that were related to different levels of semantic processing (i.e., more or less familiar environments; stereotypical or atypical images). The purpose was to determine if differences in the quantity, accuracy, and errors recalled were related to the age of the witness. Research on semantic knowledge structures and schema theory were placed within the wider context of Brainerd and Reyna's (1995) fuzzy trace theory (FTT) to be used as the principal theoretical framework for generating hypotheses and predictions about how stereotypes and familiarity would influence children's and adults' recall memory of an environment.

Recall memory performance was measured three ways: (a) by the quantity of information recalled; (b) by the proportion of accurate information recalled; and, (c) by the number of memory errors (commission errors) made. The results suggest that, like recall memory for faces (e.g., Pozzulo & Warren, 2003) there is developmental variability between 4-7-year-olds and adults when recalling information about an environment. When shown an environment that increased the likelihood of semantic processing (i.e., a more familiar environment), age was an important factor in recall performance. Specifically, when recalling a more familiar environment (i.e., park), the quantity and, to a lesser extent, the accuracy of children's recall improved compared to when recalling a less familiar environment (i.e., a bank). While familiarity improved the quantity of adult's recall, it did not affect proportional accuracy of recall. Contrary to hypotheses, however, an increase in familiarity with a type of environment was related to an increase in memory errors for children, but a reduction in familiarity was related to an increase in errors for adults.

Quantity of Information Recalled

The majority of previous research suggests that adults recall quantitatively more information than children (Davies, Tarrant & Flin, 1989; Pozzulo & Warren, 2003). In keeping with past recall literature, the present study found adults' recall to be consistently higher than that of children, regardless of stimuli condition (i.e., regardless of the image presented and whether stereotypical or atypical items were presented). Semantic processing theories and related research would predict this type of difference. Adults' increased reporting may be explained by adults having more developed schemas, or contextually-based organizational frameworks than children, suggesting that they should be able to encode and subsequently recall more detail about the environment (Nelson, et al., 1983). The developmental variability predicted from FTT can also provide a reasonable theoretical basis in which to interpret these results. FTT posits that children should rely on verbatim traces, but increase their reliance on gist processing as they age. As previously indicated, verbatim traces represent the processing of actual details of the stimuli (Brainerd & Reyna, 1995). Hence, it can be assumed that children's reliance on verbatim processing (rather than gist processing) of an experience would result in less salient memories that are more difficult to recall in detail. On the other hand, gist traces represent the processing of meaning-related or subjective details of a stimulus (Brainerd & Reyna, 1995); therefore, adults' stronger reliance on gist processing (as well as verbatim processing) may lead to easier recollection of more details, thus producing comparatively more information during free recall tasks.

It appears that familiarity with the type of environment largely influenced children's reporting of information. When recalling a less familiar environment, children, overall, reported less information; however, their reporting increased when presented with an image that contained atypical items. This finding is consistent with schema theory in that, when children are less familiar with the environment, they have less developed schemas about what normally exists in that environment, resulting in a reduced ability to encode and later recall information. In addition, underdeveloped schemas may reduce the likelihood that the presence of items would introduce stereotyped errors during recall. However, given that the additional items included in the atypical conditions were known or familiar to children (see second pilot study), it is reasonable to assume that children would be more likely to recall the details that had some meaning to them in an unfamiliar environment.

Related to this, the results suggest that improved performance is likely related to how familiar the environment was to their age group. The increased reporting when recalling a familiar environment suggests that children as well as adults are able to organize and recall information using schemas, or contextually-based organizational frameworks. More specifically, the results may imply a relationship between increased exposure to an environment and the saliency of schemas about these environments. When relying on information processing and semantic memory theories, one could comprehend how specific categories could be more 'connected' to each other, thus, making them more accessible during free-recall. However, children have been found to have poorer abilities to draw these connections at the time of encoding (Brainerd & Reyna, 2005; Ceci, Papierno & Kulkofsky, 2007; Cordon, 2000) which in turn, prevents young children from relying upon those meaning connections when recalling information. When presented with a stimulus containing meaningless detail (i.e., a less familiar environment) it may reduce children's ability to store, and subsequently recall the information in any meaningful way. It is possible, therefore, that visiting an environment frequently (i.e., being more familiar with an environment), provided children (and adults) with the necessary organizational structure (schema) around which to construct their descriptions.

Although adults consistently reported more information than children, it was interesting to find that the gap between the number of descriptors recalled by adults and children lessened when children recalled a more familiar stimulus. That is, children recalled comparatively more descriptors when they were more familiar with the environment depicted in the image. These results may suggest that, although familiarity increased recall for both age groups, it may have a particular effect on children's ability to encode, organize, and recall information semantically about a stimulus. This finding speaks to the debate in which adults are consistently better in recalling information compared to children. In particular, it may suggest that repeated exposure to an environment may offset children's developmental disadvantage in using schemas to recall information and, thus, children's recall about a familiar place may be more comparable to adults than when recalling a less familiar place. Future research should continue to examine whether familiarity increases children's recall relative to adults' by increasing control over stimulus materials—for example, by controlling exposure to a place that neither child or adult would have experience with.

Accuracy

The proportion of accurate information recalled by children was related to how familiar the environment was (i.e., children were more accurate in reporting familiar environments); however, familiarity with an environment did not affect adults' reporting. These results provide further evidence for the ongoing debate about the accuracy of children's and adults' recall. Presenting children with a more familiar environment resulted in proportionately more accurate information being recalled than when presenting children with a less familiar environment. To be more specific, children were less accurate than adults were when recalling information about the adult-familiar image (i.e., bank), but were just as accurate as adults when recalling information about the image that was more familiar (i.e., child-familiar image; park). The comparability of accurate recall found between children and adults when recalling the Child-familiar picture (i.e., park) is consistent with the common research finding that proportion accuracy of children's reporting does not significantly differ from adults (e.g., Cordon, 2004; Jones & Krugman, 1986; Poole & White, 1991; Pozzulo et al., 2011). It is possible that the accuracy of adults' recall did not differ by image because adults were once children and, thus, are familiar with the park as well as the bank. Therefore, children may have stronger, well-defined schemas regarding parks in comparison to a bank, while adults' schemas for the two are equal in comparison. Exposure to, and relevancy of, parks were tested and it was revealed that adults' did not spend much time in parks. Given that mean age of the adults (21-years-old), it was assumed that a considerable amount of time has passed since parks were a frequented place with high relevancy to their lives. Given that the saliency of schemas decrease with time (Brainerd & Reyna, 2005), it was assumed that, while adults had schemas for parks, children's schemas would be more salient. Despite this, it is a limitation of the study that exposure and schemas could not be fully controlled for.

Of interest, however, was that when recalling the adult-familiar image, the proportion accuracy of children's reporting was considerably lower than that of adults. While some research shows similar results, it is a small section of the literature (e.g., Goodman & Reed, 1986; Marin et al., 1979; Poole & White, 1991). For example, Fivush, Hudson and Nelsen (1984) examined children's memory for an unfamiliar event and found that accuracy of recall memory varied with age, such that older participants were more accurate than younger participants. Lepore and Sesco's (1994) study found a similar trend, such that children in a familiar condition were able to recall more accurate information than in the unfamiliar condition. Therefore, the mixed findings of the present study parallel the mixed findings in the literature; nonetheless, the results suggest that children's recall accuracy for environments may depend on how familiar the environment is to the witness.

When examining the theoretical implications of these findings, FTT posits that verbatim traces are directly related to accuracy of information recalled and that the memory for exact surface information improves between early childhood and young adulthood (Brainerd & Reyna, 2005). Therefore, the developmental variability predicted by FTT can be used, in part, to explain the age-related difference found in accuracy with the two environments. Specially, FTT would predict adults to be more accurate than children because they have more developed verbatim traces. This is what was found in the Adult-familiar conditions (i.e., bank); adults were proportionately more accurate than children. However, the age-related results that emerged during the Child-familiar condition (i.e., park) cannot be explained by FTT alone. FTT would predict that adults would be more accurate than children in both conditions, given that adults would have more developed verbatim processing. However, proportion accuracy did not differ in the Child-familiar condition.

Schema theory, on the other hand, can be used to explain children's comparatively high accuracy when recalling a more familiar environment. More specifically, semantic processing theories advocate that increased exposure to a park may have resulted in children using schemas as a method to organize information during encoding and recall. Therefore, increased exposure (i.e., increased familiarity) resulted in more detailed and meaningful schemas developing (Bartlett, 1932) and, thus, these schemas were used during the encoding and recall processes, resulting in more accurate and meaningful information being recalled in the short term. On the other hand, children's lower exposure to banks may have lessened their ability to meaningfully store and recall accurate details about a bank environment. Therefore, if we are more familiar with an environment, the objects we see in the environment will have more meaning and may result in increased activation of schemas during the encoding and, subsequently, the recall of these items. The more meaning the stimulus has during encoding may increase the accuracy when recalling those items. Similarly, when children are exposed to an environment for which they do not have a detailed schema built (e.g., a bank), the items in the environment are, in essence, meaningless at the point of encoding, and thus cannot be accurately recalled at a later point.

Therefore, this theoretical consideration suggests that verbatim processing may explain why accuracy, in part, improves with age; however, it also suggests that the developmental increase in the use of gist processing predicted by FTT may depend on how familiar the stimulus is. Given that increased exposure may be related to stronger schemas in children, it is possible that familiarity with a stimulus increases children's use of gist and verbatim traces, compared to when they are unfamiliar with the stimulus.

Errors

A less optimistic picture emerged when children's recall errors were compared to those of adults. The 'developmental reversal in false memory' is a body of research that has found that children may be less likely than adults to report false memories (i.e., errors of commission) than adults during recall tasks that involves strong semantic-connections (Holliday, Reyna, & Brainerd, 2007; Brainerd et al., 2008; Bruck & Ceci, 1995). The present study attempted to apply the foundations of semantic theories to FTT in order to predict which situations would result in increased memory errors. In other words, it was hypothesized that adults would report more memory errors when viewing an environment that is more familiar than an environment that is less familiar, while there would be no difference in the number of commission errors made by children across the two images. However, the findings of the present study do not support the expected reversal in false memories (i.e., developmental variability) that was predicted using FTT. While adults (M = .31, SD = .71) did report more errors than children (M = .27, SD = .60), the difference was too trivial to provide insight into age-related explanations for memory errors for these two age groups. This suggests that recall memory for an environment may actually be less susceptible to memory errors (i.e., false information) than other types of stimuli, such as word lists (e.g., De Beni & Palladino, 2004).

Interestingly, a reversed trend was found, such that children's reporting of commission errors, like adults', increased when recalling the child-familiar image. It can be argued that this is because adults, as well as children, were more familiar with a park environment than a bank, given that adults were once children. It could be that children and adults have stronger, well-defined schemas regarding parks in comparison to a bank. As indicated previously, the results suggest that familiarity with an environment may actually influence the use of, or reliance on, gist processing. If children and adults had highly developed schemas for a park, it is possible that this increased their reliance on gist processing, which in turn resulted in more memory errors being made. However, schema theory, even if used in conjunction with FTT, cannot explain why adults, despite reporting being more familiar with banks (and reporting more information about banks) did not recall more memory errors about the bank. Another factor, other than familiarity and semantics, may be driving children's surprisingly high number of memory errors. In order to examine this we turn to the nature of the memory errors made by each age group.

Even though no age-related differences were found in the reporting of memory errors, the nature of these commission errors made were strongly related to the age of the witness, as well as to how familiar the witness was to the stimuli. More specifically, children were more likely to report irrelevant errors (i.e., recalling an unrelated item that does not ordinarily 'fit' with the immediate environment; De Beni & Palladino, 2004), particularly when they were less familiar with the environment in the picture. On the other hand, adults were more likely to report relevant errors (i.e., recalling an item that would, in any other situation, 'fit' in that specific environment). When recalling any environment, the errors recalled by adults were usually relevant to the environment (e.g., ATM machine in a bank). In the case of the child participants, the errors reported when recalling an unfamiliar environment (i.e., bank) were often not at all relevant to the environment (e.g., a smoothie stand in a bank). This finding is consistent with previous research where young children (approximately 5-year-olds) have been found to be more likely to report false information that is not related to the stimulus (i.e., word list; Brainerd, Reyna, & Forrest, 2002; Dewhurst & Robinson, 2004; Yonelinas, 2002). This finding is also consistent with the developmental variability predicted by FTT, which posits that younger children (late preschool and early school-aged) are more likely to rely on verbatim traces, while older children and adults rely more on gist processing (Brainerd & Reyna, 2005). Therefore, it would stand to reason that, if adults are more likely to recall memories using gist traces (i.e., semantic connections), then the errors they report would likely be highly semantically related to the stimulus — which was indeed found to be true. The fact that children reported errors that were not relevant to the environment—particularly when that environment was foreign to the child—may support FTT's prediction that children have less developed gist processing abilities (i.e., schemas) than adults; however, it also suggests that another factor may be causing young children to report seeing irrelevant items in the pictures.

A possible explanation is related to the demand characteristics of the experiment—namely social pressure to provide an answer to a question even if the child does not have a good idea of what the correct answer is. Social pressure is a frequently explored theme within the domain of child eyewitness memory (e.g., Cassel, 1993; Ceci & Bruck, 1993). For example, some research has investigated the influence of interview pressure on child witnesses. Ceci and Bruck (1995), for example, discuss how system variables, such as questioning method, are very influential in the accuracy of children's accounts of an event. Though a lot of this research has investigated children's suggestibility to false information during an interview process, it is possible that the same pressure felt by a child to adapt false information is similar to pressure felt by a child to report as much information as possible during the free-recall questions for the present study. In addition, there has also been research examining a different form of social pressure: social pressure to provide a response. For example, Pozzulo et al., (2011) examined the role of social pressure (i.e., pressure to make a decision/response) on children's false-positive identification rates. This study concluded that, when reducing cognitive effort, presenting the child with a simple task increased their selecting an innocent person from a lineup.

Pressure to provide a response could explain children's higher level of irrelevant commission errors. The presence of an adult has been shown to influence children's reporting significantly more than the presence of a peer (e.g., Ceci, Toglia, & Ross, 1988; Knock & Winer, 1986). Thompson and colleagues (1997), for example, explain the effect of adults' presence on children's performance as a lack of confidence that results in children turning to an adult for cues on how to respond to the situation. For the present study, if children had less developed schemas and were less familiar with the environment depicted in the image, it is possible they felt pressure to respond just by the fact that an adult was asking the question. More research is needed to understand the dynamic effect adults have on children during questioning, even when no misinformation is exchanged. For example, perhaps instructions could be made explicitly clear to ensure that children are aware that not providing a response is acceptable. For example, instructions could include, "*If you cannot remember anything else about what you saw, that is okay.*"

Real World Implications

Memory errors, frequently referred to as false memories, present both practical and theoretical problems for the eyewitness literature. When an eyewitness is asked to remember information for the police or in a courtroom setting, it is important to find a balance between eliciting the most accurate information from them, while ensuring that inaccurate information is not unintentionally presented. Finding a balance is a practical problem that can be addressed by conducting basic memory research that has meaningful application to the real world, much like the present study.

It has been reported that thousands of children witness crimes in their home throughout Canada each year (Dauvergne & Johnson, 2001). When a child witnesses a crime in a familiar type of environment, such as a home or a local park, it is important to understand whether their increased exposure to the environment will improve or hinder their ability to recall and report accurate information about the event. The present study suggests that recalling information about a familiar environment improves children's recall in terms of both detail provided and the accuracy of that detail, suggesting that children may be better 'rememberers' when they witness a crime in a familiar environment compared to an unfamiliar environment. Nevertheless, the quantity of false information reported (i.e., commission errors) was also higher when children recalled information about a more familiar environment (i.e., park). This suggests that children may report more accurate as well as inaccurate information when witnessing a crime in a familiar environment. Like children, adults demonstrate they are better 'rememberers' when recalling information about familiar places; however, adults' improvement was found only in terms of the increased reporting of information, not in terms of accuracy. Adults reported more errors when recalling a less familiar environment. In addition, familiarity with an environment was not a factor in the relevancy and adults' errors, but it was for children's errors, such that children reported more irrelevant errors when they were less familiar with the environment.

These findings have important implications for police and justice personnel — particularly concerning investigative techniques used to elicit information from child witnesses. Previous research has demonstrated that young children may be highly susceptible to misleading or false information, and to inappropriate interviewing techniques, especially compared to adult witnesses (e.g., Bruck & Ceci, 1999; Ceci & Bruck, 1995). Taking this developmental difference into account, these results suggest the need for increased caution when questioning or interviewing young children about a crime in a familiar place due to their propensities to report false (and irrelevant) information. Inappropriate methods of questioning or interviewing may not only increase children's acceptance of misinformation (including unintentional misinformation; Bruck & Ceci, 1999), but may also increase the number of memory errors reported about the environment, such as what was stolen or what was used as a weapon. For instance, directly asking a child whether an item (e.g., a knife) was present in a crime (e.g., robbery at a local park) has been shown to increase their chances of recalling that item as present, even when it was not (Cassel, Roebers, Bjorklund, 1996). However, asking this biased question about a familiar place may activate certain schemas or methods of memory processing, such as gist traces, and ultimately lead to an increase in children's recall errors. However, before such conclusions can be drawn, additional research is needed to examine: (a) whether an erroneous memory for an environment is related to an erroneous memory for an event, such as a crime; and, (b) whether method of questioning is related to the accuracy of recall for different environments.

Limitations and Future Directions

The present research found a very low number of memory errors overall (M =.27), especially when compared to others studies, in which errors have a range from M = .31 (McDermott & Watson, 2001) to 2.08 (Leippe, Romanczyk, & Manion, 1991). Therefore, this suggests that the methodology for the present study did not elicit enough memory errors to allow for differences. Perhaps making the task more difficult by means of altering the method or materials would result in greater variability and, thus, allow for a more rigorous test of errors. For example, using images as a method of eliciting memory errors may have been related to the low number of memory errors reported. Much of the previous memory research (i.e., false information literature) has examined commission errors using word lists (e.g., Brainerd et al., 2006). It is possible that using word lists as a stimulus resulted in more opportunities to make errors, given that errors would be more obvious due to there being pointedly less stimuli in a word list than in an environment image. With images, it is possible that the increased level of objects actually increased the chances of the information recalled being correct. In addition, exposing participants to the stimuli for seven seconds may have provided them with enough time to process a significant amount of the existing information and, thus decreasing the likelihood of recalling memory errors. For example, McDermott and Watson (2001) presented adult participants with semantically related word lists and found that as the presentation length increased (to 5 ms/word), false recall declined. Therefore, if children were shown the pictures for a shorter period, it may have resulted in an increased number of memory errors.

A limitation of the present study relates to the emotional tone surrounding an environment. When a person, particularly a child, witnesses a crime in a familiar place, it is likely to occur in a negative setting with the witness being victimized, such as in the case of abuse. While the emotional context of an environment is an important factor in memory performance, given the ethical issues surrounding testing memory for negative, familiar places, the present study only tested 'positive' environments (i.e., environments that were not likely to have any negative meaning for the participants). Similarly, research suggests that the role of the witness, victim or bystander, is an important factor in memory, such that those who are a direct participate in an event (i.e., victim) are less susceptible to suggestibility (Rudy & Goodman, 1991) and have superior memories after long periods of time (Cordon, Pipe, Sayfan, Melinder & Goodman, 2004). As a result, the ecological validity of this study is limited in that it may not be representative of victims and of those who witness events in negative, real-world situations.

Given the nature of the present research questions and materials, a fully crossed design was not possible. As a result, it was not possible to conduct a general linear model (GLM) test for three-way interactions between the three independent variables: Age (child, adult), Picture (child-familiar, adult-familiar), and Condition (stereotypical, atypical). Despite this, important information was revealed that could act as foundation for future research. From a theoretical perspective, future efforts are required to understand the role that stereotypes may have on recall errors. How do we measure whether children perceive and use stereotypes during encoding and recalling tasks? How does this level of perception and use of stereotypes influence errors of commission? From an applied perspective, it is important to test for a relationship between stereotypes and recall performance using alternative methods. In contrast to much of the research examining stereotypes about people, the present study attempted to determine if the presence of schema-consistent and -inconsistent information activated schemas and stereotypes about the environments and, thus, influenced recall memory performance. The findings that the presence of stereotypical or atypical items had no influence on recall accuracy or the number of commission errors, were surprising given the widespread support for the influence of stereotypes on memory and reporting of false information (e.g., Brewer and Treyens, 1981; Memon et al., 2006; Lampinen, et al., 2001; Pezdek et al., 1989; Pozzulo & Weeks, 2006; Spiker, 1984).

One possible explanation for this is that the materials were not designed in a way that sufficiently activated stereotypes (i.e., gist traces) about the environments shown in the image. Schema research has found that social stereotypes are activated by unique combinations of categorical and contextual information (Casper, Rothermund, & Wentura, 2010). Casper et al. (2010) among others have argued that presenting only categorical information with no related contextual meaning is not sufficient to trigger the activation of stereotypes (Barden, Maddux, Petty, & Brewer, 2004; Blair, 2002). For example, Casper et al., (2010) discussed how placing categorical information (e.g., young versus old) into a wider context, such as using a statement, "Martha K (78 years) was sitting on a park bench" (Casper et al., 2010, p.131), activates stronger stereotypes than without the context.

For the present study, it is possible that simply presenting schema-consistent and schema-inconsistent items with no deeper context was not sufficient to activate schemas about the environment during the encoding and recalling stages, and this may explain the non-significant effect of these items on recall. Perhaps if the schema-consistent and -inconsistent items were placed within a larger, more contextualized framework, such as a short story about each image shown (e.g., have the environment the focus in a short slide show or film that outlines an event), it might provide enough context to activate schemas, thus influencing recall. Exposing witnesses to an environment within a context of an event is not unlike what a person experiences when witnessing a crime. Future research should further examine how stereotypes about environments influence recall performance by exposing witnesses to different environments containing stereotypical or atypical items within the context of a larger event.

Conclusion

The purpose of this research was to determine how children's and adults' recall memory is influenced by familiarity with type of environments and stereotypes about these places. Overall, stereotypes had minimal effect on memory. On the other hand, it appears that familiarity with a type of environment is influential on the quantity and accuracy of young children's memory when recalling information about those places. Familiarity with a type of environment also influenced adults' recall memory; however, this is to a lesser extent than children (i.e., only influenced quantity of recall). Although, adults did not report more memory errors than children, familiarity appears to affect child and adult reporting of memory errors in different ways. It appears that adults make errors because they are 'filling in the gaps' by using semantic connections to recall information; whereas children's errors are less related to the use of semantic connections, but instead, may be related to social pressure to report information (i.e., reporting for the sake of reporting). Therefore, semantic theories (e.g., schema) and, to a limited extent, FTT, are useful in predicting, interpreting, and understanding the factors that influence children's and adults' performance on memory tasks — particularly, in relation to the quantity and accuracy of information recalled about an environment.

Given the mixed results of the study, more research is needed to better understand the importance of semantic knowledge structures on children's recall, particularly in applied eyewitness contexts. Developing a stronger understanding of what factors influence the accuracy of children's recall is an important component of understanding children's overall abilities as eyewitnesses. Understanding what situations may lead to increased errors and/or accuracy can then be applied with the intention of making police interviews and other related eyewitness investigative procedures more effective. Children's tendencies to recall false and often irrelevant information about familiar places may inform police and courtroom interviewing methods. Specifically, it may suggest a need for increased vigilance in how questions are presented to child witnesses in order to minimize the inaccurate (and irrelevant) information being reported (e.g., no leading questions; informing children that it is ok if they cannot remember). Future research should continue to examine children's memory for environments, specifically, by whether erroneous memory for places is related to erroneous memory for an event, such as a crime.

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Appendix A - Instructions for Viewing Images

Hi, my name is ________. We are going to play a remembering game. Did you want to play?

Ok, I am going to show you a picture. Please pay <u>special</u> attention when I show you the pictures because afterwards I am going to ask you some questions about it, ok? **(Repeat if necessary)**

(Show pictures for 7 seconds on the computer)

Please tell me everything you remember about the picture. **(Write down complete answer. Follow with up to two prompts: (1) "Do you remember anything else?" If the child still offers no response, again ask, (2) "Do you remember anything from the picture?").**

(Repeat until all four pictures are done.)

Ok, that's it! We are done. Thank you for your help!

Appendix B -Description form

Free recall

Please write down (tell me) everything you remember seeing in that picture:

What was that place?

What do you do at places like that?

How do you know?

Appendix C -- Parental Consent Form

Dear Parent(s)/Guardian(s),

As researchers from Carleton University, we are conducting a study to better understand children's memory and their ability to remember what they see. The *Department of Psychology's Ethics Committee* at Carleton University, the *Ottawa-Carleton District School Board*, the principal and teacher of your child's school has granted us permission to request your child's participation in this study.

This study is directed at understanding children's memory. Your child will be shown 4 generic images for about 20 seconds in total. Two of the images will be scenes commonly familiar to children (e.g., toy store, an outdoor play structure). The other two images will be environments commonly familiar to adults (e.g., restaurant and a bank). Following the viewing of each of the images, your child will be asked what they remember. Your child also will make craft activities and have a story-time. The total time to conduct this research will be approximately 60 minutes. This research is important because it will inform us about children's memory and how it develops.

We would greatly like to include your child in this project. Results from previous research have shown that children have enjoyed the experience of participating in this type of study. The study will take place at your child's school, during class time and at the teacher's convenience. Three-four female researchers will work with small groups of children at one time for approximately 80 minutes. Children will be asked questions about the scenes individually however.

Participation in the study is completely voluntary and your child may withdraw from the study at any time. As well, your child may choose not to participate even though you have granted permission for him/her to do so. Participants' responses will remain completely anonymous and strictly confidential. The information that is gathered will not appear on any school records and will have no bearing on their evaluation of classroom performance. The information gathered is solely for research purposes and will only be seen by the researchers involved. Also, note that the gathered information will not contain your child's name or any other form of identifying information.

Please indicate on the form below whether or not you give your child permission to participate in the study. Please indicate your decision on the bottom portion of this letter and return the bottom portion to your child's teacher as soon as possible. **We ask that if you do decide to give your child permission to participate in the study that you please save a copy of the letter with the contact information in the event that you or your child have any questions after participating**. We sincerely appreciate your co-operation. If you should have any questions or comments about this research please feel free to contact, Dr. Joanna Pozzulo (Faculty advisor, 613-520-2600, ext.1412) or Kaila Bruer (Principle Investigator, 520-2600, ext. 3695). If you should have any ethical concerns about this study please contact, Dr. Monique Sénéchal (Chair, Carleton University Research Ethics Committee for Psychological Research, 613-520-2600, ext. 1155). Should you have any other concerns please contact, Dr. Anne Bowker (Chair, Department of Psychology, 613-520-2600 ext. 8218).

Sincerely,

Joanna Pozzulo, Ph.D., C.Psych.
Department of Psychology
Director, Institute of Criminology and Criminal Justice
Carleton University

Kaila Bruer, BA (Hons.)
Department of Psychology
Carleton University

(Please return to teacher)

The information collected for this project is confidential and is protected under the Municipal Freedom of Information and Protection of Privacy Act. (1989, Bill 49)

I have read and understood the request for my son/daughter to participate in the study on children's memory. Please select one of the following:

I have discussed this with my son/daughter and

____I **give permission** for my son/daughter to participate in this study and to see researchers on the day of testing in my child's school. I understand that my child will be asked about places. I understand that all of my child's responses will remain anonymous and that he/she is participating voluntarily and is able to withdraw at any time. Any questions or comments I may have will be answered by the principal investigator.

____I **do not give permission** for my son/daughter to participate in this study.

Name of Student (please print): ____________________________________

Name of Parent/Guardian (please print): ______________________________

Signature of parent/guardian: ______________________________________

Date: ____________________________

Appendix D- Informed Consent Form- (Adults)

The purpose of an informed consent is to ensure that you understand the purpose of the study and the nature of your involvement. The informed consent must provide sufficient information such that you have the opportunity to determine whether you wish to participate in the study.

Present study: Eyewitness Memory: What do you remember about what you see?

Research personnel: The following people will be involved in this research project and may be contacted at any time: Kaila Bruer (Investigator, 613-520-2600, ext. 3695); Dr. Joanna Pozzulo (Faculty Advisor, 613-520-2600, ext. 1412). If you should have any ethical concerns about this study please contact, Dr. Monique Sénéchal (Chair, Carleton University Research Ethics Committee for Psychological Research, 613-520-2600, ext. 1155). Should you have any other concerns please contact, Dr. Janet Mantler (Chair, Department of Psychology, 613-520-2600, ext. 4173).

Purpose: The purpose of this study is to examine memory for certain events.
Task requirements: You will be asked to respond to a series of questions regarding several generic images.
Duration and locale: Testing will take place in Room 111 Social Sciences Research Building, Carleton University. The session will last approximately 60 minutes.
Potential risk/discomfort: There are no potential physical or psychological risks involved in this experiment.
Anonymity/Confidentiality: All the information you provide will be strictly confidential. This data will only be used for research at Carleton University. Your answers will be coded in such a way that you cannot be identified.
Right to withdraw: Your participation is strictly voluntary and you may withdraw from the experiment at any time without academic penalty.
Signatures: I have read the above form and hereby consent to participate in this study. The data in this study will be used for research publications and/or teaching purposes. I am aware that the data collected in this study will be kept strictly confidential and anonymous. My signature indicates that I understand the above and wish to participate in this study:

Participant's Name (print): ______________________________

Participant's Signature: _________________________________

Researcher's Name (print): ______________________________

Researcher's Signature: _________________________________

Date: _________________________

Appendix E -- Participant Demographics/Familiarity Assessment Form: Child

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To gain a greater understanding of our participants, we ask that you complete the information below. **Please note** that this information is for research purposes only and these answers will be kept confidential; no one will be able to identify you, your child, or your answers.

Please answer the questions below regarding your child who is participating in this study. Thank you!

1) Please indicate your child's gender: Male Female
2) Please indicate your child's age in months: __________
3) Please indicate the primary language used in the home to communicate with your child: __________________
4) Please indicate how many times per month your child visits a bank (circle)?

   0 1-2 3-5

   6-10 10-15 15 +

5) Please indicate how many times per month your child visits a formal restaurant (i.e., not fast food)?

   0 1-2 3-5

   6-10 10-15 15 +

6) Please indicate how many times per month your child visits an outdoor children's play structure (circle)?

   0 1-2 3-5

   6-10 10-15 15 +

7) Please indicate how many times per month your child visits a toy store (circle)?

   0 1-2 3-5

   6-10 10-15 15 +

8) How relevant (i.e., important or significant) is a bank to your child's daily life (circle)?

   10.......20.......30.......40........50......60.......70.......80.......90.......100

   Not Relevant Moderately Relevant Absolutely Relevant

9) How relevant (i.e., important or significant) is a formal restaurant (i.e., not fast food) to your child's daily life?

10.......20.......30.......40........50......60.......70.......80.......90.......100

Not Relevant	Moderately Relevant	Absolutely Relevant

10) How relevant (i.e., important or significant) is an outdoor play structure (i.e., at a park) to your child's daily life?

10.......20.......30.......40........50......60.......70.......80.......90.......100

Not Relevant	Moderately Relevant	Absolutely Relevant

11) How relevant (i.e., important or significant) is a toy store to your child's daily life?

10.......20.......30.......40........50......60.......70.......80.......90.......100

Not Relevant	Moderately Relevant	Absolutely Relevant

12) Are there any other places you can think of that your child visits frequently during any given month? ____

____

Appendix F -- Participant Demographics/Familiarity Assessment Form: Adult

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To gain a greater understanding of our participants, we ask that you complete the information below. **<u>Please note</u>** that this information is for research purposes only and these answers will be kept confidential; no one will be able to identify you or your answers.

Please answer the questions below about yourself. Thank you!

1) Please indicate your gender: Male Female
2) Please indicate your age in years and months: __________
3) Please indicate the primary language used to communicate at home:

   ____

4) Please indicate how many times <u>per month</u> you visit a bank (circle)?

0	1-2	3-5
6-10	10-15	15 +

5) Please indicate how many times <u>per month</u> you visit a formal restaurant (i.e., not fast food)?

0	1-2	3-5
6-10	10-15	15 +

6) Please indicate how many times <u>per month</u> you visit an outdoor children's play structure (circle)?

0	1-2	3-5
6-10	10-15	15 +

7) Please indicate how many times <u>per month</u> you visit a toy store (circle)?

0	1-2	3-5
6-10	10-15	15 +

8) How relevant (i.e., important or significant) is a bank to your daily life (circle)?

10.......20.......30.......40........50......60.......70.......80.......90.......100

Not Relevant	Moderately Relevant	Absolutely Relevant

9) How relevant (i.e., important or significant) is a formal restaurant (i.e., not fast food) to your daily life?

10.......20.......30.......40........50......60.......70.......80.......90.......100

Not Relevant	Moderately Relevant	Absolutely Relevant

10) How relevant (i.e., important or significant) is an outdoor play structure (i.e., at a park) to your daily life?

10.......20.......30.......40........50......60.......70.......80.......90.......100

Not Relevant	Moderately Relevant	Absolutely Relevant

11) How relevant (i.e., important or significant) is a toy store to your daily life?

10.......20.......30.......40........50......60.......70.......80.......90.......100

Not Relevant	Moderately Relevant	Absolutely Relevant

12) Are there any other places you can think of that you visit frequently during any given month?____

____

Appendix G- Written Debriefing Form (Adults)

What are we trying to learn with this research?

This experiment is about children's and adults' ability to recall an environment or an event when levels of "familiarity" and "stereotypes" of the each environment are taken into account. We are assuming that some environments are more familiar to children (e.g. toy store, pet store, or outdoor play structure) while others are more familiar to adults (e.g. bank, restaurant, or library). Each participant was shown four images that included either stereotypical or non-stereotypical items. Following this, each participant was asked to recall everything they can remember about the images, as well as asked some particular questions about the images.

Traditionally, memory research with children suggests that children remember less information than adults after witnessing an event and are more vulnerable to memory intrusions or errors, especially when recalling an event or person who is familiar to them (Brainard & Reyna, 2010). More recent research by Brainard and Reyna (2007) suggests that children may be less vulnerable to memory intrusions that may be due to children relying more on a different part of the brain to retain memories than adults (Brainard & Reyna, 2007). The purpose of this project is to investigate if children are more or less likely than adults to report non-present objects in the images presented to them.

While research has been done to determine if the level of familiarity affects a child's accuracy of identification, less research has examined the differences that exist between adult witnesses and child witnesses when recalled a scene or an environment that is either familiar or stereotypical. Because child eyewitnesses may not have same level of exposure to certain locations than an adult would have, this may influence how much detail a witness recalls and how accurate it may be. Currently, it is unclear if having increased familiarity with an environment will increase, or decrease memory errors for children versus adults.

Why is this important to psychologists or the general public?

Determining the level of accuracy when recalling an event, particularly a crime, is of great concern because it has direct and serious consequences in the Criminal Justice System. Similar to problems of mistaken identification, memory errors recalled the environment in which a crime occurs has negative influences and can lead to wrongful convictions (Wells et al., 1998). Developing research on the most effective ways to increase accuracy in eyewitness recall can help prevent innocent people from being incarcerated.

Where can I learn more?

Brainerd, C. J., & Reyna, V. F. (2007). Explaining developmental reversals in false memory. *Psychological Science, 18*(5), 442-448. doi:10.1111/j.1467-9280.2007.01919.x

What if I have questions later?

If you wish to discuss this research any further feel free to contact any one of the following people: Kaila Bruer (Principle Investigator, 520-2600, ext. 3695) or Dr. Joanna Pozzulo (Faculty Advisor, 520-2600, ext. 1412). If you should have any ethical concerns about this study please contact, Dr. Monique Sénéchal (Chair, Carleton University Research Ethics Committee for Psychological Research, 613-520-2600, ext. 1155). Should you have any other concerns please contact, Dr. Janet Mantler (Chair, Department of Psychology, 613-520-2600, ext. 4171).

At this time we would like to thank you for taking the time to take part in this study. Your participation has been greatly appreciated. **THANK YOU!**

Appendix H – Debriefing Form - Children

I would like to thank you for helping us with our project. Your help has given us information on how well people your age can remember what they learned. People your age might be better "rememberers" about places you see more often, like a play-structure at a park. Adults might be better rememberers of places they go more often, like a bank. We are not sure, so we wanted to see how well you remembered these different places. With your help today, we can learn how often people your age can remember everything they see when they are at certain places.

Do you have any questions?

Thank you for all your help!

Appendix I - Intraclass correlation coefficient (ICC; Absolute Agreement) for inter-rater reliability of scored variables: Pilot

		ICC	95% CL	p value
Bank				
	Number of Descriptors	0.99	0.97-0.995	<.001
	Number of Correct Descriptors	0.99	0.98-0.996	<.001
	Number of Memory Errors	1.00	.	.
	Self-Report Familiarity	0.91	0.80-0.96	<.001
Restaurant				
	Number of Descriptors Recalled	0.99	0.99-1.00	<.001
	Number of Correct Descriptors	0.99	0.99-1.00	<.001
	Number of Memory Errors	1.00	.	.
	Self-Report Familiarity	1.00	.	.
Park				
	Number of Descriptors Recalled	0.99	0.97-0.99	<.001
	Number of Correct Descriptors	0.98	0.95-0.99	<.001
	Number of Memory Errors	0.93	0.86-0.97	<.001
	Self-Report Familiarity	zero variance	.	.
Toy Store				
	Number of Descriptors Recalled	0.99	0.99-.997	<.001
	Number of Correct Descriptors	0.99	0.986-0.997	<.001
	Number of Memory Errors	0.96	0.91-0.98	<.001
	Self-Report Familiarity	1.00	.	.
Overall		*M*=0.95		

Note. CL = Confidence Limits.

Appendix J - Testing of Age and Gender Effects

Age Effects

Table 7.

Age breakdown of child participants.

Age (Years)	*N*
4	6
5	62
6	32
7	6
Total	106

Given that a larger than anticipated child age range was included in the sample, age effects were examined using a series of t-tests. It was revealed that recall of those who were less than 5-years-old (i.e., 4-years-old) was not significantly different from the target age range (i.e., 5-6-year-olds), t (97) = .88, p=.38, nor from those who were older than 6 (i.e., 7-year-olds), t (10) = 1.90, p=.09. In addition, recall of those who were older than 6 (i.e., 7-year-olds) also did not significantly differ from the target age range, t (97) = .65, p=.51.

Gender Effects

A mixed ANOVA was conducted to determine whether recall was related to participants' gender. For child participants, gender was not a significant factor in the amount of information recalled, F (1, 101) = .89, p = .35. Similarly, for adults, gender was not a significant factor in the amount of information recalled, F (1, 85) = .05, p = .83.

Appendix K- List of Memory Errors made in the Adult-familiar Image (Bank) as a Function of Witness Age and Error Relevancy

Error	Age	Relevant/Irrelevant
Dinosaur	Child	Irrelevant
Potatoes	Child	Irrelevant
Dog	Child	Irrelevant
Telescope	Child	Irrelevant
Smoothie-Stand	Child	Irrelevant
Money	Child	Irrelevant
Candles	Child	Irrelevant
Kitchen	Child	Irrelevant
Phones/Telephone	Child	Relevant
Clock	Child	Relevant
Cash Register	Child/Adult	Relevant
Net	Child	Irrelevant
Numbers	Child	Relevant
Letters	Child	Relevant
Bouncy-ball	Child	Irrelevant
Remote	Child	Irrelevant
Paying-Machine	Adult	Relevant
Files	Adult	Relevant
Paper	Adult	Relevant
Sofa	Adult	Relevant
Plant	Adult	Relevant
Coffee	Adult	Relevant
Bank-machine	Adult	Relevant

Steps	Adult	Relevant
Lamp	Adult	Relevant
Animal Service Sign	Adult	Irrelevant
Bank Card	Adult	Relevant
Office Supplies	Adult	Relevant
ATM Machine	Adult	Relevant
Children's Train	Adult	Irrelevant

Appendix L—List of Memory Errors made in the Child-familiar Image (Park) as a Function of Witness Age and Errors Relevancy

Memory Error	Age	Relevant/Irrelevant
Castle	Child/Adult	Relevant
Shark	Child	Irrelevant
Toilet	Child	Relevant
Rocket	Child	Irrelevant
Cannon	Child	Relevant
Spinning Strawberry	Child	Relevant
Mat	Child	Irrelevant
Blocks	Child	Relevant
Sand castle	Child	Relevant
Tire	Child	Relevant
Poster	Child	Irrelevant
People	Child	Relevant
Bucket	Child	Relevant
Lemonade stand	Child	Relevant
Ball	Child	Relevant
Boat	Child	Relevant
Fortress	Child	Relevant
Pail	Child	Relevant
Kingdom	Child	Relevant
Turntable	Child	Relevant
Monkey bars	Child/Adult	Relevant
Truck	Child	Relevant
Tree house	Child	Relevant

School	Child	Irrelevant
Merry-go-round	Child	Relevant
Stroller	Child	Relevant
Motorcycle	Child	Irrelevant
Rocking horse	Adult	Relevant
Fence	Adult	Relevant
Carousel	Adult	Relevant
Play house	Adult	Relevant
Scooter	Adult	Relevant
Toy-truck	Adult	Relevant
Trashcan	Adult	Relevant
Skipping rope	Adult	Relevant
Table	Adult	Relevant
Pets	Adult	Relevant
Duck	Adult	Relevant
Bouncy car	Adult	Irrelevant
Water-slide	Adult	Relevant
Clock	Adult	Irrelevant
Mirror	Adult	Irrelevant

Appendix M—Relevancy Form: Bank & Park

Are these Items relevant or irrelevant to a typical bank?

	✓ Relevant (belongs)	✓ Irrelevant (doesn't belong)
Dinosaur		
Potatoes		
Dog		
Telescope		
Smoothie-Stand		
Candles		
Kitchen		
Phones/Telephone		
Clock		
Cash Register		
Net		
Numbers		
Letters		
Bouncy-ball		
Remote		
Paying-Machine		
files		
Paper		
Sofa		
Plant		
Coffee		
Bank-machine		
steps		
lamp		
Animal Service Sign		
Bank Card		
Office Supplies		
ATM Machine		
Children's Train		

Are these Items relevant or irrelevant to a park (i.e., outdoor play structure)?

	✓ Relevant (belongs)	✓ Irrelevant (doesn't belong)
Castle		
Shark		
Toilet		
Rocket		
Cannon		
Spinning strawberry		
Mat		
Blocks		
Sand castle		
Tire		
Poster		
People		
Bucket		
Lemonade stand		
Ball		
Boat		
Fortress		
Pail		
Kingdom		
Turntable		
Monkey bars		
Truck		
Tree house		
School		
Merry-go-round		
Stroller		
Motorcycle		
Rocking horse		
Fence		
Carousel		
Play house		
Scooter		
Toy-truck		
Trashcan		
Skipping rope		
table		

Appendix N- Debriefing Story /Colouring Book Prize (reduced size)

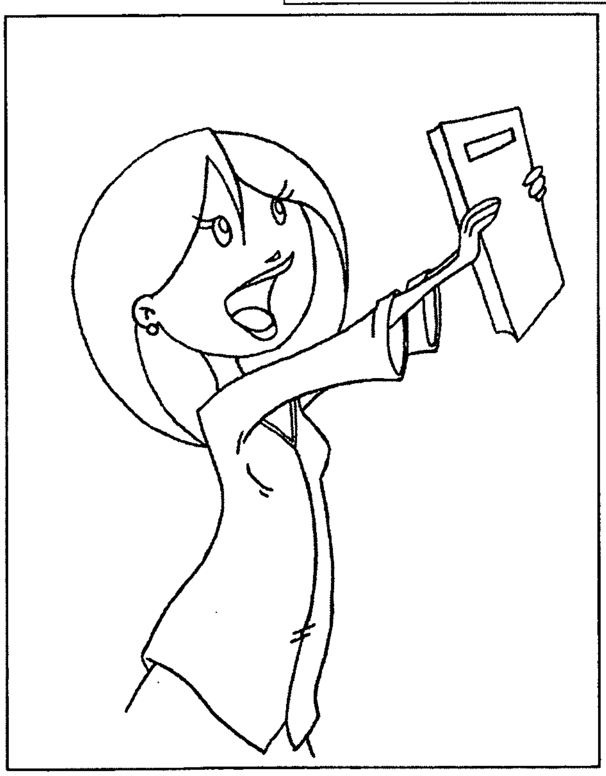
(Written by Dr. Julie Dempsey)

WHO IS THAT?

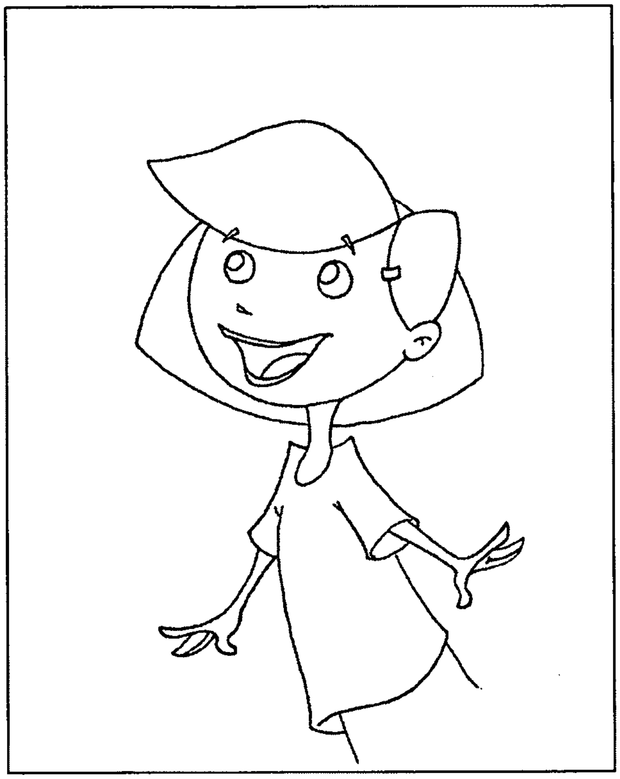
Thank you for participating in our research ☺

Dr. Joanna Pozzulo
Email: joanna_pozzulo@carleton.ca
Phone: 613-520-2600 ext. 1412

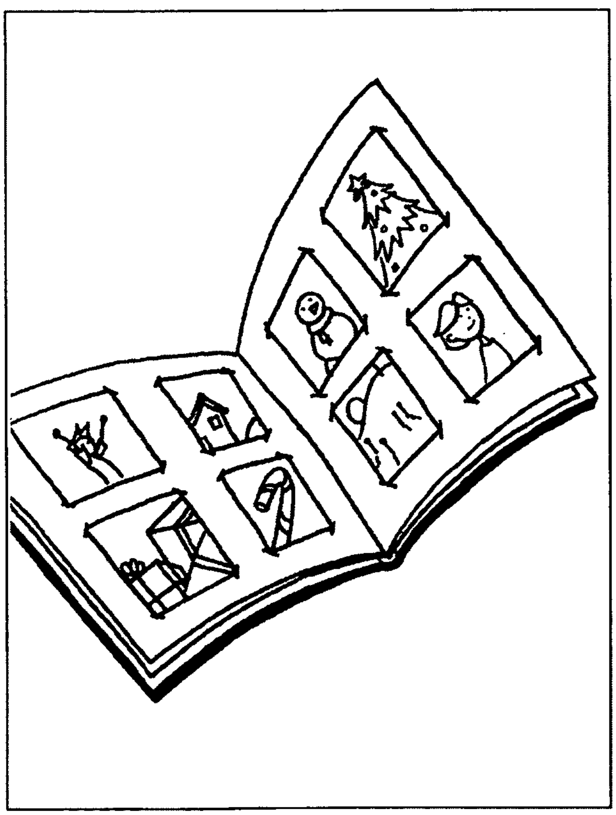
Carleton University



"I finally finished putting all the pictures in the photo album," Mom said as she held it up.

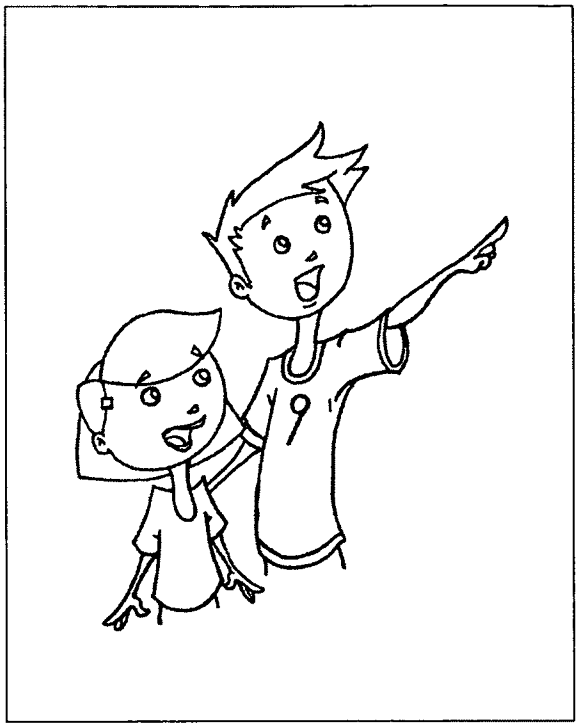


"I want to see!" said Lily excitedly.



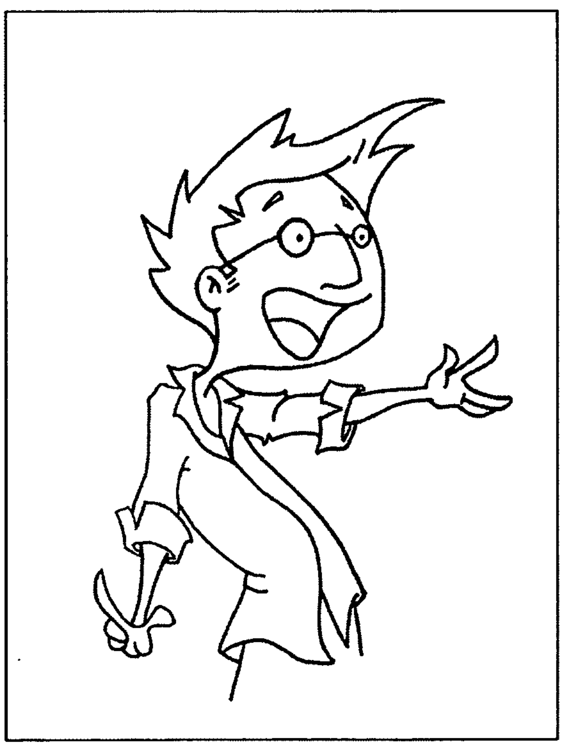
Lily opened the book.

"These pictures are from Christmas! There's a picture of the Christmas tree and one of the Snowman I built."



Lily turned the page.

"Wow! Look Mommy there's a picture of me and Daddy at the baseball game. That was so much fun."



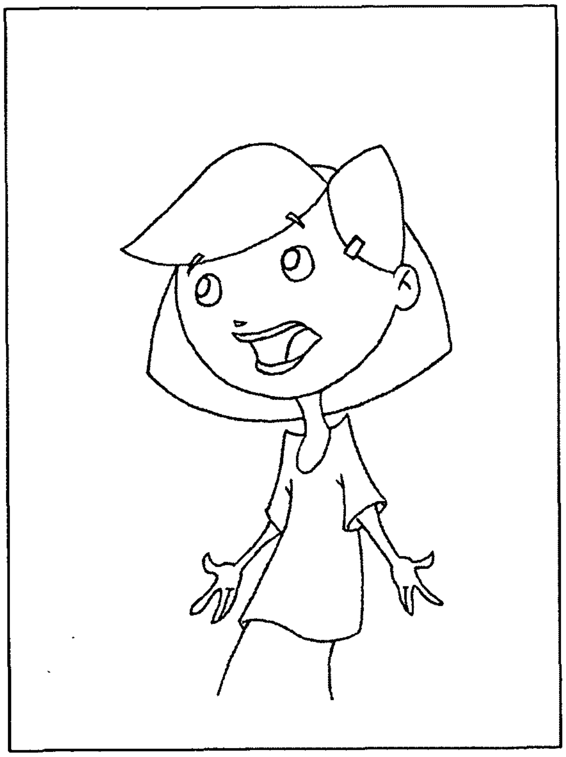
Lily looked at the next picture.

"Who is that?" Lily asked her Mom.

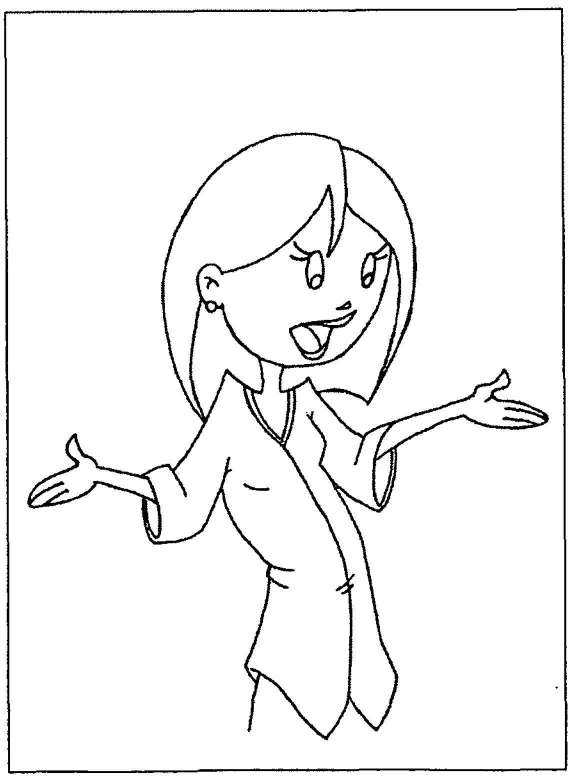
"That's Uncle George. We saw Uncle George at Grandma's birthday party."

"Oh. I don't really remember him," Lily said looking confused.

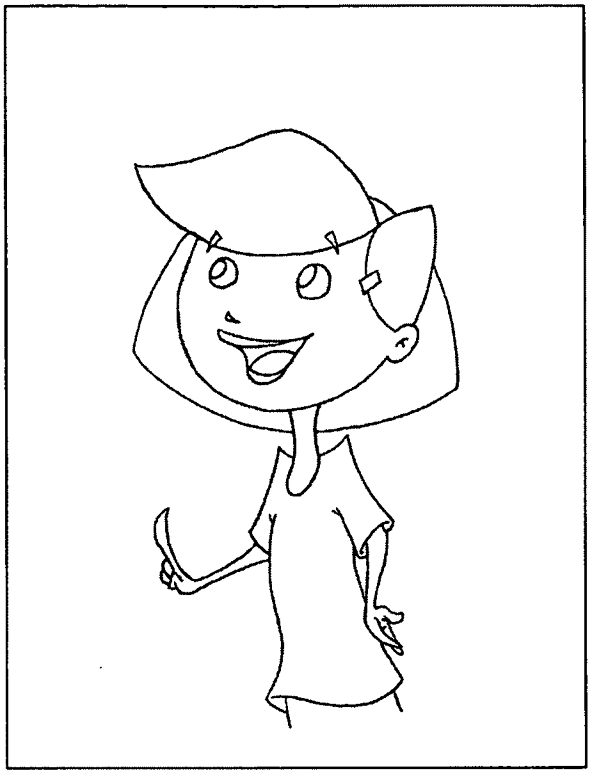
"We don't get to see Uncle George very often," Mom said.



"Mommy, why can I remember who Daddy is in the pictures, but I don't remember Uncle George?"

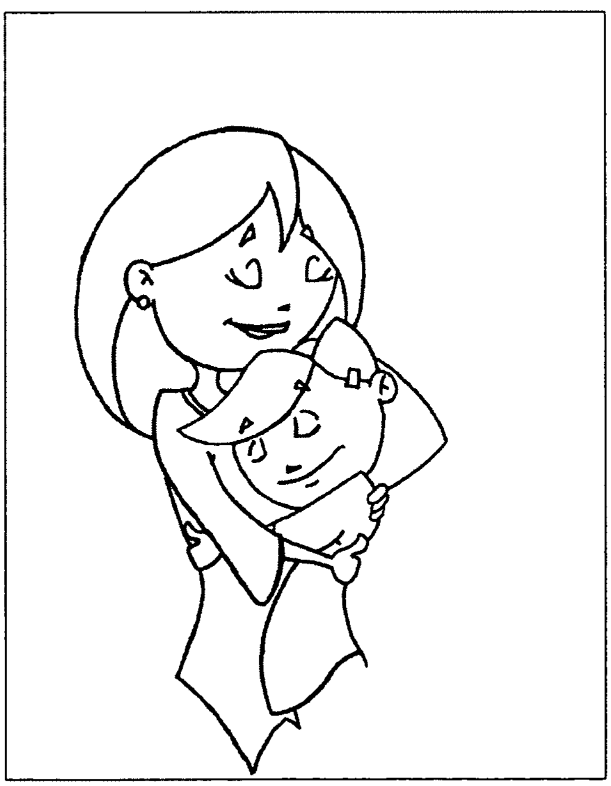


"It's easier to remember people who we see all the time and it's harder to remember people we don't see often or who we just meet. Because you see Daddy everyday it's easy to remember who Daddy is and what he looks like. It's a lot harder to remember who Uncle George is and what he looks like because we only see him once a year. Do you understand?"



"I think so Mommy. I can remember people I see all the time, but it's harder to remember people I only see sometimes."

"That's right."

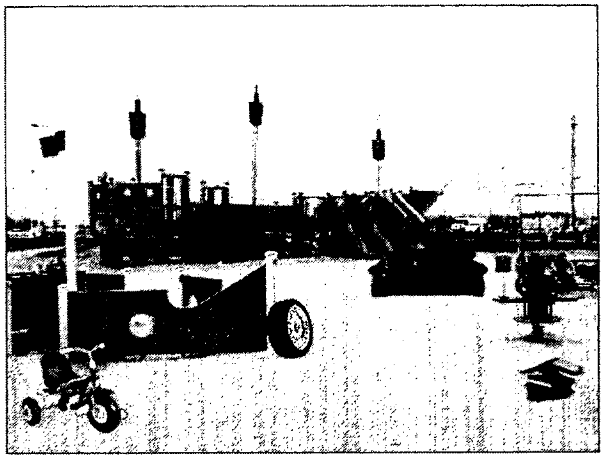


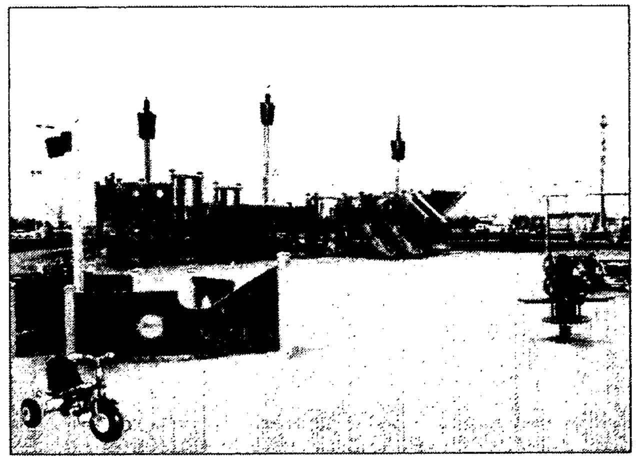
"I'll always remember you Mommy," Lily said and gave her Mom a big hug.

Appendix O—Environment Images

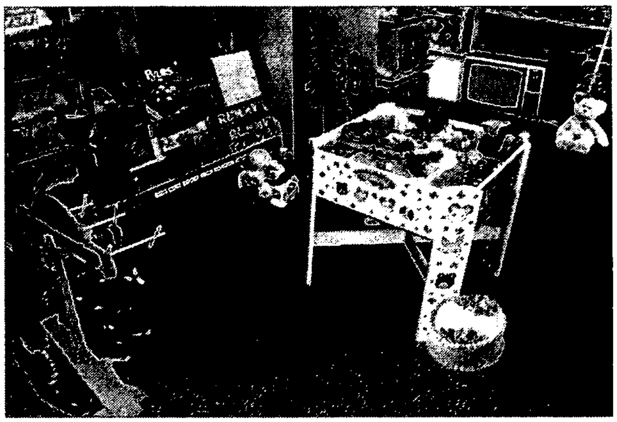
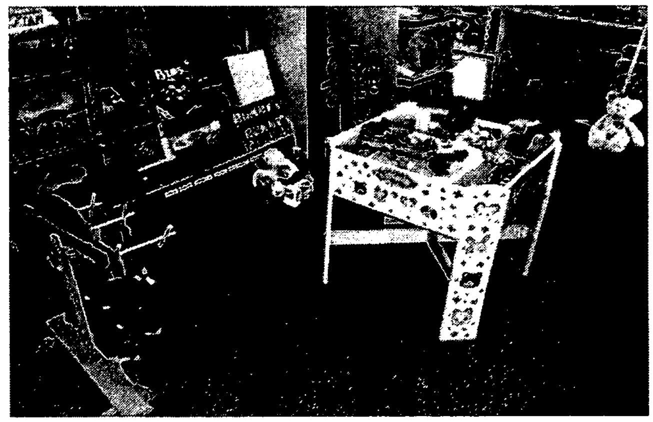
Images Analyzed

Non-Stereotypical Environment **Stereotypical Environment**





Additional Images Tested

Appendix P- Coding Manual

How to use the coding manual:

This study is interested in descriptions of OBJECTS, such as quantity, colour, shape, size. NOT LOCATION (e.g. above the door frame to the right of the pictures is a banana→ this would only be two: one for door and one for bananas).

All words that are standalone words (i.e., make sense alone) are coded as 1. Words that accompany a standalone word, but is not a standalone word itself is lumped with the standalone word to be coded as 1 (e.g., teddy bear→ bear is a standalone word so bear =1 descriptor; teddy is not a word alone, so teddy bear=1 descriptor). In the case of words where both accompanying words are standalone (e.g., book shelf), count them each as 1 descriptor unless either word is mentioned elsewhere in the response (i.e., books were on the book shelves→ book =1, book shelve = 1). Any additional adjectives should be counted as a second object. For example: teddy-bear=1; pink teddy-bear=2. For repeats of the same description=count as one. (e.g., there are two grey doors on the right and behind the two grey doors there is a....) = grey, door, two→ 3 descriptors. The coding manual is divided by general item description, thus all acceptable descriptions for any one item will be located within the same cell.

- Commas (",") separate descriptors each equalling 1 point.
- Slashes ("/") separate alternative descriptors within the same cell; all answers are valid and equal one descriptor
- Semi-colons (";") are used to separate descriptors that are related to each other (e.g., describe the same item in a different way).
- Brackets () serve to provide the coder with additional information that can help them determine accuracy of the answers.
- Prepositions are not scored; rather are used like commas (",") to separate descriptors as well as provide additional information that can help them determine accuracy of the answers.

Testing familiarity (ID accuracy of Images): Accepted Answers

- Bank: Bank, office. "work there" or "get money"
- Park: park, playground, play yard. "Play"

Bank Stereotypical	Bank Non-stereotypical
3, Long, Black, rectangular, rugs/mats	3, Long, Black, rectangular, rugs/mats
Bank/office/place where you get money	Bank/office/place where you get money
Small, Black, garbage/trash, can	Small, Black, garbage/trash, can
Hallway/corridor	Hallway/corridor
Wood/brown counter	Wood/brown counter
Separate/individual/enclosed/executive/secluded, office/glass, room with a desk, black, computer	Separate/individual/enclosed/executive/secluded, office/glass, room with a desk, black, computer
Waiting/seating area	Waiting/seating area
Round, Blue, posts/dividers	Round, Blue, posts/dividers
Silver/white, hanging, lights	Silver/white, hanging, lights
White/Cream, walls	White/Cream, walls
Grey/Blue, Screen/Poster	Grey/Blue, Screen/Poster
Black, Debit/money, machine/card-reader	Black, Debit/money, machine/card-reader
4, Big, Black, partitions/stands/posts/poles/stands, with silver/metal bottoms/bases/guard-rails	4, Big, Black, partitions/stands/posts/poles/stands, with silver/metal bottoms/bases/guard-rails
Section for lineup/lines/customer queue/line separators/rope stands/line formation/line space/railings/ boundary-line/fence (child) things that prevent you from crossing, with black, stretchy, roping/ribbons/barrier/elastic, barriers tape/strings/belts/things/dividers/guard-rails Marked area for lineup/ lineup stations/things that separate waiting lines	Section for lineup/lines/customer queue/line separators/rope stands/line formation/line space/railings/ boundary-line/fence (child) things that prevent you from crossing, with black, stretchy, roping/ribbons/barrier/elastic, barriers tape/strings/belts/things/dividers/guard-rails Marked area for lineup/ lineup stations/things that separate waiting lines
(4) little, Blue, soft/comfy, lounge, chairs/ benches/sofas/seats/love seats, with brown/birch/wood trim	(4) little, Blue, soft/comfy, lounge, chairs/ benches/sofas/seats/love seats, with brown/birch/wood trim
Hanging, white, bilingual (English and French), plastic, sign, with words	Hanging, white, bilingual (English and French), plastic, sign, with words
Exit, sign (2)	Exit, sign (2)
tiled, light, white, floor	tiled, light, white, floor
Light, blue, wall	Light, blue, wall
White, light, wall	White, light, wall
Pink, pail, with green, spots	Pink, pail, with green, spots
Light Brown, Brown, door (at back)	Light Brown, Brown, door (at back)
Window (shows separate office)	Window (shows separate office)
Black, computer, screens	Black, computer, screens
White, Thermometer/thermostat	White, Thermometer/thermostat
Multicoloured, picture/painting/poster/art (in separate office)	Multicoloured, picture/painting/poster/art (in separate office)
White ceiling	White ceiling
Bright, dangly, cylinder-shaped, Pot-lights/lights/lamps	Bright, dangly, cylinder-shaped, Pot-lights/lights/lamps
(big) White/beige/light-coloured, tiled, floor	(big) White/beige/light-coloured, tiled, floor
4, individual/separate, Teller, Stations/banking/areas counter/help-stands/ stands/shelves/booths/cubicles/stalls/customer service kiosks, with three, blue, deco's/columns/pillars, glass/frosty/opaque separators, and wooden/brown, siding/panels -in a row	4, individual/separate, Teller, Stations/banking/areas counter/help-stands/ stands/shelves/booths/cubicles/stalls/customer service kiosks, with three, blue, deco's/columns/pillars, glass/frosty/opaque separators, and wooden/brown, siding/panels -in a row
2, sit-down, desks/tables/stations	2, sit-down, desks/tables/stations
1, curvy, long, reception/main/front/help, desk/counter (to left)	1, curvy, long, reception/main/front/help, desk/counter (to left)
Black, Security, Camera	Black, Security, Camera
Glass, window/wall	Glass, window/wall
	Few, multiple, pack of, Yellow, Bananas
	Black, White, Grey, Cat/Kitty/Kitty-Cat
	Little, Yellow, Red, Toy, children's, dump, truck/bull-dozer/car
	(#) Colourful, blue, green, pink, yellow, orange, red, crayons/ markers

Park Stereotypical	**Park Non-stereotypical**
Light/white, sand/sandpit/sandbox, beach-ground	Light/white, sand/sandpit/sandbox, beach-ground
Park/play structure/playground/playset/jungle-gym/play-area for kids/children; (looks like a) big, grand, pirate ship	Park/play structure/playground/playset/jungle-gym/play-area for kids/children; (looks like a) big, grand, pirate ship
Large, long, grey-coloured, ship-like, wooden, play/climbing structure with a wood, face/walkway.	Large, long, grey-coloured, ship-like, wooden, play/climbing structure with a wood, face/walkway.
Blue, sky with clouds	Blue, sky with clouds
2, blue, slides/sliders	2, blue, slides/sliders
Pointed, triangular, red, flag on white/beige, post, pole	Pointed, triangular, red, flag on white/beige, post, pole
Red, ship-like/sail boat, play structure, fence in sand with yellow, imprinted, outlined, painted, anchor	Red, ship-like/sail boat, play structure, fence in sand with yellow, imprinted, outlined, painted, anchor
Small, three-wheeled, plastic, tricycle/bicycle with vibrant, colours; blue, seat; yellow, peddles and handles; red, bars black, tires.	Small, three-wheeled, plastic, tricycle/bicycle with vibrant, colours; blue, seat; yellow, peddles and handles; red, bars black, tires.
3, green, flags on tall, post	3, green, flags on tall, post
4, red, holes/circles/windows (in play structure)	4, red, holes/circles/windows (in play structure)
Rope, ladder/climbing thing (to climb structure)	Rope, ladder/climbing thing (to climb structure)
Grey/beige, building	Grey/beige, building
Sliding/fireman, pole	Sliding/fireman, pole
Pole with foot-loops (to climb)	Pole with foot-loops (to climb)
Stairs/Steps	Stairs/Steps
Bench	Bench
Green, teedar-toddar/children's-ride, rocking/thing that moves back and forth, structure with: two, seats; big, coils; octopus/animal	Green, teedar-toddar/children's-ride, rocking/thing that moves back and forth, structure with: two, seats; big, coils; octopus/animal
Blue, fish, bouncy, bench/see-saw/ride/toy/thing to play on	Blue, fish, bouncy, bench/see-saw/ride/toy/thing to play on
2, blue, children's, swings/swing-set/ride with yellow, plastic, bar/covering	2, blue, children's, swings/swing-set/ride with yellow, plastic, bar/covering
3, light, posts	3, light, posts
6, trees with no-leaves	6, trees with no-leaves
Green, grass/plants	Green, grass/plants
2, power/hydro, line, posts	2, power/hydro, line, posts
White, truck/van	White, truck/van
Light, Beige/brown, building	Light, Beige/brown, building
White, car	White, car
Beige/tan, car	Beige/tan, car
Cars/vehicles in parking-lot	Cars/vehicles in parking-lot
Red, blue, backpack (on red play structure)	Red, blue, backpack (on red play structure)
Sidewalk, cement, gravel	Sidewalk, cement, gravel
	Old-style, rotary-dial/turn-dial, black, telephone
	Stack/pile of blue books with yellow/beige and red paper and black spine.
	Black lamp/light
	Brown/purple leather couch/chair
	Tricycle/bicycle/bike(3 wheels)/red/yellow/blue/3-wheeler