

Children's Memories Of Dental Procedures: Effects Of Individual Differences, Question
Type And Temporal Delay

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Abstract

This study explored external and internal factors and their effect on children's memory of a naturalistic, potentially stressful event, namely, a dental procedure. Specifically, question format (yes/no questions versus multiple choice questions) and temporal delay (short delay versus long delay) were the external factors examined, while anxiety, temperament, distress level, working memory and previous experience were the internal factors examined. Children (N=68) aged 4-12 years and their parents participated. Prior to the procedure, children provided ratings of their current anxiety on an anxiety rating scale. Following the procedure, children provided pain ratings and were given 24 forced choice questions regarding the dental event. Parents responded to questions regarding their child's previous medical experiences and temperament via a questionnaire. The findings suggest that: (a) multiple-choice questions are more problematic than yes/no questions, (b) that younger children are more suggestible than older children, especially when asked "no" and "absent feature" questions; (c) children who report more pain and anxiety, and whose parents describe them as less sociable, evidence higher rates of suggestibility; and (d) after a two month delay, on average, children accurately recalled their pain for the dental event, however, higher trait anxiety scores were associated with higher recollection of experienced pain. The findings are discussed with respect to implications for interviewing children and for management of pain in clinical settings.

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DEDICATION

This thesis is dedicated to my parents, Alirio dos Santos Rocha and Maria Edite Margarido Rocha. Growing up I watched two people with thick calluses on both hands work 15 and 16 hours a day to create a better childhood for their children than the ones they lived. Two people who came to Canada with little education, unable to speak the language, who taught me all I needed to know about faith and hard work by the simple eloquence of their example.

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List of Abbreviations

ANOVA	Analysis of Variance
CAMPIS-R	Child-Adult Medical Procedure Interaction Scale
CMS	Children's Memory Scale
CWP	Chronic Wide-spread Pain
EAS	Emotionality, Activity, Sociability
FPS-R	Faces Pain Scale - Revised
FTT	Fuzzy Trace Theory
LP	Lumbar Puncture
MANOVA	Multivariate analysis of variance
OSBD	Observational Scale of Behavioral Distress
TABC	Temperament Assessment Battery for Children
STAIC	State-trait Anxiety Inventory for Children
VAS	Visual Analogue Scale
VCUG	Voiding Cystourethrogram

Chapter 1: Children's Memories of Dental Procedures: Effects of Individual Differences, Question Type and Temporal Delay

Studies that have examined children's recollection of personal or stressful events demonstrate that young children can make significant errors in their memory reports, sometimes claiming that entirely untrue events occurred (e.g., Ceci, Loftus, Leichtman & Bruck, 1994; Poole & Lindsay, 1995). On the other hand, research findings also indicate that even young children can, at times, recall such experiences quite well and can even maintain resistance to misleading questions (Merritt, Ornstein, Spicker et al., 1994; Saywitz, Goodman, Nicholas & Moan, 1991). Because of such variability in findings, it is important for researchers to investigate factors that might influence the reliability of children's reports. To this end, researchers have begun to examine the influence of two different classes of factors that may affect children's vulnerability to making false reports. As described by Ceci, Bruck and Melnyk (1997), the first set of factors is considered external to the child and may include interviewing factors such as the context of the interview, the structure of the interview or the characteristics of the interviewer. The second set of factors is considered internal to the child as it relates to the child's developmental stage, or the child's social, emotional, biological and cognitive functioning.

Results from studies on external and internal factors will provide insight, not only into why some children are highly accurate and others are particularly prone to being misled, but also why, across studies, children's memory capabilities and

susceptibility to false suggestions appear to vary quite substantially. Furthermore, knowledge about internal factors may also help identify children who are more or less susceptible to erroneous narrative reports following misleading suggestions (Quas, Qin, Schaaf, & Goodman, 1997). This knowledge is important in legal settings where guilt or innocence may be determined based on a child's testimony.

Investigations of memory for distressful events may also have the added benefit of informing pediatric health psychology research and practice. For example, such knowledge may help tailor treatment regimens to children's individual predispositions. Indeed, a recent study has shown that reframing children's memories of previous lumbar punctures (LPs) so as to encourage recall of positive aspects of the procedure improves coping and decreases distress during subsequent LPs (Chen, Zeltzer, Craske, & Katz, 1999).

The main goal of the present study was to investigate how external factors (suggestive questioning techniques, delayed interviewing) and internal factors (individual differences such as temperament, previous experience, distress level, working memory capacity and anxiety) influence children's suggestibility and accuracy for a potentially distressful procedure – a dental procedure. A second goal of the present study is to examine how the aforementioned internal factors and one external factor (temporal delay) influence children's recollection for their self-reported pain/distress after a delay. The effect of question type will not be examined in relation to children's memory for pain/distress because distress will be measured via only one type of question.

In the next section, the importance of the present research to both the eyewitness testimony and pediatric health psychology literatures is discussed.

Theories regarding children's memories and suggestibility for distressful events are reviewed. Next, two external factors predicted to influence accuracy and suggestibility – type of questions asked and influences of delayed interviewing - are examined. Following is a review of some specific internal factors proposed to influence accuracy and suggestibility, namely age, cognitive factors and social-personality factors. Individual differences due to cognitive variables and those relating to social-personality variables are delineated, following the parameters established by Quas et al. (1997). The specific research questions and hypotheses are proffered, followed by the methodology, results and discussion sections.

Importance of Studying Memory and Suggestibility for Distressful Events

Throughout their lives children endure a variety of distressful experiences that may be caused by illness, dental, medical and surgical procedures or hospitalisation. It is also the case, unfortunately, that many children often witness crimes or violence in their homes (Kenning, Merchant & Tomkins, 1991; Pynoos & Eth, 1986) and schools (Pynoos & Nader, 1989). In addition, many children are victims of physical and sexual maltreatment (Finkelhor, Williams, Burns & Kalinoweski, 1988; Terr, 1990; Zimmerman, Wolbert, Burgess & Harman, 1987). In the last decade, researchers have noted that children's memories of these distressful events may be qualitatively different than memories for nondistressful events. Specifically, it has been suggested that negative life events might be given special status in children's memories (Goodman, Hirschman, Hepps & Rudy, 1991).

Research focussing on children's memory of distressful procedures is of considerable importance to several "basic" and "applied" issues in psychology.

Specifically, research on children's memories of distressful procedures may inform research on children's eyewitness testimony and may also provide information as to what children recall about distressful procedures and ultimately aid in the prevention of procedural distress and later medical avoidance. Both are discussed below, in turn.

Importance to Eyewitness Testimony

Each year thousands of children in North America are involved in the legal system (Ceci & Bruck, 1995). Indeed, by the late 1980's increasingly more young children were being asked to testify in court, particularly in cases involving sexual abuse (Bruck, Ceci & Melnyk, 1997). Often these children testify about the alleged actions of a parent, teacher, babysitter, relative or neighbour. When this happens, the case is often decided based on the relative credibility of the child versus the defendant. Such testimony may result in life-altering decisions for those involved. Therefore, it is important to better understand the factors, both beneficial and harmful, that influence children's testimony.

In many legal situations, the events about which children provide testimony are highly distressing personal experiences. A great deal is known about age-related changes in children's abilities to provide verbal reports about distressful events (Goodman, Quas, Batterman-Faunce, Riddlesberger, & Kuhn, 1997; Merritt et al., 1994). However, only recently has attention been paid to understanding the individual difference factors that may influence children's recollections and suggestibility for distressful events. Suggestibility can be defined as the extent to which individuals come to accept information introduced after an event has occurred (e.g., via questioning). This post-event information may actually become incorporated into their memory recollections (Gudjonsson, 1986), such that children recall events that did not

occur. Understanding the effect of internal factors and external factors such as questioning techniques and effects of temporal delays on accuracy and suggestibility for distressful events will also inform theory, research and clinical practice (Peterson & Grant, 2001). For example, for scientists, research may elucidate the nature of memory, its malleability and strengths, as well as its complex workings and development. For practitioners, it has the potential to inform interviewers of all sorts (e.g., law enforcement personnel, social workers, teachers, medical professionals, attorneys) about how to obtain the most accurate and credible information from children.

From previous research, we know that, under some circumstances, children's recall can be very accurate over multiple interviews and across time (Fivush & Hammond 1990; Fivush, Hammond, Harsch, et al., 1991). For instance, Hammond and Fivush (1991) interviewed preschool children about a trip to Disneyworld experienced with their families when the children were between 2.8 and 4.5 years of age. The interviews took place either 6 or 18 months after the vacation. Children reported about 20% of the detail about their vacation spontaneously, with children interviewed after 6 months providing more details than children interviewed at 18 months. All children, regardless of their age or the time at which they were interviewed, were able to recall some details of the vacation when questioned about specific experiences.

Even though research suggests that children can recall aspects of their experiences, the completeness and consistency of children's autobiographical recall are quite dependent on several external (e.g., question repetition, question type, cues, delay) and internal factors, the importance of which are briefly outlined below. For

example, external factors present in the interviewing environment influence accuracy and suggestibility. When questions are repeated during interviews, the accuracy of reports is compromised. This may be due to social demands; that is, adults do not usually repeat questions in normal conversation unless the listener failed to give the desired answer, and hence children sometimes change their answers when specific questions are repeated (Poole & White, 1991, 1993; Siegal, 1991). In addition, repeating specific questions (e.g., Did the doctor have a red beard?) during an interview tends to elicit inconsistency and speculation among children (Poole & White, 1991, 1993).

The availability of cues (e.g., specific questions, anatomically correct dolls) can also affect recall, with more and/or better cues increasing the completeness of recall. However, different sets of cues and/or different interviewers may evoke recall of different subsets of an experience, leading to inconsistent reporting (Hudson, 1990). We also know that specific questions (e.g., Did the doctor take off your socks?) and even specific and leading questions (e.g., The doctor took off your socks, didn't he?) can serve as retrieval cues for young children's recollections, however, the number of errors also commensurately increases (Dent, 1982). Specific questions are seen as risky because they may introduce details that were never encoded or are no longer remembered by the child (Poole & Lamb, 1998). This raises the risk of error because both children and adults show poorer memories as critical details become more peripheral (Goodman et al., 1997). Secondly, children often try to answer specific questions that are nonsensical (e.g., Is a cup sadder than an orange?; Pratt, 1990). Understanding how different cues or questioning techniques influence

children's reports is important because specific questions are commonly used while interviewing young children (Peterson & Grant, 2001).

The length of the delay before questioning occurs is another external factor that will affect recollection and suggestibility for previous experiences. Given that delays of between 2- and 10- months between referral for prosecution and trial or other depositions have been cited in the literature (Whitcomb, 1992), it is imperative that researchers, and those involved in the judicial system, understand the impact of delay on children's recall of meaningful events.

Although there has been marked improvement in understanding external factors that influence children's reports of meaningful events (e.g., Poole & Lamb, 1998), researchers suggest that information is still needed to develop methods of interviewing children that elicit information that is maximally accurate and that minimises suggestibility (Peterson & Grant, 2001; Poole & Lindsay, 1995). That is, we need to decrease the characteristics of questioning that push a child to respond in a particular way.

Compared to studies examining external factors, there have been fewer studies examining internal factors. Still, researchers are beginning to identify individual differences that affect children's memory and suggestibility. This move is an effort to understand why children, even in the same age group, can perform so differently within and across studies, and to help identify children who are more or less susceptible to providing erroneous reports following misleading suggestions (Quas et al., 1997). In future research it will be important to ascertain the degree to which such individual-difference factors affect children's memory generally versus children's memory only for certain types of experiences, such as stressful experiences (Quas,

Goodman, Ghetti, & Redlich, 2000). Such investigations may help identify children who are susceptible to providing false reports following misleading suggestions and therefore would be beneficial in legal settings where verdicts are sometimes decided on the basis of a child's testimony.

Importance to Pediatric Health Psychology

In addition to benefiting eyewitness testimony literature, studying memory and suggestibility for distressful events may have the added benefit of informing theory and research in pediatric health psychology. Specifically, increasing knowledge about factors influencing memory for distress may have implications for the management of children in medical settings in which they experience and/or remember pain and discomfort. In the pediatric health psychology literature, there exists much research on factors influencing children's reactions to distressful procedures (e.g., Fradet, McGrath, Kay, Adams & Luke, 1990; Jay, Ozolins & Elliott, 1983; Katz, Kellerman & Siegel, 1980; Rocha, Prkachin, Beaumont, Hardy & Zumbo, 2003), however, there has been little systematic work on how and what children remember about such events and what factors may influence these recollections.

Distressful experiences may involve both pain and more global concepts, such as strain (force or influence that puts pressure on something) and anxiety (worry, nervousness that something bad might happen). Pain has been defined by the International Association for the Study of Pain (IASP) as an unpleasant sensory and emotional experience which is associated with actual or potential tissue damage, or may be described in terms of such damage. Thus, pain is typically seen as a sensory and emotional response to some nociceptive input. Indeed, researchers who study childhood pain understand that the "unpleasant sensory and emotional experience"

may also include feelings of fear, anxiety, loneliness, anger and sadness. The concept of distress can also encompass several psychological constructs such as pain, anxiety, fear, or sadness, but need not necessarily be a response to nociceptive stimulation. For example, during a dental visit to have a cavity filled, all children will experience some, albeit minimal, tissue damage (e.g., needle poke), which could result in the experience of pain. The observed distress response to the needle will include pain, but also a mix of other negative emotions. The child may exhibit distress due to anxiety about the possibility of pain or unfamiliarity of the situation or being restrained in an uncomfortable position, which is not associated with pain per se. Although such distress behaviour can contribute to increased pain response, it can also occur independently of pain. In the present study, children will be asked to report specifically on their level of pain (i.e., “how much it hurt”). Of course, as mentioned, the presence of various other negative emotions may influence their pain reports. As such, the present study will use the term pain/distress throughout.

The fact that the experience of pain, and therefore distress in response to pain, is associated with “actual or potential tissue damage” highlights the importance of memory in the assessment of previous experience with pain. To refer to the dental example once again, if a child recalled a previous dental filling in which she experienced extreme distress and pain, she may exhibit an exacerbated response to her current filling because she has assessed the potential threat of tissue damage to be high. Thus, children’s expectations of future experiences of distress and pain will be influenced by their previous memories (Merskey, 1979).

From the pediatric health psychology literature, we have learned a great deal about the factors that influence children’s pain behaviour. For example, we know that

pain tends to vary as a function of developmental differences (e.g., Bournaki, 1997; Fradet et al., 1990; Jay et al., 1983), individual differences such as temperament (e.g., Rocha et al., 2003; Schechter, Berstein, Beck, Hart & Scherzer, 1991) and the quality of prior experience with painful events (Bijttebier & Vertommen, 1998; Dahlquist, Gil, Armstrong et al., 1986; Frank, Blount, Smith et al., 1995; Rocha et al., 2003). Prior experience and knowledge about painful situations may also have a profound effect on anxiety and stress in anticipating an upcoming painful event and also on one's response in a current painful situation (Ornstein, Manning & Pelphey, 1999). Thus, it follows that what the child recalls about the experienced event would also influence pain behaviour.

Increasing our knowledge of memory for painful events is important for several reasons. First, clinicians use children's recall as a source of evidence, at least in part, both in diagnosis and assessing improvement following treatment. Thus, knowledge of factors that affect bias and distortions in memory could help clinicians in their interpretations of patients' reports (Erskine, Morely & Pierce, 1990). Memory for pain is often implied in assessment instruments used in research. For example, scales measuring pain behaviour may be anchored 'no pain' and 'most extreme pain' indicating that children are to compare their current pain with a pain memory. To do this children have to encode the level of pain accurately and then retrieve the representation and compare it to their current pain. Such a complex process is likely influenced by the developmental level of the child as well as individual difference factors that may mediate the level of attention paid to the pain experience.

The examination of children's memory for pain is also important because evidence suggests that memory for painful events may be related to later pain and

illness behaviours. It has long been known that patterns for exhibiting illness behaviours develop in childhood and carry on into adulthood (Mechanic, 1980). Research has suggested that children's memories of early medical experiences may affect their later fear and pain levels, as well as their tendency to avoid medical situations (Pate, Blount, Cohen & Smith, 1996).

Given that memories of previous medical experiences may influence later medical behaviour, it follows that interventions that serve to prevent the development of negative memories may be beneficial. Indeed, recent research suggests that this is the case. Cohen, Blount, Cohen et al. (2001) compared the effects of psychological (distraction with a movie) intervention, pharmacological intervention (eutectic mixture of local anesthetics: EMLA) and typical care (no intervention) on children's memories of a hepatitis B vaccination (a series of three intramuscular injections given over a 6-month period) after a 6 month delay. They found that distress ratings did not differ between the three intervention groups immediately following the injections. However, after six months, children recalled that the treatment conditions (psychological and pharmacological) were superior to control conditions (typical care) for distress relief. The authors report that the intervention did not distort memories in a positive sense (i.e., sway children to believe the injection was less painful than they had thought), but rather seemed to have buffered the children from forming negative recollections that occur with typical care (e.g., children with typical care recalled experiencing more pain than they initially reported). The study was conducted with low income, inner city African American children, and therefore, is limited in its generalizability beyond children with those characteristics.

Research also suggests that a child's memory of an early painful medical procedure may diminish the effect of analgesia provided during subsequent procedures. For instance, Weisman, Bernstein and Schechter (1998) examined the consequences of inadequate analgesia during repeated painful procedures (bone marrow aspiration and/or lumbar puncture) in children with cancer. Children were randomly assigned to either an active drug group or a placebo control group for a study of the efficacy of oral transmucosal fentanyl citrate in alleviating pain during painful procedures. During the second procedure, all children received adequate anaesthesia. For children under eight years of age, reported pain was consistently higher for those children who received placebo initially compared to those who received anaesthesia. Thus, children who were not provided with adequate analgesia, and would therefore likely experience and recall their pain, exhibited exacerbated pain response during a second procedure during which they *were* provided with adequate analgesia.

The authors suggested that if a child has a painful experience with a procedure, the memory of that experience may cause anxiety about subsequent procedures. This anxiety might influence the degree of pain the child reports feeling during later procedures. Alternatively, it is possible that "memory" of pain in the nervous system may have resulted in neural sensitisation or hyperexcitability, which requires larger doses of analgesics to suppress (IASP: Clinical updates, 1999). This hypothesis would be consistent with the findings of Taddio, Katz, Hersich and Koren (1997). These researchers studied the effects of neonatal circumcision and its association with pain responses to routine vaccination at four or six months, and

found that circumcised infants had higher behavioural pain scores and cried longer than non-circumcized infants.

Memory for pain has also been implicated in the establishment of chronic pain syndromes. Researchers suggest that the memory of pain can actually be more damaging than its initial experience (IASP: Clinical updates, 1999). For example, the severity of acute pain has been shown to influence the development of chronic pain (Tasmuth et al., 1995). In addition, Flor and Birbaumer (1994) suggested that the sensory re-experiencing of a pain representation might actually provide a mechanism for the maintenance of chronic pain in the absence of any measurable tissue damage. A recent study compared recall of adverse events in childhood in a population of adults with chronic wide-spread pain (CWP) and in adults with no pain problems (McBeth, Morris, Benjamin, Silman & MacFarlane, 2001). The researchers found that the CWP group significantly over-reported remembering having experienced adverse child events (e.g., hospitalisations, loss of parent, physical or sexual abuse) when compared to the no-pain group. Thus, the CWP group, according to medical records, did not actually experience more adverse events in childhood than the no-pain group, but apparently erroneously recalled such events.

There also exists some research on children with chronic pain and memory biases. For example, similar to research with adult chronic pain patients (e.g., Pincus, Pearce & McClelland, 1993), children with chronic pain have been found to recall more pain-related words and to process pain-related information faster than children without chronic pain (Koutanji, Pearce, Oakley, & Feinmann, 1999). These changes in information processing seem to occur because of suffering from long-term pain.

Once such information processing biases are in operation, they could exacerbate the pain experience.

In sum, the foregoing provides the rationale for understanding the relevance of research on children's memory for distressful events to both eyewitness testimony and pediatric health psychology domains. The next section describes the theories that may help explain the roles of external and internal factors in recall accuracy and suggestibility for distressful events.

Theories Regarding Children's Memories and Suggestibility for Distressful Events

In this section, a conceptual understanding of memory and suggestibility is presented. Next, several theories pertaining to memory and suggestibility are discussed. Finally, Fuzzy Trace Theory (FTT) is reviewed in more detail.

Researchers who study memory and suggestibility have developed several approaches for thinking about the workings of the human memory system. Despite numerous views on how memory works, most researchers agree that memory is a constructive rather than a reproductive enterprise (Ceci & Bruck, 1995). As described by Ceci and Bruck, memories are not passively recorded by one's senses, and then stored in their initial quality; nor are memories mechanically accessed in their original state when one tries to remember them. Rather, because of the constructive nature of memory, we sometimes add, delete and shape memories of our experiences. These transformations can occur at the time of the initial recording (encoding) of the event, during storage of the event or at the time of retrieval of the event.

Understanding this conceptualisation of memory provides a basis for understanding the process of suggestibility. In the extant research, there are two

contrasting views of suggestibility. The first, and traditional, view defines suggestibility as memory based, that is, as the extent to which individuals come to accept and subsequently incorporate information provided after an event (e.g., via questioning) into their memory recollections (e.g., Powers, Andriks, & Loftus, 1979). From this perspective, suggestive questioning actually alters children's memories of the event. Thus, if children are asked the suggestive question, "The dentist said a curse word, didn't she?" and respond affirmatively, that incorrect detail will become a part of their memory for the event.

The second view of suggestibility is socially-based and defines suggestibility as the extent to which, within a closed social interaction, people come to accept messages communicated during formal questioning, which results in their responses to the questions being affected (Gudjonsson & Clark, 1986). Thus, from this socially-based perspective some children are more likely than others to defer the contents of their memories to their beliefs about what the interviewer wants them to report (i.e., acquiescence). This view does not imply that memories of the event are actually altered.

Researchers attempting to determine the relative importance of social versus memory-based, or cognitive, factors have found inconsistent results (Ceci & Bruck, 1995). Consistent with the conceptualisation of Reyna and Lloyd (1997), it seems more likely that both factors interact to influence suggestibility effects. For instance, it is possible that the degree to which social factors play a role has a cognitive basis. When memory traces are weak (or when there is no memory for the original event) children may be more compliant and willing to accept suggestion because there is no competing trace to challenge the suggestion. On the other hand, when the traces are

strong, the child is less likely to incorporate misleading suggestions into memory. Ceci and Bruck (1995) suggest that the opposite may also be true – that it is possible for social factors to underlie the effectiveness of cognitive mechanisms (e.g., encoding) in producing suggestibility. For example, a child may attend more to suggestions from an authority figure (a social factor), which may ensure greater encoding (a cognitive factor). This broader conceptualisation of suggestibility allows for the consideration of a range of internal and external factors in memory and suggestibility processes.

If, as has been suggested, variations in memory for distressful events do reflect the interaction of different external and internal factors, then theoretical underpinnings of these effects need to be considered. Unfortunately, researchers report a dearth of theory-driven research on factors relating to children's memories and suggestibility for distressful events (Ornstein et al., 1999; Reyna, Holliday & Marche, 2002). Nevertheless, there are several theories available that may help to explain both external and internal differences in memory and suggestibility. Two theories often used to explain individuals' memory for event details are the Yerkes-Dodson Law and the Easterbrook Hypothesis. Theories used to explain suggestibility have included Gudjonsson and Clarke's (1986) socially based model, source monitoring theory's cognitive based model, and FTT - an overall model of cognitive development that attempts to account for both socially and cognitively based suggestibility effects. These theories will be briefly outlined below.

Regarding memory for event details, researchers have looked to various theories including the Yerkes-Dodson Law and the Easterbrook Hypothesis. Yerkes and Dodson (1908) proposed an inverted-U-form relation between physiological

arousal and cognitive efficiency or performance that has since been used to predict the relation between distress and memory in people. It is assumed that an increase of arousal from very low levels to moderate levels causes more cognitive resources to be available and increases the rate of mental and response operations. However, if the arousal level exceeds a hypothetical threshold on the arousal continuum, then mental efficiency begins to decline. Recent research suggests that the relationship between arousal and memory may not be so straightforward and contemporary findings do not often find support for the theory (e.g., Burke, Heuer, & Reisberg, 1992; Christianson & Loftus, 1987; Goodman, Hepps, & Reed, 1986).

Easterbrook (1959) reinterpreted the Yerkes-Dodson law in terms of changes in attentional focus, suggesting that attention to relevant cues increases at optimal levels of stress, but then decreases as stress becomes high. Therefore, under high stress, people concentrate on fewer features in their environment and many features get less attention. Research with adults (e.g., Christianson & Loftus, 1987; 1991; Yuille & Cutshall, 1989) provides some support for the Easterbrook hypothesis; however, studies with children have not supported Easterbrook's hypothesis (Goodman et al., 1991; Peters, 1987; Vandermaas, Hess & Baker-Ward, 1993). The discrepancy in adult and child findings suggests that developmental differences may mediate the processing of information in distressful situations and theories used to make predictions on relationships between child distress and memory should take into account possible developmental differences.

Gudjonsson and Clark (1986) developed a socially-based model of suggestibility that has been frequently examined with adults and adolescents. In this model, suggestibility is defined as the extent to which, within a closed social

interaction (e.g., an investigative interrogation), people's accounts of events become altered by misleading information and inter-personal pressure within interviews (Gudjonsson, 1984).

As described by Gudjonsson (1988), suggestibility is viewed as dependent upon the coping strategies that individuals can generate and implement when dealing with the uncertainty and expectations of the interrogative situation. Specifically, a non-suggestible coping strategy involves a critical analysis of the situation and a facilitative problem-solving action, whereas a suggestible coping strategy involves 'cognitive avoidance' and a lack of facilitative problem-solving action. For example, a typical coping strategy of highly suggestible people, according to the model, is to give answers that seem to them plausible and consistent with the external cues provided during the interview, rather than critically evaluating each question and only giving affirmative answers to questions they clearly remember. In addition, motivational variables move the individual towards accepting or rejecting suggestions. Subjective or motivational factors (e.g., the need to reduce uncertainty and anxiety, fear of negative evaluation, social avoidance, lack of assertiveness) may influence the coping strategies that people use to deal with uncertainty during interrogation.

In contrast to Gudjonsson and Clark's (1986) socially based model, the source-monitoring framework provides a cognitive, or memory-based, explanation for suggestibility. Specifically, suggestibility occurs when individuals erroneously identify the origin of their memories (i.e., misattribution of the source) (Johnson, Hashtroudi & Lindsay, 1993). For example, source monitoring might involve remembering in what place or at what time an event occurred, or identifying the

speaker of some verbal information and keeping track of who did or said what. If one cannot remember the source of a false detail that that was verbally presented by the interviewer (e.g., the dentist took your temperature, didn't she?), one could come to believe that it was actually experienced or seen, rather than suggested. According to the source monitoring framework, both the memories of the actual experience and the suggested information (e.g., via questioning) could remain separate and intact, but information about their sources might not be accessed (e.g., Zaragoza, Lane, Ackil, & Chambers, 1997). Thus, this view would predict that accurate information exists in memory and can potentially be accessed.

Reyna and Lloyd (1997) suggest that the source-monitoring framework cannot explain some findings in memory research and suggest that FTT can explain differences in source confusions, while also allowing for a socially-based explanation of suggestibility findings. FTT (Brainerd & Reyna, 1993; Reyna & Brainerd, 1995; Brainerd, in press) is considered a global model of cognitive development. Regarding suggestibility, the theory posits that, as was mentioned, suggestibility can exist on a continuum from a memory-based to socially based process. At one end of the continuum, internal, or memory based, processes are said to influence suggestibility (e.g., false recognition effects) while at the other end of the continuum, external or socially-based processes are said to influence suggestibility (e.g., repeated questioning) (Reyna & Lloyd, 1997). Because of FTT's broad-based nature encompassing both general memory, as well as suggestibility, as well as its strong research base (Bjorklund, 2000), it will be used as a guiding theory for the hypotheses in the present research, whenever possible. A more thorough description of FTT as it pertains to suggestibility is described below.

Fuzzy Trace Theory

External factors affecting children's memories and suggestibility have been explained using tenets of FTT (Reyna 1992; 1998). Although FTT does not explicitly predict how memory might operate under potentially stressful conditions such as dental procedures, it does provide insight into how certain situations, some examples of which are provided below, may make individuals prone to increases in suggestibility. Following this discussion is a review of how FTT may explain true and false reporting on recognition memory tests; these principles will guide predictions in the present study whenever possible.

Fuzzy Trace Theory assumes that people prefer to think, reason and remember by processing in-exact "fuzzy" memory representations rather than working logically from exact, verbatim representations. These memory representations (or traces) exist on a continuum from literal, verbatim representations to fuzzy, imprecise gist-like traces that are stored in parallel. For example, after a routine physician visit with your child you possess verbatim memories of any painful procedures, important dialogue and perhaps unique or novel experiences, as well as a gist memory of having gone to the doctor. The gist memory is not simply a remnant of faded verbatim memories. Instead, it is comprised of one's comprehension of this outing. When one tries to retrieve these memories, the verbatim and gist memories are dissociated from one another. For example, an individual may be able to clearly recall her child having a temper tantrum as she exited the vehicle without remembering that it occurred on her way to visit the physician.

Research has shown that, generally, verbatim memories are more susceptible to interference and forgetting than gist memories (Reyna, 1995; Reyna & Brainerd,

1995). However, some verbatim memories remain accessible for a lifetime, for example, you may be able to recall exactly where you were when the space shuttle Columbia exploded. FTT also states that shortly following an event, both accurate and non-accurate recollections of the experience tend to be based on different types of memories (verbatim and gist). For instance, the day after the physician visit you may correctly report that your child had his/her temperature checked and falsely report that your child received a balloon at the end of the visit. The true report is likely due to retrieval of verbatim memories, while the false report is likely due to reconstruction from a gist memory (your child usually receives a balloon after visiting the doctor). As time goes by, however, verbatim memories fade more rapidly than gist, thus, true reports come to be based on the same memory mechanism as false reports (i.e., reconstruction from the gist of experience).

The processing of these fuzzy and verbatim memories varies with development. Although young children do extract some gist, early in life children are biased toward storing and retrieving verbatim traces (Brainerd & Gordon, 1994; Marx & Henderson, 1996) relative to older children and adults. A verbatim-gist shift occurs sometime during the early elementary school years, with children then demonstrating a gist bias (Brainerd & Gordon, 1994).

The developmental differences in this verbatim-gist distinction may help explain some of the differences found in children's suggestibility (Reyna et al., 2002). According to FTT, one of the reasons children make memory errors is because the type of memory that they access is inappropriate (Reyna, 1995). For example, imagine a younger child and an older child both attempting to recall a previous dental visit. If questioned immediately following the procedure, "Did the dental assistant

rinse your teeth” (verbatim detail) both children might be as likely to answer the question correctly. However, if the children were asked, “Did the poke hurt more than the rinsing?”(gist detail) it is possible for the younger child to falsely reject this true inference. This would occur because young children are biased towards relying on verbatim information, and the question calls for retrieval of gist information. On the other hand, older children would be less likely to make this error as they rely more on gist memory traces and would be able to make a correct inference.

Nevertheless, relying on gist information can also lead to false reports. Take the example of an older child experiencing a routine visit to the doctor. The child would likely accurately recall verbatim details immediately following the event, however after a delay would rely primarily on gist memories. Thus, if the child is asked, “Did the doctor take your temperature? ” when in fact that event did not occur, reliance on gist memory may lead the child to erroneously concede that the event occurred. This may be because a child who has had repeated visits to the doctor would presumably understand medical gist. Nevertheless, because storage of both verbatim and gist traces increase with age, older children will have more verbatim memories accessible to them than younger children, and will therefore generally exhibit lower levels of suggestibility than younger children.

Fuzzy Trace Theory is a comprehensive theory that can account for the effects of developmental variation and delayed testing in children’s accuracy and suggestibility. However, its current state of development precludes explicit predictions regarding the influence of internal factors (e.g., pain experience, temperament, anxiety) on true and false reports of potentially distressful events.

For the present study, whenever possible, predictions for accuracy and suggestibility will be based on the tenets of FTT. Therefore, we will presume that the children in the present study will store dissociated verbatim and gist traces of the dental experience. According to FTT theory, children's reporting of this event on recognition memory tests will depend on the type of memory that is accessed, as well as retrieval cues in the test questions (Brainerd, in press). With regard to the type of memory that is accessed, if children are given a recognition memory test immediately following the event, when verbatim memories would be most accessible, probes about a true detail that occurred (i.e., 'target' probes) would be better retrieval cues for verbatim memory traces than for gist traces. For example, the target probe, "Did the dentist wear glasses?" would have higher accuracy rates immediately following the procedure than after a 2-month delay. This is the case because on recognition tests, when verbatim information is still accessible, individuals mentally compare the test probe information with their verbatim memory (e.g., "I remember seeing glasses on the dentist's face"). This mental comparison will result in a correct 'identity judgement.' Indeed research has shown that 'hits' (accurate reports on recognition tests) are based predominantly on the retrieval of verbatim traces (Reyna & Brainerd, 1995).

On the other hand, if only gist information is present in the child's memory, then the target may provoke gist retrieval, which induces a more global or 'fuzzy' recollection of the detail, which is called 'similarity judgement.' For example, the child may have encoded a gist memory that identifies that the dentist "wore something on his face," and correctly respond to the target item presented. Therefore, accurate responses on recognition tests where the target detail is presented in the

question can be based on either (a) a verbatim memory match for the target detail ('identity judgment') or (b) a gist memory whose content appears to overlap with the experienced event and the target detail ('similarity judgement'). Therefore in the case of true memory, verbatim and gist retrieval are considered convergent processes (Brainerd, in press).

In addition to measuring targets (events that actually occurred), false reports of dental events are measured by administering recognition tests for events that we know did not happen, which are called 'distractors'. Distractors are commonly used in suggestibility studies in order to compare children's reports of both true and false events. In regards to false reporting (false alarms in recognition tests, e.g., incorrectly reporting "yes" to the distractor: "Did the dentist rub toothpaste on your gum?"), FTT assumes verbatim and gist retrieval are opponent processes, with gist retrieval supporting false reporting and verbatim retrieval suppressing it. Gist retrieval will predominate when the targets in the questions present false, but meaning-preserving, items so that such items typically induce global feelings of meaning overlap with target experiences, which supports false alarms (errors) on recognition tests. For example, the recognition probe "Did the dentist rub toothpaste on your gum" may induce memories of the gist experience that the dentist rubbed "something" on their gums, and therefore this overlap in meaning may lead some children to falsely report that detail. Gist processing that results in false alarms is called "similarity judgment." It is also possible that false, but meaning preserving, questions may sometimes produce retrieval of the verbatim traces of the corresponding target (actually experienced) detail (e.g., the recognition probe "rubbed toothpaste on your gums" may provoke retrieval of verbatim traces of being told that 'jelly' was rubbed on the

gum, and jelly is seen as different than toothpaste). Recalling this verbatim detail presents a mismatch from the information in the question, and will allow the child to correctly reject the falsely presented item: “the dentist rubbed something on my gum, but it wasn’t toothpaste because I clearly remember the dentist telling me it was jelly.”² According to FTT, rejecting distractor questions on recognition tests is called non-identity judgements (Brainerd, in press).

The semantic relatedness of the retrieval cue presented in the question will also influence recall and false reporting (suggestibility). FTT assumes that some dentally related distractors in questions will be better retrieval cues for the gist of the children’s experience than other dentally-related distractor questions and will therefore produce increased false reporting. If the distractor is semantically related to the dental event, increased false reporting is expected. For instance, the non-semantically related distractor probe, “Did the dentist take your blood pressure?” is less likely to elicit false reports than the semantically related distractor, “Did the dentist floss your teeth?” The first distractor would not be consistent with children’s dental gist memories (presuming they had visited the dentist before) because it would not happen in dental treatment and therefore is easier to reject. The second distractor, on the other hand, may be consistent with the child’s gist memories of dental visits and the child may incorrectly report that it occurred.

The preceding discussion has described how the type of information presented in the question can influence what type of memory is cued (verbatim versus gist) and how the type of cued memories will influence true and false reports. It is also important to note that information may be presented in the target or distractor that the child might not know. For example, when the dentist rubs something on the gum and

it tastes like toothpaste, then unless there is some kind of explanation presented, the child may be justified in assuming it was toothpaste. This issue would be more common in younger children or children with less dental experience. In addition, some children may not understand some of the words in the questions presented (e.g., blood pressure) and may incorrectly accept the distractor item without asking for clarification from the interviewer.

The specific hypotheses and predictions for the present study, based on the above-mentioned principles of FTT, are explicated at the end of the introduction. The following sections describe the specific external and internal factors that may influence children's accuracy and suggestibility.

External and Internal Factors Affecting Accuracy and Suggestibility for Distressful Events

When a child attempts to recall a distressful event, there are several components of the experience the child may have encoded. For example, memory representations may involve the integration of details of the event and the emotions experienced, such as pain. Because not everything that we experience is routed to permanent memory, some incoming information must be selected for processing and therefore attended to, whereas other information is ignored. Thus, not everything that is experienced is stored in long-term memory and the different components of the experience all compete for attention in the memory system (Ornstein et al., 1999). It is possible that various external and internal factors may contribute to how much and what information becomes encoded and stored.

External factors such as interviewing techniques and time delays have been examined (Bruck et al., 1997). More recently, internal factors such as the cognitive or

social characteristics of the child have also been proposed to influence recall and suggestibility (Quas et al., 1997). Some researchers have argued that one internal factor, namely age differences, can explain much of the variation in memory and suggestibility (e.g., Poole & Lamb, 1998). However, others (Bruck et al., 1997; Goodman et al., 1997; Quas et al., 1997) contend that age differences are not able to account for the variability evidenced in memory in same-aged children, nor can they completely explain the variability in children's suggestibility and false memory. Therefore, the influence of both external and internal factors on memory and suggestibility warrants investigation. In the following, the external factors that have been examined regarding memory and suggestibility will be reviewed, focussing on the influence of types of questions and length of testing delay. Then, internal factors influencing memory and suggestibility will be reviewed, with particular focus on age and specific social/personality and cognitive factors.

External Factors Affecting Accuracy and Suggestibility

Several factors that are external to the child have been found to be predictive of accuracy and suggestibility in eyewitness testimony research (e.g., factors related to the structure of the interview, length of interview delays, or the characteristics of the interviewer). Bruck et al. (1997) have referred to such factors as external factors. In pediatric health psychology, the only research examining external factors related to recollection for pain, to date, has been on the effects of delay. Both will be discussed, in turn, below.

Bruck et al. (1997) provide an overview of the possible roles of various external factors in accuracy and suggestibility including stereotype induction, repeated interviews, emotional tone of the interview, interviewer status, use of

anatomically correct dolls, and use of specific questions and repeated questions. Other external influences described by Quas et al. (2000) involve the forensic context of the event. For example, they described situational factors such as the child being at a police station, knowing that something bad may have happened, knowing who may have done the bad things, and having an idea of what the bad things may have been.

Research on external factors and memory has elucidated specific variables that influence children's susceptibility to misleading questions. As reviewed by Quas et al. (2000), we know that many children can be resistant to misleading questions when they are interviewed once or twice about a personal, salient event, particularly when the misinformation provided concerns abuse-related actions and when children are about five years of age or older. Quas et al. also note that, children's willingness to assent to the occurrence of false events has been shown to increase when they are repeatedly told that false events, especially false positive/pleasant events, occurred and children's false report rates are higher for plausible events than for implausible events, when questions are phrased in difficult, legalese terminology and when children are questioned by cold and non-supportive interviewers. In addition, when children are interviewed after long delays, their false reporting rates have been shown to increase (Goodman et al., 1991; Poole & White, 1993). These findings have been useful in developing interview strategies that seek to minimise memory errors and decrease suggestibility (Poole & Lamb, 1998).

Although all of the above-mentioned external factors may be important in children's recollections, the present study focussed on the effect of two external factors, namely, forced-choice questions and the effect of delayed testing. As described by Peterson and Grant (2001), forced-choice questions can be either yes/no

or multiple-choice questions. Understanding how different question types influence or bias children's responses is important because many interviewers use such questions (Peterson & Grant, 2001), although guidelines for good interviewing practice have recommended avoiding them (e.g. Poole & Lamb, 1998). Understanding the effect of testing delay is also important as in today's judicial systems child witnesses often have to wait for long periods before being interviewed (Whitcomb, 1992).

Type of Question

Studies (e.g., Baker-Ward et al., 1993; Goodman et al., 1991; Roebers & Schneider, 2001) examining children's accuracy and suggestibility typically begin with open-ended prompts (e.g., "Tell me what happened during your needle"), followed by more specific questions (e.g., "What kind of medicine were you given?"), and then proceed with yes-no questions about aspects of the event not already reported (e.g., "Did the nurse give you a sticker?"). However, not all studies take into account the type of question that was used to elicit the data examined, even though the type of question influences children's reports of events. In addition, relatively little work has focussed on forced choice or closed questions, despite the fact that they are frequently used in forensic situations (Peterson & Grant, 2001). The present study examined differences in the type of forced-choice question asked in order to determine the question types that are more likely to increase false reporting (suggestibility).

Forced-choice questions. According to the categorisation of Poole and Lamb (1998), specific questions ask about a particular detail or concept and often can be answered in a single word (e.g., "What colour was her hair?"). Other researchers (Peterson & Biggs, 1997) divide this group of questions into two types: "Wh"

questions (e.g., what, when, where) and forced-choice questions. Forced-choice, or closed, questions refer to specific questions that have a limited number of response alternatives and can include multiple-choice and yes-no questions. Peterson and Grant (2001) refer to yes-no and multiple-choice questions as forced-choice questions, and the same terminology was employed in the present study.

If one does not differentiate between the type of questioning used to elicit children's recollections of distressful events, then overall, children's accuracy for distressful events has been reported to be quite good. Merritt et al. (1994) found that children aged 3-7 years remembered approximately 88% of the features of a voiding cystourethrogram (VCUG) procedure. Similarly, Peterson and Bell (1996) found that children (2-13 years) who experienced a traumatic injury remembered 67% of the details of the event. Four-to-eight year-old children were found to recall, on average, 89% of the details of a dental filling procedure (Vandermaas et al., 1993). Chen, Zeltzer, Craske and Katz (2000) found slightly lower accuracy rates for a lumbar puncture (LP) with overall accuracy at 65% in pediatric cancer patients aged 3-18 years. Chen et al. (2000) suggested that the lower accuracy rates in their study may be due to participant differences. That is, children with cancer experience multiple types of procedures, whereas children in other studies may experience only one aversive or traumatic event over the course of the study. Because children's memories are more accurate for events that are unique and distinctive (Howe, 2000), pediatric cancer patients may have formed "scripts" for some of the frequently experienced procedures, which may serve to decrease accuracy (e.g., Ornstein, Merritt, Baker-Ward et al., 1998).

Although these studies report good-to-excellent recall rates among young children, it is noteworthy that accuracy rates included responses to both free recall and specific (yes/no) questions. Use of yes/no questions has been found to elicit unreliable information from children, particularly pre-schoolers, because children typically have a response bias when answering them. This response bias may be due to conversational dictates that suggest that children should try to answer questions and be co-operative, so some children frequently say “yes” to yes/no questions (Poole & Lamb, 1998). For example, Poole and Lindsay (1995) asked children yes/no questions about science demonstrations they had experienced and completely novel demonstrations. The children erroneously responded “yes” to 62% of the questions about demonstrations they had never experienced. Similarly, Peterson and Biggs (1997) and Peterson, Dowden and Tobin (1999) found that when preschool-aged children answered yes/no questions about traumatic injuries, a ‘yes’ response was likely to be correct whereas a “no response” was equally likely to be wrong or right. That is, children were biased towards making one of the two responses, usually "yes," and the authors of the studies stated that interviewers and researchers cannot count upon a yes/no response being veridical because of this response bias.

Similar results have been produced in other studies as well (e.g., Goodman et al., 1991; Lepore & SESCO, 1994; Peterson & Grant, 2001). Indeed, studies have found that children answer “yes” to seemingly inappropriate questions such as “is red heavier than yellow?” (Hughes & Grieve, 1980). Thus, high error rates for “yes” responses suggest that researchers should avoid relying solely on children’s answers to yes/no questions and other question types should also be considered. Accordingly,

guidelines for good interviewing practice recommend the avoidance of specific questions (Poole & Lamb, 1998; Yuille, 1988).

When we re-examine the above-mentioned studies and only consider responses to open-ended questions, the accuracy rates are 65% (Merritt et al., 1994), 33% (Peterson & Bell, 1996) and 12% (Vandermaas et al., 1993). The accuracy rates actually drop when we exclude specific questions, which seems contrary to the literature that states that open-ended recall tends to be highly accurate (Poole & Lamb, 1998). However, the drop is likely due to the fact that, because the yes/no questions employed were not counterbalanced such that half of the correct responses were “yes” and half “no,” when children exhibit response bias (“yeah-saying”) accuracy rates would erroneously increase. This type of counterbalancing problem may also have been present in the Chen et al. (2000) study. They examined responses to specific yes/no questions only. In addition, the correct responses to all of the specific questions in these studies was “yes,” rather than dividing the questions such that half would be correctly answered by “yes” and half by “no.” Thus, the actual accuracy rates from these, and other, studies remain unclear, given that we do not know to what extent the children were acquiescing and responding “yes” to the specific questions asked; that is, exhibiting a response bias.

Children have also been reported to have difficulty responding accurately to multiple-choice questions (e.g., “was it the doctor or the nurse?”). This is because children have a tendency to use a response set (e.g., typically they will select the second option rather than the first) and because children seldom provide “I don’t know” responses (Peterson & Grant, 2001). However, some multiple-choice questions have been found to be more reliable than others.

For example, Peterson and Grant (2001) questioned preschoolers about a scenario they participated in and then compared the effect of yes/no and multiple choice questions in which they were provided with two options. More specifically, children were provided with five types of question formats (1) yes/no questions for which the correct answer was “yes” (termed “yes” questions), (2) yes/no questions for which the correct answer was “no” (termed “no” questions), (3) 2-option multiple choice questions for which the correct answer was choice 1 (termed “choice 1” questions), (4) 2-option multiple choice questions for which the correct answer was choice 2 (termed “choice 2” questions) and (5) 2-option multiple choice questions for which neither of the options was correct (termed “neither choice” questions). In addition, half of the children were informed that they could say “I don’t know” in response to a question. Results showed that overall yes/no questions were more problematic than multiple-choice questions because of children’s bias to responding “yes” to these questions. The authors argued that multiple-choice questions might be preferable to yes/no questions because of a response bias with the latter type. However, the authors cautioned that these findings need to be replicated and conducted in more forensically relevant contexts.

According to FTT, the relationships between question type and accuracy are more complex than those presented by Peterson and Grant (2001). One would predict differential performance based on, for example, the retrieval cues provided in the question and the time elapsed since the to-be-remembered event. When comparing “yes,” “no,” “choice 1,” “choice 2,” and “neither choice” questions, using tenets of FTT, “neither choice” questions would be expected elicit the most false reports,

followed by “no” questions, and “choice 1 and 2” questions. “Yes” questions would be expected to elicit the least false reports. An explanation is provided below.

With regard to yes-no questions on a recognition test immediately following the procedure, employing the tenets of FTT would lead one to predict that “yes” questions would elicit the best recall, given that the target detail is presented in the question, and target details are the best cues for verbatim memory. Verbatim memory is more likely to be present at immediate testing and therefore high rates of accuracy are expected, as would be low rates of false reports. “No” questions present a semantically related distractor, therefore, are easier to reject at immediate testing (when verbatim memory is high), and more difficult to reject after a delay (when verbatim memories have faded, and where gist memories are consistent with the presented distractor). Regarding “choice 1” and choice 2” questions (in which a target detail and a distractor are presented), FTT predicts higher rates of recall at immediate testing, because, again, the target detail is the best cue for verbatim memories, and would be used to reject the distractor. “Neither choice” questions would be expected to elicit the highest rates of false reports because two distractor items are presented. False reporting from “neither choice” questions would be especially high following a delay, when the child accesses gist traces that lack specificity (are fuzzier) and therefore may not necessarily contradict the misleading details. Thus, FTT can help to explain why some question types lead to more error than do others.

Delayed Testing

Effect of delayed testing on recall of event details. Knowledge about the impact of delay on children’s recall of stressful events is of importance to both researchers as well as the judicial system. Concerning the latter, research on what

information children retain after a delay can inform current understanding of children's abilities to provide accurate testimony in legal settings (Ornstein et al., 1999). In general, research has shown age-related differences in rates of forgetting, with older children exhibiting less forgetting (e.g., Baker-Ward, Gordon, Ornstein, Larus, & Clubb, 1993; Howe, 1987, cited in Howe & Brainerd, 1989). In addition, events that are more "distinctive" (i.e., are unique, or stand out, from one's general experience and knowledge) will be retained in memory for longer periods (Howe, 2000).

The type of probe, or question, asked has also been found to influence recall after a delay. Poole and White (1993) conducted a 2-year follow-up to their 1991 study described above. When the children were interviewed at the 1-week follow-up they averaged about 7% errors. Two years later, 20% of the information that children reported was inaccurate. In particular, children who spontaneously reported the main theme of the event (pen snatching) were found to make fewer errors (14%) when compared to children who were prompted with a specific question (25%). This study indicated that children's memories do decay over time, but that specific questions are particularly problematic when children's memories are no longer readily accessible. Again, this finding is consistent with the principles of FTT, which state that after a delay, verbatim memories have faded and therefore children's memories are more likely to be based on gist. If the specific questions asked are consistent with the meaning of the gist retrieved, then children are more likely to erroneously conclude that the event in question occurred. For example being asked, "Did the dentist give you a toothbrush to hold?" may be consistent with the general gist memory that they were given something to hold in their hands (e.g., a mirror) during the procedure.

Regarding the effect of delay on recall for medical procedures, the results are mixed. For example, some research has shown that reports for medical procedures such as VCUG, surgical procedures and emergency room visits can be quite accurate up to one year after the event, at least for the gist of the experience (e.g., Goodman, Quas, Batterman-Faunce, Riddlesberger, & Kuhn, 1994; Howe, Courage & Peterson, 1994; 1995). The accuracy of 3-7 year-olds memories was more impressive when they were questioned about a VCUG (Merritt et al., 1994). These children correctly identified 83% of the event features after six weeks and falsely acknowledged only 7% of the nonexperienced events. In addition, the accuracy rates remained stable over the six weeks, suggesting that perhaps the increased salience of the event had a facilitative impact on memory.

In contrast, some research suggests that most children show decreased memory for medical procedures following a delay. Steward and Steward (1996) interviewed 130 3-6 year-old children who visited various pediatric outpatient clinics at a state hospital. Participants were interviewed again at delays of one and six months. The children's spontaneous reports of body touch (via open ended question) were highly accurate (94%) during the first interview and reports revealed no developmental differences. When asked what they were touched with (a specific question type), children's accuracy decreased somewhat (72%), with only about half the reports from 3-year-old children being accurate. One month after their clinic visit, children demonstrated significant forgetting about body touch, their accuracy dropping from 94% to 79%. At the 6-month interview the accuracy of spontaneous reports of body touch was stable (72%). Children's pain ratings were positively related to how accurate they were in recalling body touch, but only at the six-month

follow-up. Thus, the above research suggests that after a delay of six months, children's memories of being touched by medical personnel significantly decrease. However, children who experience higher levels of pain are more likely than children who did not experience high levels of pain to recall body touch more accurately and completely.

Other studies have also demonstrated that delayed recall can be problematic when children are interviewed regarding stressful medical events. For example, Goodman et al. (1991) re-interviewed 3-7 year-old children one year after having received an inoculation at a health clinic. The amount of accurate information in children's free recall declined during the course of the year, whereas the amount of inaccurate information remained stable. Again, children were especially inaccurate when responding to specific questions.

Repeated medical events appear to influence children's recollections of the event. Some researchers have found that when children experience subsequent medical procedures a reconstruction or blending of memories for the original event can result. For example, Howe et al. (1995) found that children who had subsequent experiences in the emergency room tended to intertwine those recollections when they were questioned about the original emergency room visit. Similar effects have been obtained by others (e.g., Bruck, Ceci, Fancoeur, & Barr, 1995; Ornstein, Shapiro, Clubb, Folmer & Baker-Ward, 1997). Although the blending of multiple experiences may not inhibit the recall of the original experience, an interviewer who did not know beforehand what the original experience was would not be able to disentangle the "blended" report to obtain an accurate picture of the target event. This difficulty is an issue of significant concern in courtrooms today (Howe, 2000).

In summary, accuracy for event details declines over time, but the rate of decline can be a function of the types of questions the interviewers ask and perhaps the salience of the event. In studies examining children's accuracy and suggestibility for distressful events, it is therefore important to consider the effect of delay. Given the personal salience of many of these events, it is quite likely that children will exhibit good memory when the interview directly follows the to-be-remembered event. Consistent with this idea, children's pain ratings for a medical procedure have been shown to be positively related to how accurately they recall body touch, but only after a lengthy delay (Steward & Steward, 1996). Thus, the effects of external and internal factors may be more pronounced after a delay, when verbatim memory begins to fade and children must rely on gist traces of the event.

Effect of delay on recall of pain/distress. Given clinicians' reliance on children's recall of pain and distress in evaluating treatment, researchers have been interested in answering questions such as: "is reliance on children's pain memories justified?" and "over what time period are these memories reliable?" (e.g., Zonneveld, McGrath, Reid & Sorbi, 1997).

Lehmann, Bendebba and DeAngelis (1990) studied the consistency of pain ratings of recalled painful events in children aged 3 to 8 years over a one-week delay. Children compared the difference in pain intensity of two recalled painful events on three different pain rating scales in responses to the question "Which one shows me 'pain' as much as you had from the (recalled experience)." Children were also asked which of the two experiences "hurt more." Results showed that for children seven years of age and under, the consistency of pain intensity ratings between the two sessions was 20-55%, whereas the children aged eight and older recalled the relative

difference in pain intensities consistently 50-100% across all pain ratings. Note that this finding is consistent with FTT. The children were to make a comparison between the pain experienced during two procedures, which requires processing of gist information, rather than mere retrieval of a verbatim detail. FTT would predict that younger children would have much more difficulty with the task due to their reliance on verbatim memories.

Lander, Hodgins and Fowler-Kerry (1992) compared experienced and recalled pain (2-month delay) of 5-17 year old children undergoing venipuncture. Using McGrath's faces pain scale (McGrath, deVeber & Hearn, 1985), consisting of nine faces, they found that 75% of children were accurate within one face. Another 16% were accurate within two faces. The researchers used a 100-mm visual analogue scale (VAS) to assess recall of pain intensity and found that 43% were accurate, 24% recalled less pain and 33% recalled more pain than was previously reported. However, the findings likely reflect measurement issues, given that two different types of scales were used (i.e., faces scale and VAS) to measure both affective pain and pain intensity.

Zonneveld et al. (1997) conducted an investigation on the accuracy of children's memories for pain over a one-day and a one-week delay. They studied 5-16 year-old inpatients' recall of their average and worst pain intensity by comparing the level of recorded pain intensity with the level of recalled pain intensity 1 day and 1 week after recording, using the 7-point Bieri's Faces Pain Scale (Bieri, Reeve, Champion, Addicoat, & Ziegler, 1990). Results showed that accuracy was high and exhibited little decrement over 1 week. Older children had more accurate recall of their worst pain intensity.

Children's memory for a novel pain stimulus has also been found to be reliable over a long delay. Badali, Pillai, Craig, Giesbrecht and Chambers (2000) examined children's memory of pain intensity for pain from a cold-pressor task. In this task, participants immerse their hand in temperature-regulated cold water and are typically asked to hold it in the basin as long as they can. Children (aged 5-12 years) rated their pain immediately following the procedure and again one-year later. Ratings were made on the 7-point Bieri Faces Pain Scale (Bieri et al., 1990). When agreement between initial and recalled ratings of pain were examined, results showed fair to good agreement beyond chance, suggesting that children could reliably recall their pain intensity ratings over time.

In summary, the research in the pediatric health psychology literature suggests that, on average, children can accurately recall previously experienced pain and distress. What we have yet to learn is what factors may influence their accuracy.

Internal Factors Affecting Memory and Suggestibility for Distressful Events

In the eyewitness testimony literature, recent investigations into whether there are internal factors such as developmental or individual differences that can distinguish children who accurately recall a distressful event from those who do not have been conducted (for reviews see Bruck et al., 1997; Quas et al., 1997; Quas et al., 2000; Reyna et al., 2002). Such pursuits may help distinguish children who readily report false information from those who are resistant to doing so and may therefore help identify children for whom special interviewing precautions should be taken to maximise accurate testimony. Although, to date, no studies in the pediatric health psychology literature have addressed the topic of individual differences in memory for distressful procedures, researchers have suggested that understanding specific

factors that affect encoding and retrieval of pain and distress is a worthwhile area for investigation (Cohen, Blount, Cohen et al., 2001; Ornstein et al., 1999).

When a child undergoes a distressful procedure, several developmental and individual difference factors may affect what information the child encodes. Generally, the older the children are, the more they will recall, and the less susceptible they will be to accepting false suggestions. Cognitive and social/personality individual differences may also be important. For example, a child having a dental cavity filled may have a biological predisposition to be anxious. This trait anxiety may directly interfere with recollections of distress and event details. In addition, the child's temperament and previous experience with dental fillings may also influence this process. A child with a more adaptable temperament may exhibit attenuated anxiety levels, and perhaps better recall.

It is also likely that the child's previous experience with dental fillings will affect recall. We might expect a child who has had several fillings to accurately recall the events and distress associated with dental fillings. On the other hand, a child who has had several fillings may also have formed a script for such procedures, and may erroneously defer to script memories (gist). The quality of the child's previous experience will also play a role in recollection. A child who has had a negative previous experience may expect higher levels of pain and distress for subsequent procedures and overestimate distress levels. Variations in the severity of distress and pain might also influence subsequent memory. For example, the child who exhibits little distress while the dentist injects the anaesthetic, or drills the cavity, may have more cognitive resources available to attend to the details of the event. Children's cognitive abilities to maintain and transform temporary information during mental

operations (working memory) may also serve to influence recall for event memory. For example, poorer working memory capacity may compromise an individual's ability to distinguish between true and false information, thus rendering susceptibility to suggestive influence more likely.

Given the call to examine the role of social-personality factors in suggestibility (e.g., Quas et al 1997; Pipe & Salmon, 2002), the present study focussed on, in addition to age, the role of anxiety, temperament, and pain experienced during the procedure examined. In addition, two cognitive factors, previous dental experiences and working memory capacity were examined. This focus is due to a dearth of previous research on these individual difference factors in children. In the next section, an overview of research that has examined sources of variation in children's memories for distressful events according to developmental differences and cognitive and social-personality individual difference factors is presented.

Developmental Factors

Across studies of children's accuracy and suggestibility, the most consistent predictor of differences in children's performance is age. An abbreviated review of developmental differences in recall accuracy and suggestibility is presented.

When children are asked to free recall events, such as an interaction with a stranger or a story, there is a linear increase in the completeness of recall across the age span from preschool to early adolescence (e.g., Leippe, Romanczyk, & Manion, 1991; Saywitz, 1987). However, although younger children provide less information in free recall than do older children, the content of their responses is not less accurate; that is, errors of omission are more common with younger children but errors of

commission tend to be rare and do not vary with age (Pezdek & Roe, 1995). As described by Quas et al. (2000), young children have also been shown to remember events that they only experienced one time, especially those that have some personal significance for them (e.g., Fivush, Hudson & Nelson, 1984; Hamond & Fivush, 1991).

Although young children can recall their experiences, they also tend to forget information more quickly than do older children (Baker-Ward et al., 1993; Brainerd, Kingma & Howe, 1985; Brainerd & Reyna, 1990). In addition, young children also have limited abilities in use of retrieval strategies to facilitate their memory (e.g., Cox, Ornstein, Naus, Maxfield & Zimler, 1989). Thus, the tendency to make reporting errors, especially when time or new information weakens the verbatim memory trace, is common among all children, but particularly in younger children and especially preschoolers (Ceci & Bruck, 1995).

Developmental differences in children's suggestibility are also dependent on the age of the participants. Pezdek and Roe (1995) noted that most researchers agree that by the age of 10 or 11 children are no more vulnerable to interrogative suggestion than are adults. For example, some studies have found no differences in the suggestibility between preadolescent children and adults with a wide range of tasks (Cohen & Harnick, 1980; Duncan, Whitney & Kunen, 1982; King & Yuile, 1987; Saywitz, 1987). However, when preschool children are compared to older children and adults they have been found to be disproportionately affected by misleading suggestions (Bruck & Ceci, 1999; Ceci & Bruck, 1993).

With regard to children aged 5-12 years, the results are equivocal. Reyna et al. (2002) noted that some studies have reported developmental differences in

suggestibility across this age group (e.g., Ackil & Zaragoza, 1995; Cassel & Bjorklund, 1995), while others have found younger children to be no more suggestible than older children and adults (Ceci, Ross & Togliani, 1987; Holliday, Douglas & Hayes, 1999). Reyna et al. (2002) concluded that there are indeed age differences in suggestibility from preschool to early adolescence, with preschoolers being especially susceptible to suggestion and younger school-aged children being more susceptible than are older children. They noted that the studies that do, and do not, find suggestibility effects across the early school years differ considerably from one another. In particular, a lack of highly sensitive interviewing techniques that control for children's initial level of memory may be masking subtle developmental differences in memory. And when such techniques are employed, younger children are found to retain less than older children (Titcomb & Reyna, 1995). Brainerd and Reyna (1998) argued that the inconsistencies among studies examining false recognition effects (i.e., that false recognition effects sometimes decrease with age, sometimes increase with age and are sometimes age invariant) can be explained using tenets of FTT. Specifically, age differences in false recognition effects are affected by the variability of the probes in the tasks presented among the various studies. The different probes influence the reliance on verbatim versus gist memory (Brainerd & Mojardin, 1997; Reyna & Kiernan, 1994) and such differences are not accounted for in much of the research.

As has been described, age is a clearly important predictor of memory accuracy and suggestibility in children, however, several other factors associated with the children themselves must also be considered, such as social-personality and cognitive differences.

Social-Personality Factors

Although little empirical research is available, we should expect that variation in social-personality factors such as anxiety, temperament and pain response would play a role in children's accuracy and suggestibility for an event. Previous memory studies with children have considered influences such as temperament (e.g., Jensen & Stjernqvist, 2002, Merritt et al., 1994; Roebbers & Schneider, 2001) and distress levels (e.g., Bruck et al., 1995; Merritt et al., 1994, Steward & Steward, 1996). In adults, factors such as introverted personality characteristics (Ward & Loftus, 1985) and state anxiety (Gudjonsson, 1988) have been associated with high suggestibility scores. The present study focused on three social-personality factors, namely anxiety, temperament and children's self-report of pain response to a dental procedure, which will be discussed in turn.

Anxiety. Anxiety may affect memory for painful situations. High state (situation-specific) anxiety in adults has been associated with less accurate recall of the intensity of the experienced pain (Arntz, Van Eck & Heijmans, 1990; Erskine et al., 1990; Kent, 1985). Among children the results have been equivocal. A significant positive correlation has been found between state anxiety and the amount of pain children aged 5-17 years expected and recalled from venipuncture (Lander, et al., 1992). That is, children who reported high levels of anxiety about the venipuncture on the Spielberger State Anxiety Scale tended to over-estimate the level of pain they would experience and then, after a two-month delay, were more likely to remember experiencing more pain than they initially reported.

On the other hand, Zonneveld et al. (1997) examined daily pain diaries of hospitalised children aged 5-16 years and they found that anxiety was not related to

the accuracy of pain recall. A study examining children's expectations and recollections of discomfort associated with dental treatment (cavities filled) found that state anxiety did not affect children's self-reported discomfort (Huq, Lindsay & Roberts, 1992). Specifically, when children's (aged 7-16 years) memory for their discomfort during the procedure was assessed three months following the procedure, even the most anxious children (as assessed by the Spielberger State Anxiety Scale; Spielberger, Edwards, Lushene, Montuori, & Platzek, 1973) recalled no more discomfort than they had reported immediately after the treatment. The authors concluded that children were able to recall their discomfort without distortion.

Vandermaas et al. (1993) examined the effects of anxiety on memory for event details in children aged 4-8 years who were undergoing dental procedures. They found that age mediated the effects of anxiety on memory. Specifically, high levels of anxiety had a debilitating effect on reports of older children but not younger children. However, when the child's previous experience with the dentist performing the procedure was held constant, the interaction of age and anxiety on memory was no longer statistically significant. The authors concluded that, based on their research, the effects of anxiety on memory are complex in that several factors such as age, experience and level of anxiety are influential factors in the anxiety-memory relationship. In the Chen et al. (1999) study described earlier, children's age also mediated the effects of anxiety on recall. Children's self-reports of anticipatory anxiety and anxiety during the lumbar puncture were both negatively associated with total memory scores one week after the procedure. However, when age was controlled, only children's reports of anxiety during the LP remained marginally significant. The authors suggest that this finding may be accounted for by the fact

that younger children show more distress during LPs and have poorer memories relative to older children.

Children's level of fear has been found to be related to accuracy of event details of a VCUG procedure (Merritt et al., 1994). Fear is considered intense and circumscribed anxiety that often has complex reactions taking the form of escape or avoidance of the threatening situation (Barrios & Odell, 1998). Merritt et al. (1994) found that the more fearful children were judged to be by a technologist, the less they recalled of the procedure, for both immediate and delayed recall.

Regarding the effects of anxiety on children's suggestibility, there is no extant research. However, increased self-esteem in adults (Gudjonsson & Singh, 1984) and increased self-efficacy in children (Mazzoni, 1998) has been related to resistance to suggestibility. Some researchers have suggested that anxiety levels may actually account for these findings (Bruck et al., 1997). That is, perhaps the anxiety associated with low self-esteem interferes with the encoding or retrieval of information.

Temperament. Several studies have identified children's temperament as a possible contributor to memory accuracy and suggestibility, and thus worthy of investigation (e.g., Belsky, Spritz & Crnic, 1996; Goodman et al., 1997; Quas et al., 1999). Children bring to distressful situations their own individual responses, which may determine how they deal with pain, their response to it, and their memory for the event. One method of conceptualising these varying responses is to label them as temperament. Temperament can be defined as a behavioural style of reacting to the environment (Thomas & Chess, 1977). Although researchers do not always measure temperament in precisely the same way, most would agree that such attributes as activity level (the typical pace or vigour of behaviour), irritability or emotionality

(how easily and intensely upset the child becomes over negative events), soothability (how easy the child is to calm after being upset), fearfulness, and sociability (receptiveness to social stimulation) are important components of temperament (Rothbart & Bates, 1998).

Few studies have examined the role of temperament in predicting behavioural distress and memory for a procedure. Merritt et al. (1994) found two of six temperament dimensions to be associated with recall and behavioural distress during a VCUG. Using the Temperament Assessment Battery for Children (TABC), the results of Merritt et al. showed that adaptability and approach-withdrawal were related to recall accuracy. Thus, children who were reported by their parents to adjust easily to new circumstances and to be more likely to approach new situations recalled more details of the VCUG. The authors suggest that these significant relationships are likely based on individual differences in the manner in which the VCUG is experienced, and hence, encoded in memory. That is, features of the individual child's temperament may influence the aspects of a situation that the child directs his/her attention to and on how the event is later interpreted. For example, differences in temperament may be associated with differences in coping with stressful situations and may thus contribute to the encoding of an experience that may vary substantially from child to child.

A recent laboratory study examining the effects of individual differences in children's recall for a videotaped social interaction found that shy children were less accurate in answering specific questions (yes/no) than were children of the same age group that were not rated as shy (Roebbers & Schneider, 2001). After viewing the videotape, children were asked to provide a free narrative (free recall) of what they

remembered from the film. Three weeks later, children were again asked to free recall what they remembered from the film, and were also given 27 cued recall questions. Half the children were asked unbiased questions (e.g., “What did the boy look like?”) and half were asked misleading forced choice questions (e.g., The boy had 60 dollars in his purse didn’t he?). Children’s accurate responses to the unbiased recall questions were negatively related to teacher ratings of shyness. Although the researchers did not define shyness as a measure of temperament, most researchers consider shyness to be a component of temperament. In particular, sociability and shyness tend to be regarded as similar, although distinct, personality traits (Bus & Plomin, 1984). Roebbers and Schneider cautioned that age explained much of the variation in children’s accuracy scores, however, shyness had an independent negative effect on accuracy using regression analyses. Roebbers and Schneider (2001) suggest that shy children may perceive and feel the demand characteristics of the interview situation more strongly. That is, overall, children trust adults’ knowledge and may feel more likely to defer to their position as authoritative adults (e.g., Montgomery & Miller, 1997), particularly when misleading questions are asked.

Researchers in the dentistry field have determined that parental ratings of their children’s temperament were predictive of the amount of amnesia experienced during dental treatment (Jensen & Stjernqvist, 2002). Specifically, following sedation with midazolam, children aged 1-4 years had dental extractions. Parents completed the EAS Temperament Scale (Bus & Plomin, 1984). To assess the amnesic effect, the dentist gave the child a toy animal to play with eight minutes after administration of the sedative. The parents were asked to evaluate the amnesia on the day following the procedure by asking the child whether he or she recalled the toy animal. A set of

pictures with three different animals was shown to the child and the child was asked to point out which one he or she had played with before dental treatment. Results showed that higher scores of negative emotionality were significantly related to better recall of the toy animal, thus, less amnesia. The authors argued that perhaps children scoring high on negative emotionality might be more wary of their surroundings and therefore have a better remembrance of what happened during the sedation. It is also possible that children with high levels of emotionality will also exhibit increased arousal, which may lead to increased recollection of event details (Fivush, 1998).

Researchers have recently begun to explore the relationship between temperament dimensions and suggestibility. For example, children characterised as inhibited in temperament tend to become excessively anxious when punished by adults (Schacter, Kagan & Leichtman, 1995). It has been suggested that these children may also be reluctant to resist adults' suggestions or directions, even though they know that they are wrong (Bruck et al., 1997). Schacter et al. (1995) studied four year-old children who were classified as either high-reactive (inhibited) or low-reactive (not inhibited) in infancy. In one task, the experimenter asked the child to perform several actions, some of which would be sanctioned by parents (e.g., pouring water from one cup to another) and others that could result in punishment by parents (e.g., throwing a ball at the experimenter's face). Results showed that the high reactive children were more obedient, less likely to refuse the experimenter's request and less likely to question why an act should be carried out.

The results of the effects of shyness on suggestibility, unfortunately, are mixed. Some studies have shown negative relationships between ratings of children's shyness and suggestibility (Scullin & Hembrooke, 1998, as cited in McFarlane,

Powell & Dudgeon, 2002), whereas others revealed positive relationships (Endres, Poggenpohl, & Erben, 1999) and no significant relationships (Muir-Broadbush, King, Downy & Peterson, 1998) using participants of similar age ranges.

The aforementioned data suggest that temperament may be an important factor in children's suggestibility. The present study focused on two aspects of temperament, namely sociability and shyness.

Pain response. From research conducted with adults, we know that, overall, people are moderately accurate in recalling pain (e.g., Hunter, Phillips & Rachman, 1979; Jamison, Sbrocco & Paris, 1989; Roche & Gisbers, 1986). However, as described in a review by Erskine et al. (1990), studies show that level of pain may moderate memory. For example, people with chronic pain tend to overestimate pain levels (Jamison et al., 1989; Linton & Gotestam, 1983; Linton & Melin, 1982) and pain ratings of prior painful events tend to be a function of present pain intensity, rather than episodic recall of the prior event (Eich, Reeves, Jaeger & Graf-Radford, 1985). In addition, patients who are self-reported to be more emotional and behaviourally distressed tend to overestimate their pain levels (Jamison et al., 1989).

It is possible that the pain experienced by a child during a procedure may also be a critical mediator in determining what information that child encodes and then later recalls. Although research is beginning to investigate specific factors that may influence what children remember during distressful events, few studies have explored the link between pain and memory for event details. In addition, no studies to date have explored the link between internal factors (e.g., anxiety, temperament) and accuracy of recalled pain levels.

Some researchers have found no relationship between children's pain and accuracy of details for the to-be-remembered event. Bruck et al. (1995) had children rate their response to an inoculation using a poker chip scale. With this measure, children were asked to identify how much hurt they felt by identifying the appropriate number of chips (white chips were indicative of no pain while red chips that were indicative of pain ranged from one to four). They found no relation between children's reports of pain and their accuracy of recalling event details such as the pediatrician and his behaviours during the procedure. Oates and Shrimpton (1991) also examined the role of pain in children's memory for event details of a medical procedure. They interviewed children who had blood samples taken, and a control group who experienced an interaction with a friendly stranger at school, and found no relationship between children's self-reported stress (on a 5-point scale from "very stressful" to "enjoyable") and memory at 1 week or 3-6 weeks following the event.

Consistent with the above research, Merritt et al. (1994) found that self-reported pain was not related to accuracy. They asked children to rate their experienced pain from a VCUG procedure using the Oucher scale. The Oucher instrument is a photographic display of seven facial expressions depicting different levels of distress. The amounts of hurt are anchored by "no hurt" for the neutral facial expression and "the most hurt in the world" for the photo displaying intense facial grimacing, brow furrowing and tears. Results showed that pain ratings were not significantly correlated with immediate or delayed recall of features of the event.

Interestingly, Merritt et al. (1994) found that the *observed distress* rated by an experimenter on the Observational Scale of Behavioral Distress (OSBD) was related to children's recall of the VCUG procedure after a delay of six weeks. The authors

argued that their findings suggest a negative relationship between distress and remembering. They stated that although the link was statistically significant at the delayed interview rather than immediately after the procedure, limited sample size and high levels of immediate recall may have made it difficult to detect a distress-memory association at the initial interview. Goodman et al. (1997) also found a significant negative relationship between distress and memory for event details. Specifically, children who appeared more distressed (according to observer ratings) during a VCUG procedure later provided more inaccurate responses, particularly in response to specific questioning, than children who appeared less distressed. A recently published study examining factors associated with children's long-term recall of a VCUG found that, independent of age, crying during the VCUG was negatively associated with the correct information reported and accuracy in prompted recall after a six-month delay (Salmon, Price & Pereira, 2002). Crying was coded using the Crying and Screaming Scale of the Child-Adult-Medical Procedure Interaction Scale Revised (CAMPIS-R; Blount, Cohen & Frank, 1997). These distress behaviours would likely be consistent with children's self-reports of pain/distress.

In contrast, Steward and Steward (1996) found a significant positive relationship between children's judgements of painfulness of body touch during a clinic visit and the completeness of children's recollections of those procedures. In this study, 3-6 year-old children visited a pediatric outpatient clinic for various medical procedures. Children's pain ratings were made via a modified version of the Bieri Faces Scales (Bieri et al., 1990); researchers used only four of the original faces, the first, third, fifth and seventh. Memory interviews consisted of both open-ended and direct yes/no questions, although no differentiation was made on the relative

accuracy of each type of questioning. These findings demonstrate the importance of the role of children's estimates of pain in increasing the prediction of both accuracy and the amount of information that children report about past experiences. Indeed, even after a 6-month delay the child's pain rating was the only variable that was significantly related to the prediction of completeness.

Examination of how children's pain response may influence their level of suggestibility has not been conducted. There is some evidence to suggest that weaker memories are more vulnerable to suggestion (Marche, 1999; Marche & Howe, 1995; Pezdek & Roe, 1995). Thus, if high levels of experienced distress result in stronger memories, it is conceivable that memories for such events would be more resistant to suggestive questioning. Conversely, if high levels of distress result in weaker memories, then children might be expected to exhibit increased levels of suggestibility. Bruck et al. (1995) found that susceptibility to suggestion in 5-year-old children undergoing inoculation was associated with higher stress at the time of the inoculation. Specifically, children who fell sway to the suggestions took longer to calm after the inoculation, as determined by observer report. However, children's self-reported pain, using the Hester Poker Chip Scale, was not found to be related to being misled by interviewer suggestion. Their findings suggest that distress may interfere with ability to resist suggestive questioning; however, these results have not been replicated in the literature.

Cognitive Individual Difference Factors

A number of cognitive characteristics have been identified as potentially important sources of variability in children's recollections of distressful events. According to a recent review by Reyna et al. (2002), previous studies have found that

children who have a poorer understanding of dual representations (e.g., Welch-Ross, Diecidue & Miller, 1997) and poorer source monitoring abilities (Leichtman & Morse, 1997; Schacht & Marche, 2001) exhibit higher levels of suggestibility. In addition, Schaaf, Goodman and Alexander (1999) demonstrated that more inhibited children displayed increased likelihood of assenting to false events. The following describes additional work on two cognitive factors, namely previous experience and working memory, as they are expected to be related to memory and suggestibility for event details. Previous experience is also expected to be related to recollection of pain.

Previous experience. The more one has experienced an event, the more one would be expected to know about the structure of the event. This knowledge would presumably make it easier to encode store and retrieve information about the event from memory. Researchers in pediatric health psychology have examined the role of previous experience with medical or dental procedures in influencing later distress behaviour (e.g., Dahlquist, Power & Carlson, 1995; Jacobsen, Gorfinkle, & Schorr, 1990; Jay et al., 1983; Rocha et al., 2003; Taddio et al., 1997). The findings in this area, however, are mixed. When the *number* of previous procedures (i.e., the amount of exposure) a child has experienced is correlated with distress level, the results are equivocal. In infants and toddlers, more experience has been related to decreased sensitivity (Grunau, Whitfield & Petrie, 1994), but research has also demonstrated sensitization to painful experiences in infants and toddlers (Taddio et al., 1997). Some research suggests that children habituate to medical procedures (e.g., Jacobsen et al., 1990; Jay et al., 1983); whereas others report no significant effect of previous pain experiences (Katz et al., 1980; Wong & Baker, 1988). Unfortunately, in two of these

studies (Katz et al., 1980; Wong & Baker, 1988) children's age was not controlled despite the wide age range studied. That is, not accounting for the known predictable increases in pain response occurring with increasing age (e.g., Fradet et al., 1990; Jay et al., 1983) renders the results more difficult to interpret.

On the other hand, when the *quality* of children's previous experience with these procedures is examined, it has been found that children who have had previous negative experiences with medical procedures exhibit more distress during subsequent procedures than children who have previous positive or neutral experiences (Bijttebier & Vertommen, 1998; Dahlquist et al., 1986; Frank et al., 1995). Dahlquist et al. (1986) examined the link between past medical experience and children's response to preparation for throat culture examinations in pediatric outpatients aged 3-12 years. Children's experience with medical procedures was described by mothers who rated their children's reactions to four types of medical procedures on a 7-point Likert scale (1 = negative, 4 = no reaction, 7 = positive). Results indicated that children with previous negative medical experiences demonstrated more behavioural distress (assessed using the Observation Scale of Behavior Distress; OSBD) during the examination than did children with previous positive or neutral medical experiences. Similarly, Rocha et al. (2003) examined kindergarten-aged children's response to routine inoculation. Pain response was measured by the Facial Action Coding System (FACS; Ekman & Friesen, 1978), an objective, fine-grained pain measurement tool. Using the same mother-report procedure as Dahlquist et al. (1986), they found that children who experienced more previous negative experiences were more likely to exhibit increased pain response.

Thus, research has provided information on how prior experiences may affect distress. What we know less about is how these experiences (both the number and quality) may affect what children recall about these events. Perhaps the quality of prior medical experiences is important in subsequent behaviour because it influences how the event is encoded in memory. For example, a child who experienced a great deal of distress during her first visit to the dentist may recall the experience (both distress and event details) better than does a child who exhibited a neutral response. Indeed, we know that events that are unique and distinctive tend to be encoded and stored better in memory (Howe, 2000). Chen et al. (2000) examined the association between children's (aged 3-18 years) expectations of pain during a lumbar puncture and memory for the event details. With child age controlled, results showed a marginally significant effect for expectation of pain on memory. That is, children who expected to experience more pain actually recalled fewer event details. However, children's report of their actual pain during the procedure was not related to event memory. These findings are consistent with the adult literature that demonstrates high correlation between expected pain and remembered pain. That is, people tend to recall how much pain they expected, rather than how much pain they actually reported experiencing (e.g., Kent, 1985).

The number of previous experiences, or the amount of exposure, may also influence the strength of the resulting trace of the event left in memory. When an event is experienced, the longer one is exposed to the relevant details, the stronger the memory trace is expected to be (Crowder, 1979). Increases in the number of repetitions of an event are also associated with increases in the strength of the memory. Researchers have examined children's memories for event details of both

novel (e.g., Peterson & Rideout; 1998) and repeated (e.g., Chen et al., 1999) stressful procedures. However, comparison of novel and repeated stressful procedures has not been examined within the same study, which would allow direct comparison of the effect of exposure.

There have been laboratory studies that have compared children's memories and suggestibility for a single event versus a repeated event. For example, Marche (1999) presented pre-schoolers with a slide presentation depicting an event. Half of the children were exposed to the event once and asked 20 questions about specific event details, while the other half received presentation-question trials until all 20 questions were answered correctly. Results showed that children who had seen the event multiple times were less susceptible to misinformation than children who had seen the event only once. Thus, the strength of the memory influences reporting of misinformation. These findings were consistent with those of Marche and Howe (1995) and Pezdek and Roe (1994).

Based on such previous laboratory research, it seems probable that children who have experienced the same procedure on multiple occasions would also exhibit superior recall to children who have had fewer experiences. However, it is also possible that they would make more errors in recall. Specifically, it might be expected that the children would have formed general representations or scripts for these procedures, which according to FTT are considered gist memories (Brainerd & Reyna, 1995). Thus, rather than recalling the specific target event, children may erroneously report details about the way the procedure 'usually' occurs, or both. It is possible that such scripts, or gist-based memories, will influence later pain and illness behaviour. For example, researchers (e.g., Ornstein et al., 1999) have suggested that

because these scripted, general memory representations seem to be easily established, it is possible that some forms of chronic pain may be maintained in part by underlying easily retrievable scripts that are based on long-standing histories of painful medical procedures or injuries.

Despite these speculations, the research appears equivocal. Goodman et al. (1997) found that the number of prior VCUGs children experienced was unrelated to children's memory accuracy for the event. Similarly, Quas et al. (1999) found that the amount of prior knowledge that children were provided (via parental preparation) about the VCUG procedure was not related to children's memory. In contrast, Goodman et al. (1997) found that children's prior knowledge scores were positively related to memory accuracy.

The inconsistencies with previous research may be due, in part, to the extent to which the to-be-remembered event is consistent with prior experience or knowledge. For example, research has demonstrated that children's understanding of the events that typically occur during a doctor visit predicted the specific events that they will remember of an actual visit (Ornstein et al., 1997). In addition, when the to-be-remembered event does not match children's current understanding or gist for the procedure (Did the dentist take your picture?), and researchers present the children with suggestive questions that are consistent with their understanding (Did the dentist give you a toy?), children's susceptibility to false suggestions increases (e.g., Leichtman & Ceci, 1995).

In sum, based on the current research literature, we still do not know how the amount of exposure or quality (positive or negative) of prior experience with distressful procedures affects recollection of pain. Although we have information

about how the amount of exposure affects memory for event details and suggestibility, researchers have yet to determine how the quality of children's experiences affects such memory.

Working memory. Working memory is the ability to maintain and transform temporary information during mental operations (Hitch & Towse, 1995). There exist various theoretical reasons to expect that intra-individual variation in working memory and suggestibility may be related. First, the developmental patterns in working memory and suggestibility are inversely related. Indeed, one of the most consistent findings in suggestibility research is that susceptibility to suggestive influence decreases with age; in particular, preschool children are more suggestible than are older children (Ceci & Bruck, 1993). Conversely, working memory capability increases with age (Case, 1995). The developmental patterns of working memory and suggestibility suggest that an increase in working memory capacity may produce a decrease in suggestibility. The actual mechanisms through which this relationship exists may be related to speed of information processing capabilities and can be explained with the tenets of FTT, namely the ability to compare verbatim and gist memories. Both are briefly described below.

The relationship between the ability to process information quickly and working memory may be related to suggestibility. Case (1985) has argued that as the efficiency of performing mental operations increases, more information can be stored in the workspace of working memory. This increase in efficiency results in a greater volume of information that can be manipulated, thus allowing for the performance of increasingly sophisticated cognitive tasks (Hitch & Towse, 1995). In addition to the increase in storage space, the increase in processing speed over time results in greater

efficiency in the mental operations that act on this stored information. The developmental pattern of working memory and information processing speed are highly related (Case, Kurland, & Goldberg, 1982) and speed of processing may at least partially account for the development of working memory with age (Hitch & Towse, 1995). Although not examined in relation to processing speed, it may be hypothesized that resistance to suggestive inference, a complex cognitive skill, would benefit from efficient information processing. Because processing speed plays a significant role in working memory capabilities, working memory may serve as an indicator of the quality of information processing capabilities. Poor working memory competency may thus reflect poor information processing capacity. Poor information processing may compromise an individual's ability to distinguish between true and false information, thus rendering susceptibility to suggestive influence more likely.

Fuzzy trace theory provides an explanation for how working memory and information processing abilities may be related to suggestibility. Working memory capacity requires the individual to hold and manipulate information to reach a goal, while considering the context. For example, the digits backward test of working memory requires that an individual hold the digits presented in memory, actively manipulate them (reversing them mentally), and remember the context (the order) in which the digits were presented. In a recognition memory test, the individual must be able to compare the presented information (e.g., distractor) with the verbatim and gist traces of the actual experience stored in memory. Thus, in order to correctly reject false information, the individual must "keep track" of stored traces as well as the suggestive experience. Perhaps then, proficient working memory capacity renders an

individual better able to correctly reject false information (distractors) on a recognition test.

The Present Study

The present study was designed to investigate effects of external (type of questioning and delay) and internal (age and individual differences) factors on children's memory for dental procedures. Dental procedures have been shown to produce significant distress in many children, with fear of pain found to be the most important predictor of dental anxiety in both adults (Liddell & Locker, 1997; McNeil & Berryman, 1989) and children (Siegel & Peterson, 1980).

The findings from this study may extend previous research on children's memories for emotionally charged events. In addition, this study may help to determine how cognitive and social-personality individual difference factors, as well as external factors such as type of questioning and delayed testing, influence the suggestibility of children's memories. Finally, the documentation of children's memory for dental procedures may also enhance the clinical care of children, as the information will enable dental and medical staff, who must administer necessary procedures, to do a better job of preparation and follow-up with individual children.

Research Questions and Hypotheses

Research questions related to eyewitness testimony

External Factors

1. How does the type of specific question asked (yes-no versus 2-option multiple choice) influence children's suggestibility for a personally experienced, potentially distressful event?

Hypotheses: Based on the principles of FTT, the following specific predictions are proffered:

- 1A Absent feature questions are expected to elicit the lowest suggestibility scores because the information presented in the question is not related to dental gist and the misinformation is therefore easier to reject. Age differences would be expected with regard to absent feature questions, with younger children being more susceptible to incorrectly reporting that the detail occurred. This age difference would exist because the availability of gist memories increases with age, and older children would be more likely to remember what events are consistent with dental gist (e.g., getting a poke versus getting one's blood pressure taken) than would be younger children.
- 1B "Choice 1" and "choice 2" questions would elicit the next lowest levels of suggestibility, especially at immediate testing when verbatim memories are strong. "Choice 1" and "choice 2" questions introduce target information and are therefore good cues for verbatim memories. If verbatim memories are cued by the question, then it is easier for the child to reject the false choice presented.
- 1C "No" questions are expected to elicit the next lowest level suggestibility. Because a semantically related distractor is presented, children will have to correctly reject the information consistent with dental gist. This task should be difficult for children whose verbatim memories may be weaker (e.g., younger children).
- 1D "Neither" choice questions are expected to elicit the highest rates of suggestibility because two distractors are presented. Therefore, the child must

actively reject these two details, either one of which may be consistent with the gist of their memories. In addition, the presentation of two distractors would suggest to most people that the correct, or target, response is present in the question.

2. How does the type of question asked (yes-no versus 2-option multiple-choice) influence children's accuracy for a personally experienced, potentially distressful event?

Hypothesis: Based on the principles of FTT, it is predicted that children will display increased accuracy when responding to yes/no questions, than when responding to multiple-choice questions. In particular:

- 2A "Yes" questions are expected to elicit the best recall because target information is presented in the question, and thus verbatim memory would be cued. FTT states that accurate memories are based on verbatim memories, while inaccurate or false memories are based on gist. Thus, "Choice 1" and "Choice 2" questions should elicit the next best recall, as target information is present in the question. "Absent Feature" questions would be expected to elicit the next highest recall, because the incorrectly presented information is not similar to gist information and is thus easy to reject. "No" and especially "Neither" questions would elicit the lowest rates of recall because verbatim information is not present in the question and the incorrect details are consistent with dental gist, and thus children would be more likely to erroneously accept the misinformation.
3. What influence will a delay of 6-8 weeks have on children's accuracy and suggestibility for dental procedures?

Hypothesis:

- 3A Based on previous research, it is expected that, overall, children will exhibit better recall at the short delay testing session, compared to the long delay. Suggestibility scores are expected to be higher at delayed testing than at immediate testing. Based on FTT, children will be relying on gist memories at delayed testing because their verbatim memories will have faded. Thus if asked about a verbatim detail, they may be likely to acquiesce to the interviewer's suggestion if the suggestion is consonant with their gist memories.

Internal Factors:

4. What internal factors correlate with suggestibility and accuracy for a standard dental procedure? More specifically, do age, temperament, anxiety, working memory capacity, previous experience and pain/distress level help to differentiate which children will provide increased levels of false reports and decreased recollection?

Hypotheses:

- 4A Similar to findings of Roebbers and Schneider (2001), children with temperaments characterised as shy are expected to exhibit decreased accuracy. The extant literature comparing shyness and suggestibility has been mixed, thus no specific hypothesis regarding shyness and suggestibility are proffered.
- 4B Children reported to be more sociable, and perhaps consequently more likely to engage in discussion with the staff during the procedure, are expected to exhibit increased accuracy and decreased suggestibility. This finding is

predicted based on research by Salmon et al. (2002) demonstrating that children who displayed more procedure-related talk also exhibited increased accuracy.

- 4C Anxious children are expected to exhibit decreased recall and increased suggestibility. Previous research on anxiety and accuracy has been mixed, with some studies demonstrating that fear and state anxiety are negatively related to accuracy of event details (Merritt et al., 1994) and others (e.g., Chen et al., 1999; Vandermaas et al., 1993) finding no significant effect. No research with children has examined the effects of anxiety on suggestibility; however, increased self-esteem in adults (Gudjonsson, 1984) and self-efficacy in children (Mazzoni, 1998) has been linked to decreased suggestibility.
- 4D Children with poorer working memory capacities are expected to exhibit decreased recall and increased suggestibility. This is based on the premise that the ability to correctly reject misinformation presented in memory questions would be facilitated by enhanced abilities to hold and process multiple memory traces (e.g., verbatim and gist).
- 4E The quality of previous dental experiences is expected to affect recall, in that children having had higher rates of negative previous experiences are expected to exhibit decreased recall and higher levels of suggestibility. This expectation is consistent with the finding of Chen et al. (1999) that increased expectation of pain was related to decreased accuracy. Perhaps children who have experienced previous negative experiences come to expect more pain/distress from a subsequent procedure.

- 4F Children who have had more frequent visits to the dentist, and therefore likely have more knowledge about what happens during a dental visit, are expected to exhibit increased accuracy and decreased suggestibility. These hypotheses are based on findings demonstrating that increased knowledge about medical visits have been shown to be positively related to children's memory accuracy (e.g., Quas et al., 1997).
- 4G Based on previous research using child self-reported pain (Bruck et al., 1995; Merritt et al., 1994; & Oates & Shrimpton, 1991), no relationship between self-reported pain and recall accuracy is expected. Based on the paucity of previous research, the role of pain/distress level in suggestibility will be examined in an exploratory fashion.

Research questions related to pediatric health psychology

External Factors

5. What effect will a 6-8 week delay have on children's recollections of their pain/distress level?

Hypothesis:

- 5A Children will accurately recall the pain they experienced, as reported on the day of the visit (within one face on the FPSR). This hypothesis is based on previous research demonstrating good recall over long delays (e.g., Badali et al., 2000).

Internal Factors

6. What individual difference factors influence children's recall of their self-reported distress?

Hypothesis:

6A No predictions are proffered, and investigation was exploratory, due to the current paucity of research.

Chapter 2: Method

Participants and Setting

Sixty-eight parents (82% mothers) and their children participated. The mean age of the children was 8.07 years (4-12, $SD = 2.19$), and 60 percent were boys. Children who participated were visiting the dentist for a range of procedures: cleanings, check-ups and diagnostic exams, fillings, extractions and sealants (see Table 2.1 for a list of the procedures). Other demographics and characteristics of the participants are shown in Tables 2.2-2.4. The study was conducted in six dental practices in Saskatoon and North Battleford, Saskatchewan. The clinics served families from both urban and rural settings, covering areas of varied socioeconomic status.

Seventy-four parents were approached and seventy were recruited to participate in the study. Although the reasons for declining were not formally assessed, two children did not provide assent, one parent stated that her child had a speech impediment and might not feel comfortable talking on the phone, and another parent said that her child would not feel comfortable talking on the phone to a researcher. Data collection from one participant was incomplete due to the family's phone being disconnected.

Table 2.1. List of dental procedures experienced by the children.

Procedure	Frequency	Percent
Type of Procedure		
Check-up/ diagnostic exam	5	7
Cleanings	29	43
Fillings	18	27
Air abrasion fillings	5	7
Air abrasion sealants	1	1
Extractions	6	9
Filling & extraction	3	4
Pulpotomy	1	2
Total	68	100

Note. Fillings, extractions and pulpotomy involve receiving an injection.

Table 2.2. Participant age and demographic characteristics.

Variable	Range	<u>M</u>	<u>SD</u>
Parent age (years)	22.00-42.00	35.13	4.82
Socioeconomic status	21.26-70.19	41.93	11.70

Note. Socioeconomic status was calculated according to the Blishen et al. Index (1987). The mean of 41.93 represents middle class.

Table 2.3. Other sample characteristics.

Variable	Frequency	Percent
Ethnic Status		
Caucasian	64	94
Metis	4	6
Marital Status of Parents ^b		
Married	47	70
Divorced/separated	7	10
Remarried	2	3
Widowed	2	3
Never Married	4	6
Common Law	6	8

^aMetis status was determined by self-definition.

^bParents were not asked to indicate whom the child was residing with.

Table 2.4. Family descriptive information (re: dentistry).

	Frequency	Percent
Whether Parents Talked to their Children about the Dental Visit Prior to Appointment		
None	5	8
A little	42	62
In some detail	12	18
A lot	8	12
Parents Self Reported Dental Anxiety		
Not Anxious	20	28
Extremely Low	8	12
Moderately Low	18	27
Moderately High	17	25
Extremely High	5	8
Parents Self Reported Needle Anxiety		
Not Anxious	25	37
Extremely Low	20	18
Moderately Low	12	29
Moderately High	8	12
Extremely High	3	4

Measures

Eyewitness Testimony Measures

Predictor Variables

Two external factors were used as predictors of suggestibility and accuracy (the criterion variables), namely question type and delay. Five internal factors were used as predictors of accuracy and suggestibility: pain/distress levels, anxiety, temperament, previous experience with dental procedures and working memory ability. They are described, in turn, below.

Question type. To determine levels of accuracy and suggestibility (the criterion variables in the present study) in response to different forced choice questions, a 24-item recognition test was administered. Six question types were examined in the present study: (a) ‘yes’ questions in which the correct answer is yes; (b) ‘no’ questions in which the correct answer is no; (c) ‘choice 1’ questions in which 2-option multiple choice questions are correctly answered by the first choice; (d) ‘choice 2’ questions in which 2-option multiple choice questions are correctly answered by the second choice; (e) ‘neither choice’ questions in which neither of the presented choices is correct; and (f) ‘absent feature’ questions, a yes/no question for which the event probed did not take place during the dental procedure. For example, none of the children had eye drops placed in their eyes during the procedure, but the interview included a probe about this feature. Thus, a query about eyedrops is considered a suggestive question, in that it directs attention to a feature not experienced during the event being recalled. Please see Table 2.5 for an example of each question format. Question format was alternated among children such that for each of the 24 different

Table 2.5. Question formats.

Question Format		Examples
Yes/No	Yes	Did the dentist rub cotton/q-tip on your gum? Did someone floss your teeth?
	No	Did the dentist rub toothpaste on your gum? Did someone count your teeth?
	Absent Feature	Did the dentist tickle your eyes when s/he put the eye drops in?
Multiple Choice	Choice 1	Did someone floss your teeth, or did s/he count your teeth? Did the dentist rub cotton/q-tip or fluoride on your gum?
	Choice 2	Did someone count your teeth, or did s/he floss your teeth? Did the dentist rub fluoride or cotton/q-tip on your gum?
	Neither Choice	Did someone count your teeth or brush your teeth? Did the dentist rub toothpaste or vaseline on your gum?

items of information being queried, an approximately equal number of children were asked each of the six types of questions (see Appendix A for the question-type templates and four counterbalanced question formats).

Delay. The same 24-item recognition test was administered following the dental procedure (short delay) and again after a 6-8 week delay (long delay)

Pain/distress levels. Children made pain ratings on the Faces Pain Scale-Revised (FPSR: Hicks, von Baeyer, Spafford & Goodenough, 2001; see Appendix B for the scale). The FPS-R has been validated as a measure of pain intensity for use with children aged 4 or 5 and older. The scale has shown excellent inter-scale agreement, even in the youngest age groups. For example, FPS-R scores are significantly correlated with the other measures of children's self reported pain (Visual Analogue Scale, $r = 0.92$; and Coloured Analogue Scale, $r = 0.84$, Hicks et al., 2001).

Pain levels were measured immediately following the procedure. This immediate pain report was not collected for a total of 26 children because a dental practice requested that the FPS-R not be administered in the office; also, two parents requested that we not ask their children about their post-procedure pain/distress. Recall of pain was assessed during the first telephone conversation following the procedure (short delay phone interview), which typically occurred the same day of the procedure, and then again after a 6-8 week delay (long delay phone interview). At the short delay interview, the FPS-R was not administered to a total of 12 children because the family had misplaced the scale that was provided to them during the office visit. At the long delay interview, 55 of the 62 children contacted provided FPS-R ratings. Missing ratings were due to the family having misplaced the scale that was mailed to them.

In order to ease administration of the FPS-R via telephone, families were provided with an FPS-R that had numbers corresponding to each face printed about 5-10 centimetres below each face. Over the phone, the child was given the same instructions as for an in-person administration, except that after the child was asked to point to the face, they were asked to tell the researcher the number that was printed below that face. The children appeared to have no difficulty with this instruction. This telephone administration protocol was slightly different from that used by Badali et al. (2000) who, instead of numbers, placed letters of the alphabet in random order under each face.

Anxiety. Children were administered the Spielberger State/Trait Anxiety Inventory for Children (STAIC; Spielberger, Edwards, Lushene, Montuori, & Platzek, 1973). The STAIC consists of two scales that measure transitory anxiety (state anxiety) and dispositional anxiety (trait anxiety). The inventory is suitable for children from kindergarten to about Grade 6 (ages 4-12; Spielberger et al., 1973). However, the scale must be individually administered for children in kindergarten through Grade 2 (Papay & Spielberger, 1986). Both scales consist of 20 weighted items, with three response options available (see Appendix C for examples of the questions). These scales are known to be reliable and valid (Spielberger et al., 1973; Spielberger, Gorsuch, Lushene, Vagg & Jacobs, 1983). The state anxiety scale was given before the procedure. For ten of the children (15%), administration of the State Anxiety Scale was not possible as the children were called into the dental chair immediately upon arrival. The trait anxiety scale was administered over the phone to 66 of the 68 children. In both cases where the scale was not administered, parents had indicated

that the children needed to have a brief phone interview (i.e., were getting ready for bed and it was almost suppertime).

Temperament. Emotionality, activity, sociability and shyness were assessed using the EAS Temperament Survey (Buss & Plomin, 1984). The EAS temperament survey is based on a theory of temperament, where temperament is conceptualised as appearing in infancy, being relatively stable and predominantly genetically influenced (Buss & Plomin, 1975, 1984). In the present study, the Shyness and Sociability scales were used as predictor variables, given that previous research has suggested that they may be related to suggestibility (Schacter, Kagan & Leichtman, 1995).

The items for the Sociability dimension characterize sociable children as enjoying being with people, preferring to play with others rather than playing alone, finding people more stimulating than anything else, and as not being loners - rather they feel isolated when alone. The Shyness factor is not considered a temperament dimension but rather a derivative of Sociability (Bus & Plomin, 1984). According to Buss and Plomin (1984), sociability refers to the general tendency to want to be with people, whereas Shyness is more specific in nature, referring to the tendency to be tense and inhibited with strangers or casual acquaintances. It has been suggested that the EAS Temperament Survey Shyness subscale be viewed as a mixture of Shyness and Sociability (Saudino, McGuire, Reiss, Hetherington & Plomin, 1995). Buss and Plomin (1984) reported test-retest reliabilities as .72 for emotionality, .80 for activity and .58 for sociability/shyness. Buss and Plomin (1984) also reported a significant correlation of .16 between activity and sociability and other correlations being nonsignificant. See Appendix D for a description of the items for the scale.

Previous experience. Parents answered questions pertaining to the child's previous experience with dental procedures. Specifically, they were asked about how often their child has had a number of dental experiences, as well as how their child responded to each of these experiences. Responses were provided on a Likert scale ranging from 1 (negative) to 7 (positive). This scale was adapted from previous research (Dahlquist et al., 1986; see Appendix E).

Working memory. To assess working memory capacity, the 12-item (6 items, 2 trials per item) "Numbers Backward" subtest of the Children's Memory Scale (Cohen, 1997) was administered (please refer to Appendix F). The test requires the child to mentally reverse an orally presented sequence of numbers and therefore requires storage as well as active manipulation of the numbers in working memory. These aspects of storage and manipulation are integral components of the working memory system (Hutton & Towse, 2001). The numbers backwards subtest has been found to be a reliable and valid measure of working memory, standardized for use with children aged 5-12 years, and has been used in multiple studies (Chen & Stevenson, 1988).

Criterion Variables

Two criterion variables are used in the analyses pertaining to eyewitness testimony, namely suggestibility scores and accuracy scores. Free recall data were collected in the present study in order to keep the memory interview similar to what might occur in actual interview settings. However, free recall was not examined because research has demonstrated that, during initial interviews, children's free recall or spontaneous memories tend to be highly accurate, even for younger children (e.g., Quas et al., 2000). Because children's accounts of events tend to be less complete

than are those of adults (e.g., Goodman & Reed, 1986), interviewers often resort to closed questions and thus the challenge lies in determining the most appropriate closed questioning techniques.

Accuracy and suggestibility scores. A list of 24 event details was generated based on previous research (Vandermaas et al., 1993) and consultation with a dentist. From these details, 24 closed questions were asked concerning the dental staff's actions during the filling, the persons involved, and children's emotional responses and details about the context of the event. The questions were created in six question formats (described earlier). The children's responses to the questions were scored as: correct-accurate, not correct—suggestible, or not correct-not suggestible (see data scoring and reduction section below for more detail).

Pediatric Health Psychology Measures

Predictor variables. Three external factors were examined in relation to children's reports of their pain: effect of a temporal delay (6-8 weeks), amount of information parents reported providing their children before the procedure and parental anxiety. Effect of question type on pain was not examined because pain experience was not assessed via different question types, but rather by using a standard pediatric pain assessment tool, the FPS-R.

Five types of individual difference variables were examined in relation to self-reported pain: self-reported anxiety, parent-reported child temperament, parental report of child's previous reactions with dental procedures and frequency of dental visits. Please refer to earlier description of pain, anxiety, temperament, and previous experience for detailed descriptions of the variables.

Criterion Variable

Pain/distress levels. All children were asked to rate and recall the level of distress experienced during the procedure using the FPS-R, described above. Children provided ratings at three separate times: immediately following the procedure, during the short delay phone interview (median time of seven hours post procedure) and again at long delay phone interview (6-8 week follow-up). Because it was not possible to measure continuous distress during the procedure for the present study, all measures are children's recall of pain. However, due to the temporal proximity to the dental event, the first rating is assumed to be children's 'experienced' pain, and ratings at the short delay and long delay interviews are considered children's recollections of their pain. FPS-R ratings were not obtained for 40% of the children immediately following the procedure, 20% at the short delay and 23% at the long delay. The missing FPS-R data following the procedure was due to the constraints in some of the dental practices, wherein the dentists preferred we not use the FPS-R while the children were still in the office. The missing data at the short and long delay interview was due to parents losing the FPS-R that we had given to them (short delay) or mailed to them (long delay).

Procedure

Ethics approval was obtained from the University of Saskatchewan (see Appendix G). Dental practices in which to enlist the participants were recruited in several ways, based on discussion with two local dentists. First, the University of Saskatchewan Dental Clinic was contacted and permission was obtained to recruit parents and their children who visited the clinic. Second, a letter was sent to all private dental practices in Saskatchewan by the College of Dental Surgeons of

Saskatchewan (Appendix H). Dentists were asked to have someone from their office call the research lab if they were interested in having their patients participate. After four weeks, no responses were received from the dentists and so 15 practices in the Saskatoon area were followed up with a personal visit to ask if dentists might be interested in participating. One dentist was recruited by this method. Next, via a collegial connection, two other private practice dentists were recruited, one in Saskatoon and one in North Battleford, Saskatchewan. Finally, some participants were recruited through the public dental system. Overall, procedures were conducted in six different dental clinics by one of five dentists, two dental practitioners, or dental students at the University of Saskatchewan College of Dentistry.¹

The principal investigator was present at the dentists' offices and parents of children who were arriving for appointments were asked if they would be interested in participating in a study of children's responses to dental visits. A research assistant helped collect data for approximately six of the participants. Children who received medications other than local anesthetics were excluded.

After informed consent was obtained from the parent (see Appendix I for the consent and assent forms) and child assent was obtained, children completed the STAIC. The parent (82% were mothers) had the option of accompanying the child or remaining in the waiting room, according to typical procedure at the various practices.

Forty percent of parents were present during the entire event, ten percent were present for portions of the procedure and 44% of parents waited in the waiting room

¹ Independent sample t-tests were conducted to determine whether differences in children's pain scores, accuracy, or suggestibility differed according to the sex or experience level of the practitioner (i.e., student versus dentists/dental practitioners). No significant differences were found.

for the entire procedure. Parents of younger children were more likely to be present during the procedure ($t=2.78, p = .008$). No relationship between parental presence during the procedure and children's suggestibility or accuracy scores was found. Data on parental presence of seven children (7%) were not recorded.

The dentist was asked to conduct the treatment session as usual. During the procedure, a researcher recorded the main details that occurred. Parents completed the questionnaire package during their child's procedure. In the questionnaire, parents provided information on: family demographics, their child's temperament, their own anxiety about having dental work and injections, the child's previous experience with dental and other medical procedures, and whether any preparatory information about the dental visit was provided (see Appendix E).

Immediately following the procedure, children were asked to rate their level of pain/distress during the procedure on the FPS-R. Next, children were given a copy of the FPS-R in an envelope to take home and use during the first phone interview. Children were given a package of Trident gum for participating in the study and their names were put into a draw for a \$100 prize.

During the short delay phone interview, the child's memory for the procedure was examined, via free recall and 24 specific questions. For each of the key procedures (cleanings, fillings, extractions), one of four formats of interview questions was randomly assigned to each participant. Before the first telephone call, the specific questions were modified based on the information that the researcher recorded during the procedure. For example, if Question 1 was worded "Was the dentist's name Dr. _____", then the researcher placed the correct dentist's name in the blank. This interview was conducted by telephone and as shortly after the

procedure as possible. The delay in hours ranged from .25 to 96, with a mean of 14 ($SD = 21.98$) and a median of 7.00 hours. The longer delay (i.e. 96 hours) occurred for a few children whose procedures occurred on a Thursday before a long weekend and the short delay interview was not possible to do until Monday, when the family returned from their long weekend vacation. Note that the median delay was 7 hours.

During the telephone interview, children also completed the Trait Anxiety portion of the STAIC, the working memory measure (Numbers Backwards on the Children's Memory Scale), and a recalled pain/distress rating on the FPS-R. After a 6-8 week delay (mean delay in days = 49.40; $SD = 5.96$; range = 40-71), children were telephoned at home and asked the same memory questions that were given in the first interview; that is, free recall of the event and the 24 specific questions. Children were also asked to recall the level of pain/distress they experienced using the FPS-R, which was mailed to the family the week prior. Complete data for the long delay interview are missing for six children in the sample.

Chapter 3: Results

Overview of the Analyses

Analyses were organised around the two domains of research examined in the study: examination of factors relevant to eyewitness testimony and examination of factors relevant to pediatric health psychology. In regards to eyewitness testimony research, internal and external factors influencing accuracy and suggestibility were analysed. In regards to pediatric pain research, analyses were conducted to examine effects of internal and external factors on children's pain/distress scores.

Prior to conducting the analyses, scoring, data reduction and screening of the variables used in the analyses were completed. For the eyewitness testimony portion of the study, a series of repeated measures analyses of variance were conducted to examine the effect of external and internal factors on suggestibility and accuracy scores. For the pediatric health psychology portion of the study, correlations and partial correlations were used to examine factors influencing children's pain scores.

Preparation of Data

Data Screening

Prior to analyses, variables were examined for accuracy of data entry and to determine whether the data met the assumptions underlying the planned analyses. Data entry was double-checked for errors. Next, descriptive information for each of the predictor and criterion variables was examined. One case was identified as a univariate outlier because of its high (3.9) z score on the variable 'total suggestibility score' and another univariate outlier (z score = 2.58) on the variable "choice 2

suggestibility score” was identified. As per the recommendations of Tabachnick and Fidell (1996), a logarithmic transformation was applied to normalize the distributions and the relevant analyses were performed using the transformed scores. Note that because the “choice 2 suggestibility” variable ranged from 0-4, a standard logarithmic transformation was not possible and therefore the scores were transformed using the following formula: $\log(10) [\text{choice2 suggestibility}] = \log(10) [\text{choice2 suggestibility} + 1]$ (see Balota & Chumbley, 1984). The pattern of results was similar using the transformed and untransformed scores; therefore, the analyses were reported with untransformed scores to ease interpretation.

Data Scoring and Reduction

Eyewitness Testimony Predictor Variables

Question type. As mentioned in the ‘Eyewitness Testimony Measures’ section above, six question types were examined in the present study, four each of: (a) yes, (b) no, (c) choice 1, (d) choice 2, (e) neither choice, and (f) absent feature. See Table 3.1 for the mean, range and standard deviation of the scores.

Pain scores. FPS-R scores can range from zero to ten (Hicks et al., 2001). Pain scores (provided immediately following the procedure, during the short delay phone interview and at the long delay phone interview) were collapsed because, although there was a trend towards lower pain scores over time, results of a repeated measures ANOVA showed no statistically significant difference in FPS-R scores, $F(1.22,29) = 3.23, p = .06, \eta^2 = .10$. Thus, for the eyewitness testimony analyses, a composite pain score was calculated in which the three pain scores were averaged. See Table 3.2 for the mean, range and standard deviation of FPS-R scores. The mean of 2.09/10 is considered a mild amount of pain/distress.

Table 3.1. Means, ranges and standard deviations for the predictor variables used in the analyses of external factors predicting accuracy and suggestibility.

Variable name	(maximum score = 4) Mean	SD	Range
Suggestibility - Short Delay Interview			
No	.95	1.04	0-4
Absent	.47	.80	0-4
Choice 1	.44	.72	0-3
Choice 2	.38	.71	0-3
Neither	1.87	1.22	0-4
Accuracy – Short Delay Interview			
Yes	3.53	.64	2-4
No	2.70	.99	0-4
Absent	3.43	.84	0-4
Choice 1	3.24	.94	1-4
Choice 2	3.35	.91	0-4
Neither	1.79	1.15	0-4
Suggestibility – Long Delay Interview			
No	1.02	1.05	0-3
Absent	.56	.86	0-4
Choice 1	.77	.96	0-4
Choice 2	.52	.65	0-2
Neither	2.40	1.22	0-4
Accuracy – Long Delay Interview			
Yes	3.40	.64	2-4

Table 3.1 (CON'T)

No	2.55	1.11	0-4
Absent	3.34	.90	0-4
Choice 1	2.88	1.10	0-4
Choice 2	3.27	.81	1-4
Neither	1.06	1.13	0-4

Table 3.2. Means, ranges and standard deviations for the predictor variables used in the analyses of internal factors predicting accuracy and suggestibility.

Variable name	Mean	SD	Range
FPS-R average (pain/distress)	2.09	2.21	0-7
Anxiety –state	31.64	4.77	22-47
Anxiety – trait	35.75	7.90	20-60
Sociability	4.41	.86	2.25-6.25
Shyness	3.02	.90	2.25-5.25
Working memory scaled score	10.05	3.55	2-19
Previous negative experiences with dental procedures (number)	.58	.87	0-3
Frequency of previous dental visits (number)	3.52	2.24	0-9

Previous dental procedures. The frequency of previous dental visits was calculated by summing the total number of visits parents reported that their child had experienced. The parent questionnaire also included questions regarding children's responses to previous dental procedures. The scores could range from 1 (negative) to 7 (positive). A score of four is considered a "neutral" response. To determine the quality of children's previous dental visits, the number of negative reactions (when parents reported a reaction of 3, 2 or 1 on the scale described above) was summed. See Table 3.2 for the mean, range and standard deviation of the scores. The mean indicates that, on average, children had experienced less than one negative reaction during previous dental visits.

Temperament. The Shyness and Sociability dimensions of the EAS Temperament Survey were computed by determining the average score from the four items on each scale. Parents rated each item on a 5-point scale from 1 = "not characteristic or typical for your child" to 5 = "very characteristic or typical for your child." See Table 3.2 for the mean, range and standard deviation of the scores. The means on the Sociability (4.41) and Shyness scales (3.02) are comparable to those found in other studies (e.g., Sociability = 3.46 and Shyness = 2.52; Boer & Westenberg, 1994) using a similar aged sample.

Anxiety. Anxiety scores were calculated according to the scoring criteria outlined in the STAI-C manual. Thus, one score for trait anxiety and another for state anxiety were calculated. See Table 3.2 for the mean, range and standard deviation of the scores. The mean trait anxiety scores are comparable to those of the normative sample and previous research (e.g., Wachtel, Rodrigue, Geffken, Graham-Pole & Turner, 1994). However, mean state anxiety scores (31.64) are somewhat lower than

are those of previous research examining state anxiety using the STAI-C. For example, Bijttbier and Vertommen (1998) reported a mean state anxiety of 37.45 for children aged 2-12 undergoing venipuncture and Wachtel et al. (1996) reported a mean state anxiety score of 33.0 for their sample of children aged 10-17 years undergoing a range invasive procedures.

Working memory. The ‘Numbers Backwards’ subtest of the Children’s Memory Scale (CMS) was scored by awarding 1 point for each correct answer on each trial. If a score of 0 was obtained on both trials of a single item, administration was discontinued. Scores can range from 0 (none of the questions answered correctly) to 12 (all of the items answered correctly). Higher scores on the Number Backwards subtest indicate greater working memory capacities. The raw scores were converted to age-standardized scores using the normative data available in the CMS manual. Age standardized scores were considered more appropriate for the analyses given that developmental (age) differences in working memory capacity were not of interest in the present study. Please see Table 3.2 for the mean, range and standard deviation of the scores.

Age groups. Three age groups were created to examine age effects. Age groups were based on the ability to achieve relatively equal sample sizes. Group 1 children (N = 24) were aged 4-6 years. Group 2 children (N = 21) were aged 7-8 years and Group 3 children (N = 23) were aged 9-12 years.

Eyewitness Testimony Criterion Variables

Suggestibility and accuracy scores. As described earlier, suggestibility and accuracy, although related, are different constructs. Suggestibility refers to the extent to which an individual incorporates post-event information (e.g., incorrect information

introduced during questioning) into reports of the to-be-remembered event. Accuracy refers to the extent to which the individual correctly recalls information about the to-be-remembered event. Suggestibility and accuracy scores were first calculated for the different question types.

To calculate the child's suggestibility scores, the number of questions to which the child was led to respond incorrectly by the interviewer's suggestion (e.g., a "yes" response to "Did the dentist take your blood pressure?") was summed across the four questions given for each question type, except "yes" questions (maximum possible score = 20). "Yes" questions were not included in the suggestibility scores because these questions do not introduce any incorrect information to which the child might be susceptible. For example, in the "yes" question, "Did the dentist put in a filling?" an incorrect response of "no" or "I don't know" does not imply a tendency to "go along with" interviewer suggestion. Accuracy scores were calculated for each question type by summing the number of correct responses across all six questions types (maximum possible score = 24). Responses such as "I don't know" or "I don't remember" were not scored as suggestible responses.

The accuracy and suggestibility scores for each question type were calculated separately for the first interview and the second interview. These scores were used in the analyses examining the effect of question type on accuracy and suggestibility. Next, composite suggestibility scores and composite accuracy scores were calculated. The composite suggestibility and accuracy scores were used in analyses with the internal factors. For the suggestibility composite scores, the scores from the five question types (all except for "yes" questions) were summed for the first interview,

creating an overall suggestibility score for the short delay interview. Then, the same procedure was implemented for the responses to questions at the long delay interview.

Pediatric Health Psychology Predictor Variables

All of the individual difference factors examined in the eyewitness testimony analyses (temperament, previous experience, working memory, anxiety), save pain and working memory scores, were examined in relationship to children's recollection of their pain. The external factors examined were the effects of: a 6-8 week delay, the amount of information parents reported that they provided to children about the procedure, and self-reported parental anxiety levels. Parental anxiety was measured via a self-report question that asked parents to rate their own levels of anxiety when visiting the dentist (see Appendix E for the parent questionnaire).

Pediatric Health Psychology Criterion Variables

Pain scores. Please refer to section above on scoring and data reduction for these scores.

Examination of Factors Relevant to Eyewitness Testimony

It is quite likely that interactions among both external and internal factors will best predict accuracy and suggestibility. Indeed, in a review of external and internal factors, Bruck et al. (1997) suggest that an upcoming area of research within the next century will be to examine the mechanisms underlying suggestibility and develop a model that includes interactions among cognitive, social, personality, biological as well as interviewing factors. For the present study, the simultaneous examination of internal and external factors was not possible due to insufficient sample size. Specifically, combining both internal and external factors would require (a) translating the individual difference factors which are continuous variables into

dichotomous variables (e.g., high scorers on anxiety and low scorers on anxiety), which results in loss of statistical power (Spector, 1981); (b) the analysis would involve eight between subjects-factors and six within-subjects factors, and therefore very large sample sizes would be required. As such, internal and external variables were examined separately.

External Factors Influencing Suggestibility and Accuracy Scores

One analysis of the effects of question type on suggestibility and accuracy at the short delay and long delay was planned and conducted, but unacceptable power for several of the effects of interest (e.g., observed power below .80; Cohen, 1992) was noted. Thus, analyses for the short delay and long delay were conducted separately, while acknowledging an increased risk of Type I error.

The effects of question type on suggestibility and accuracy were also examined separately for two reasons. First, as explicated earlier, FTT presumes that divergent processes underlie true and false memories, thus, theoretically, combined analyses of the both suggestibility and accuracy would not be considered. Secondly, in the present study, suggestibility and accuracy scores are inter-dependent (e.g., if a participant response is scored as accurate on a particular question, s/he cannot also be scored as suggestible on the same item) and as such would not be appropriate for multivariate analysis of variance (Tabachnick & Fidell, 1996). In order to test the research questions, a series of repeated measures ANOVA's were conducted, and are described below.

Effects of Question Type on Suggestibility Scores

Preliminary analyses were conducted to rule out the possibility of effects being due to sex and the type of procedure (cleanings and checkups versus restorative

procedures versus surgical procedures). There were no significant suggestibility or accuracy effects related to type of procedure, so the data were collapsed across this variable in all analyses. However, effects due to the sex of the child were found. Therefore, as is described below, child sex is included as a grouping variable in some of the analyses.

To determine whether children's likelihood of making suggestible responses was related to the format of the question asked (research question #2), a 3 (age) X 2 (sex) X 5 (question type) ANOVA was conducted on suggestibility scores for each of the five question types (all except "yes" questions) for the short delay interview. Age (3 levels: 4-6, 7-9, 10-12) and sex (male/female) were the between-subjects factors. Question format (5 levels: "no," "choice 1," "choice 2," "neither choice" and "absent feature") was the within-subjects factor.

Results showed that question format was significant, $F(3.78,62) = 38.26, p = .000, \eta^2 = .38$. Pairwise comparisons revealed that "choice 1" questions, "choice 2" questions and "absent feature" questions were all answered with equivalent levels of suggestibility. Children's responses on these three question types reflected lower rates of suggestibility than "no" and "neither choice" questions. Children were more likely to provide suggestible responses to "neither choice" questions than to "no" questions (all p 's $< .01$). See Figure 3.1 for a visual depiction of the main effect. There was a main effect of sex, $F(1,62) = 4.69, p = .03, \eta^2 = .07$ with boys responding to the questions with more suggestible responses (see Figure 3.2). There was a significant main effect of age, $F(2,62) = 5.92, p = .004, \eta^2 = .16$ with the youngest group of children (aged 4-6 years) being more suggestible than the oldest group of children.

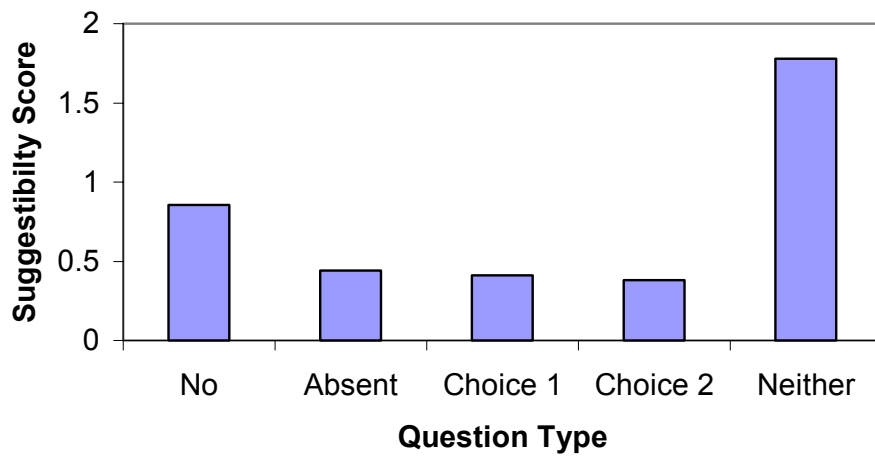


Figure 3.1. Main effect of question type on suggestibility scores at short delay interview.

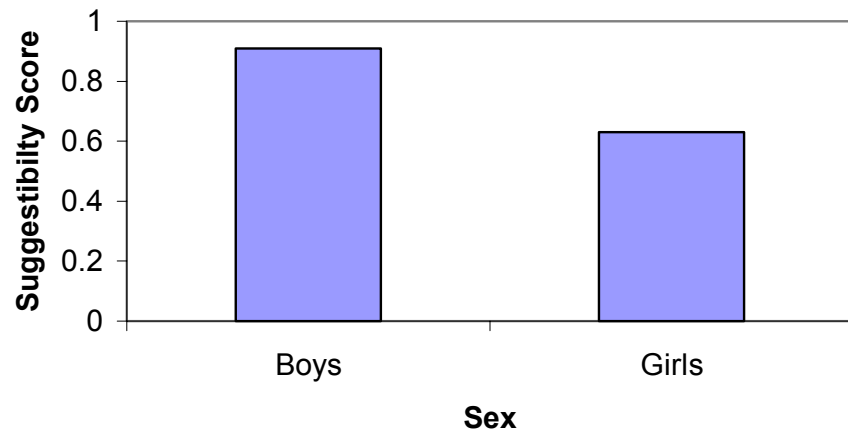


Figure 3.2 Main effect of sex on suggestibility scores at short delay interview.

The group 2 children (aged 7-8 years) were not significantly different from group 1 or 3 (see Figure 3.3).

A similar 3 (age) X 2 (sex) X 5 (question type) analysis was run for the long delay interview. There was a significant effect of question type, $F(3.97,53) = 42.84$, $p = .000$, $\eta^2 = .45$. “Neither choice” questions had the most suggestible responses, and were significantly different from the other four types. “No” questions were not significantly different from “choice 1” questions, but were significantly different from “choice 2” and “absent feature” questions (see Figure 3.4). A main effect of sex was present, $F(1,53) = 5.79$, $p = .02$, $\eta^2 = .10$, with boys providing more suggestible responses (see Figure 3.5). A significant main effect of age was found, $F(2,53) = 8.86$, $p = .000$, $\eta^2 = .25$. The youngest group of children was significantly more suggestible than the older two groups of children, who were not significantly different from one another (see Figure 3.6).

A question type by age group interaction was significant, $F(8,53) = 2.35$, $p = .02$, $\eta^2 = .09$. A follow-up ANOVA showed that age group differences existed for “no” and “absent feature” questions. Group 1 children provided significantly more suggestible responses to “no” and “absent feature” questions than Group 2 and 3 children, who were not significantly different from each other (see Figure 3.7).

In order to investigate whether suggestibility scores increased over time for specific question types, a 5 (question type) X 2 (time: short delay, long delay) X 3 (age group) repeated measures ANOVA was performed. Several significant effects were found that were already reported above. Specifically, there was an effect of time (i.e., from the short delay to the long delay suggestibility scores increased); there was a main effect of question type; a main effect of age group and a question type by age

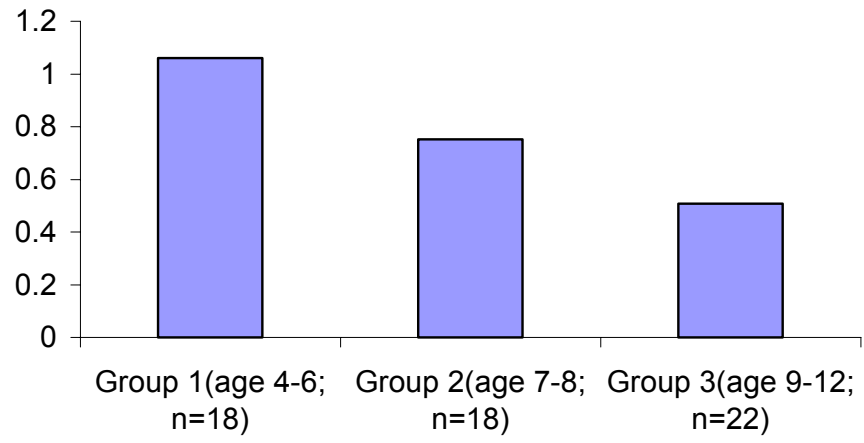


Figure 3.3. Main effect of age group on suggestibility scores at short delay interview.

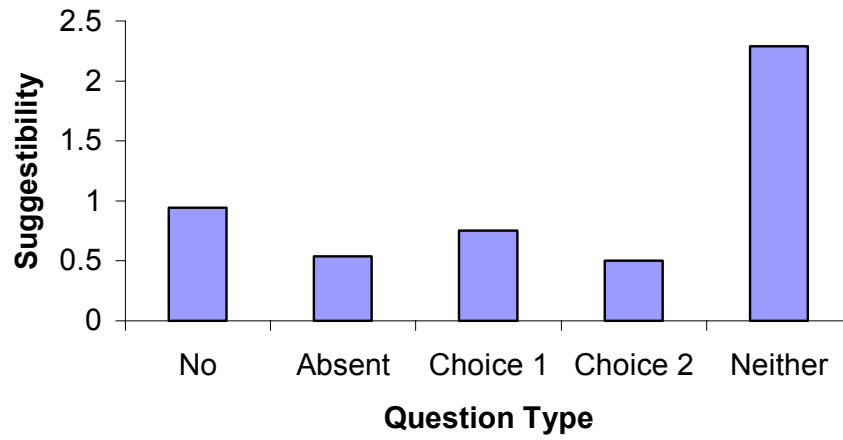


Figure 3.4. Main effect of question type on suggestibility scores at long delay interview.

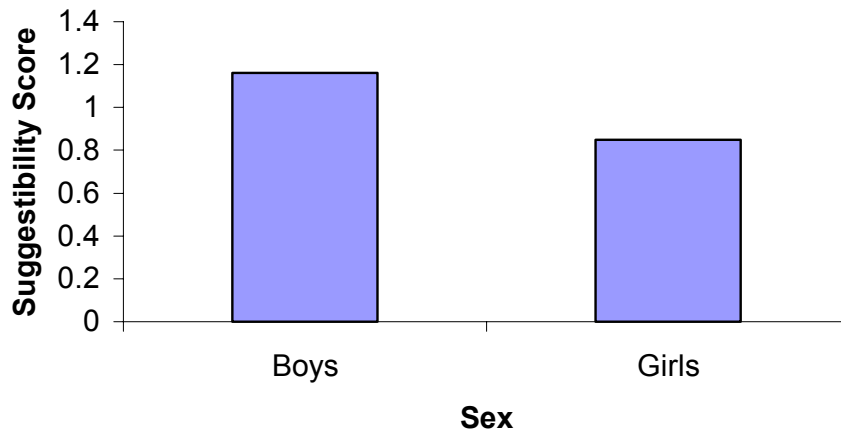


Figure 3.5. Main effect of sex on suggestibility scores at long delay interview.

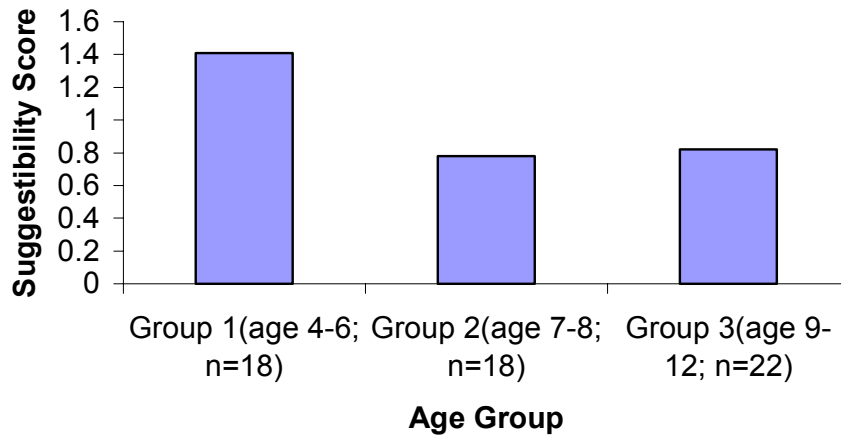


Figure 3.6. Main effect of age group on suggestibility scores long delay interview.

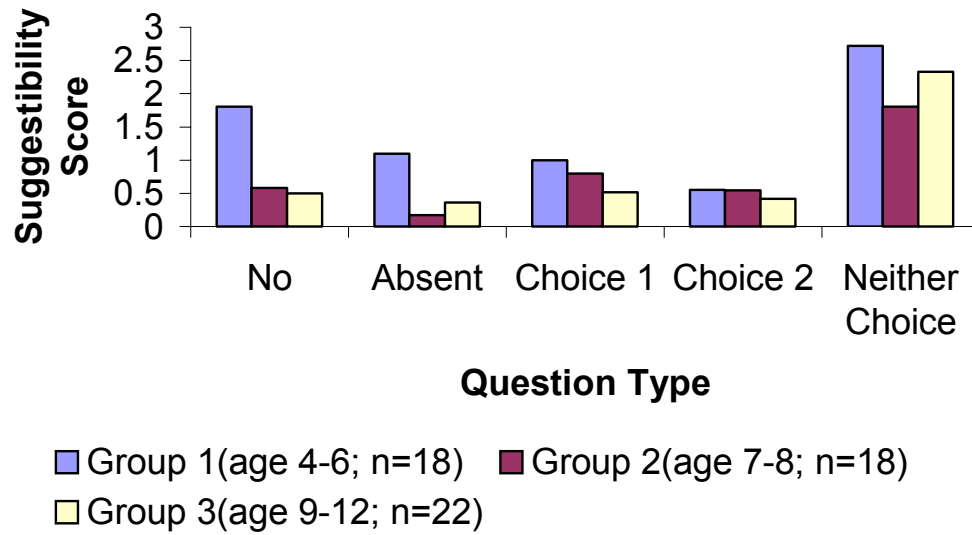


Figure 3.7. Interaction of child age group by question type for suggestibility scores at long delay interview.

group interaction. A time by question type interaction was significant, $F(3.55, 56) = 3.23, p = .01, \eta^2 = .06$. Follow-up paired samples t-tests of each question type at the short and long delay showed that “choice 1” “choice 2” and “neither choice” questions evidenced significant increases in suggestibility scores over time (all t 's > 2.00). To determine whether there were significant differences in increases to suggestibility over time between these three question types, difference scores for the short delay and long delay were calculated and means were compared. Results showed that “neither choice” questions were associated with higher increases in suggestibility scores over time than were other question types ($t(54) = 2.16, p = .04$), which did not differ significantly from each other. Please see Figure 3.8 for the mean suggestibility scores at the short and long delays for each question type.

Effects of Question Type on Accuracy Scores

To determine whether the likelihood of making correct/accurate responses was related to the format of the question asked for the short delay interview (research question #3), a 3 (age) X 2 (sex) X 6 (question type) ANOVA was conducted on accuracy scores. As before, age and sex were between-subjects factors and question format was the within-subjects factor. All six levels of question format (including “yes” questions) were included in the analyses. A significant main effect of question type was found, $F(5,57) = 24.74, p = .000, \eta^2 = .43$. Multiple comparisons revealed that “yes,” “choice 1,” “choice 2” and “absent feature” questions had the highest rates of accurate responses and were significantly different from “no” and “neither” questions. “No” questions had more accurate responses than “neither choice” questions (all p 's $< .01$). See Figure 3.9 for a visual depiction of the main effect.

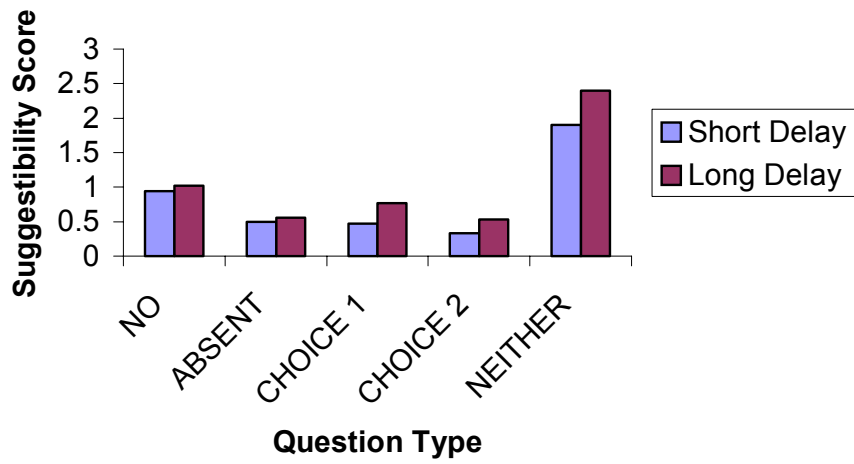


Figure 3.8. Mean number of children's suggestible responses to different question formats at short delay and long delay interviews.

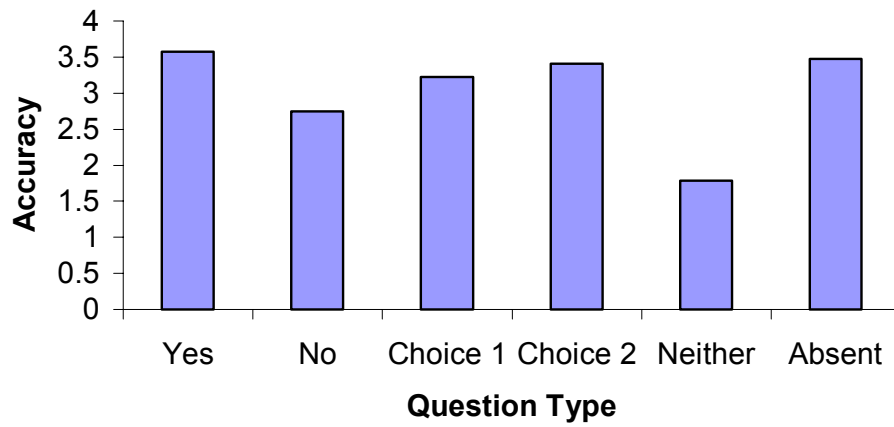


Figure 3.9. Main effect of question type on accuracy scores at short delay interview.

Tests of between-subjects factors showed a significant main effect of age, $F(2,57) = 4.62, p = .014, \eta^2 = .14$. The youngest group of children had lower accuracy scores than the older groups of children. Group 2 children were not significantly different than either group 1 or group 3 (see Figure 3.10).

A similar analysis was run for the long delay interview. The results were the same as those for short delay interview, with significant main effects of question type, $F(5,48) = 49.26, p = .000, \eta^2 = .51$ and age, $F(2,48) = 6.37, p = .004, \eta^2 = .21$ (see Figures 3.11 and 3.12 for graphical representation of the main effects).

In order to investigate whether accuracy scores increased over time for specific question types, a 6 (question type) X 2 (time: short delay, long delay) X 3 (age group) repeated measures ANOVA was performed. Several significant effects were found that are reported above. Specifically, there was an effect of time (i.e., from the short delay to the long delay accuracy scores increased), question type and time. In addition to the already presented findings, a time by question type interaction was significant, $F(5,49) = 3.56, p = .004, \eta^2 = .07$. Please see Figure 3.13 for the mean accuracy scores score over time for each question type. Follow-up paired samples t-tests of each question type at the short and long delay showed that “choice 1” and “neither choice” questions evidenced significant decreases in accuracy scores over time (all t 's > 2.00). To determine whether there were significant differences in increases to accuracy over time between these two question types, difference scores for the short delay and long delay were calculated and means were compared. Results showed that “neither choice” questions were associated with higher decreases in accuracy scores over time than were “choice 1” questions ($t(58) = -2.22, p = .03$).

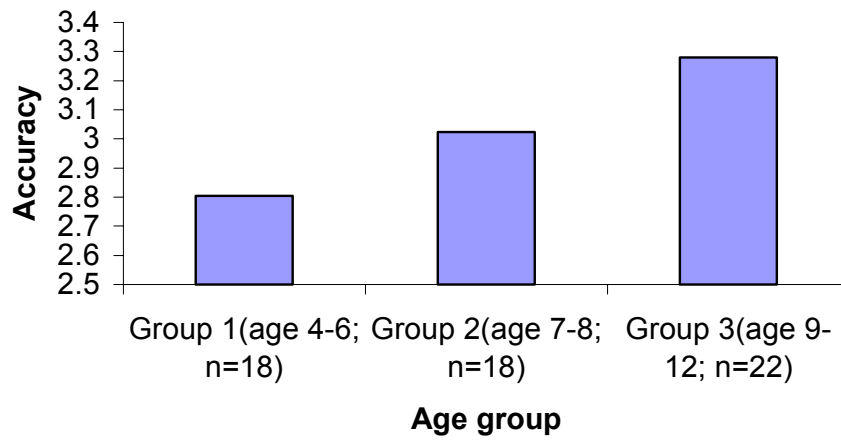


Figure 3.10. Main effect of age group on accuracy scores at short delay interview.

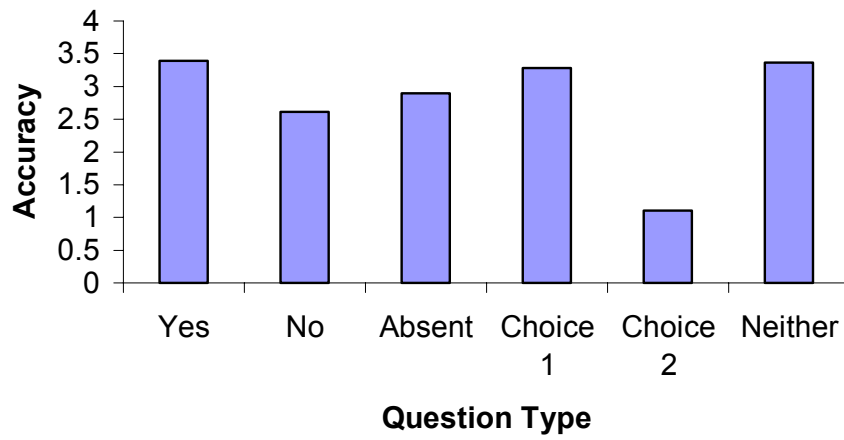


Figure 3.11. Main effect of question type on accuracy scores at long delay interview.

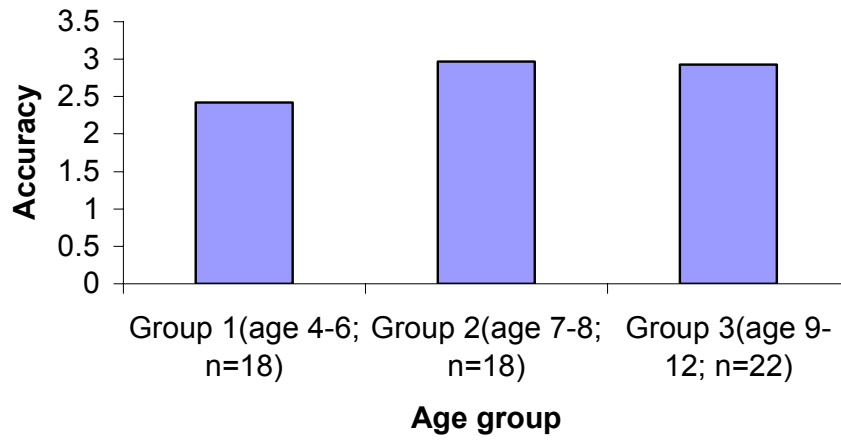


Figure 3.12. Main effect of age group on accuracy scores at long delay interview.

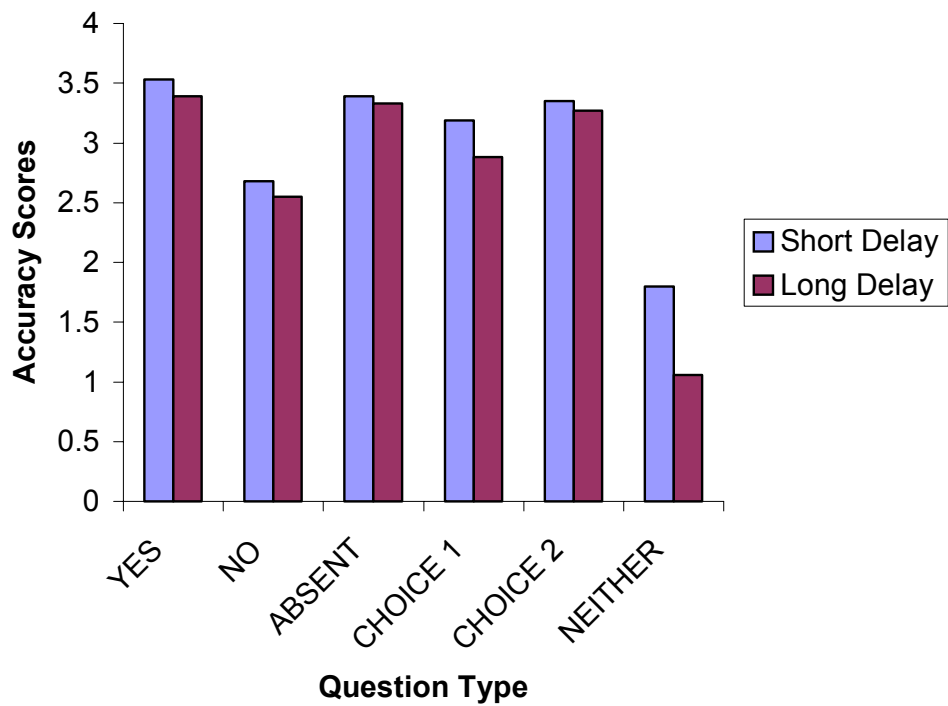


Figure 3.13. Mean number of children's accurate responses to different question formats at short delay and long delay interviews.

Internal Factors Influencing Suggestibility and Accuracy

In order to examine the relative contributions of the internal factors (individual differences) on suggestibility and accuracy (Research question #1), suggestibility scores for the short delay and the long delay were summed to create a composite score, which was considered more reliable than either independent score. The analyses described below were initially conducted separately for the short delay and the long delay interviews. No significant differences between the two sets of analyses were found, and therefore, the scores across both times were collapsed. A paired samples t-test comparing suggestibility scores for the short delay and the long delay showed that, over time, suggestibility scores increased, $t(59) = -4.91, p = .000$. At the short delay, across question types, children responded with mean suggestibility of 20% (range 0-80%), which increased to 25% (range 0-75%) at the long delay.

Accuracy scores for the short and long delay were also summed to create a composite accuracy score. Analyses were initially conducted separately for each time period. No significant differences were found, and therefore, short delay and long delay scores were collapsed. A paired samples t-test comparing accuracy scores from the short delay and long delay showed that, over time, accuracy scores decreased, $t(51) = 6.28, p = .000$. At the short delay, children responded with a mean accuracy of 75% (range 33-92%), which dropped to 68% (range 33-92%) at the long delay.

A correlation matrix (see Table 3.3) of the internal factors (e.g., pain scores, anxiety scores, sociability and shyness scores, children's experience with dental procedures, etc.) and composite suggestibility and composite accuracy scores was examined. Based on the matrix, variables with significant correlations and trends ($p <$

Table 3.3. Correlation matrix for internal factors and memory accuracy and suggestibility scores.

	1	2	3	4	5	6	7	8	9	10
1. SUGG	--	-.75*** (52)	.37** (59)	-.18 (50)	.32 ^t (33)	-.05 (58)	-.40** (58)	-.12 (54)	-.30* (58)	-.30* (55)
2. ACC		--	-.18 (52)	.07 (45)	.09 (29)	-.03 (51)	.55** (51)	.24 ^t (48)	.32* (51)	.46*** (55)
3. ANX-TR			--	.05 (57)	.41* (35)	.11 (65)	-.26* (65)	-.32* (59)	-.05 (65)	-.15 (62)
4. ANX-ST				--	.12 (28)	.12 (57)	-.03 (57)	-.05 (52)	.44*** (57)	.05 (56)
5. FPS-R					--	-.17 (35)	-.04 (35)	-.26 (32)	.09 (35)	.16 (33)
6. SHY						--	-.33** (66)	-.29* (58)	.01 (66)	-.06 (63)
7. SOCB							--	.27* (58)	.13 (66)	.11 (63)
8. WM								--	.01 (58)	.07 (63)

Table 3.3. (CON'T)

9. #NEG.DENT	--	.22 ^t (64)
10. FRQ.DENT	--	

Note. SUGG = Suggestibility; ACC = Accuracy; ANX-TR = Trait Anxiety; ANX-ST = State Anxiety; FPS-R = Pain Score (Average); SHY = Shyness Dimension of Temperament; SOCB = Sociability Dimension of Temperament; WM = Working Memory Measure; #NEG DENT = Number of Previous Negative Dental Reactions; FRQ.DENT = Frequency of Previous Dental Procedures

*** p < .001; **p < .01; *p < .05, ^t = p < .1.

.1) were considered for further analyses. Regression analyses were considered, however, based on the formula provided by Tabachnick and Fidell (1996), with the present sample size, there would be sufficient power to include only two predictor variables in the regression. Therefore, several regression analyses would be required. Because results would be equivalent using either a series of regressions or partial correlations, partial correlations were conducted to simplify the analyses. Given the wide age range examined in the present study, variation due to developmental differences was expected. For example, research has demonstrated that, with increasing age, children tend to: report less pain in response to medical procedures (Jay et al., 1983), exhibit lower levels of suggestibility (e.g., Ceci & Bruck, 1993); report less anxiety (Katz et al., 1980) and have increased working memory capacity (Case, 1995). Of particular interest was whether, *independent* of children's age, the internal factors examined were related to accuracy and suggestibility, therefore, children's age was controlled in the analyses.

Several internal factors showed a relationship to suggestibility in the correlation matrix: sociability, average pain scores, trait anxiety, number of previous negative dental reactions and total number of visits to the dentist. With age partialled, three factors were significantly related to suggestibility: sociability, $r(55) = -.36, p = .007$; children's average pain scores, $r(30) = .44, p = .012$; trait anxiety, $r(56) = .26, p = .05$. There was a trend for the number of previous negative dental reactions to be related to suggestibility, $r(57) = -.25, p = .07$. In sum, independent of child age, children who were rated by their mothers as less sociable and who provided higher self reports of pain intensity and trait anxiety were more likely to have higher suggestibility scores.

Based on the correlation matrix, sociability, number of previous negative dental reactions and total number of visits to the dentist showed an association with accuracy scores. Taking into account children's age, sociability was significantly related to accuracy, $r(48) = .51, p = .000$. Thus, children who were rated by their mothers as more sociable also evidenced higher recall accuracy. Relationships between number of previous negative dental reactions, $r(45) = .24, p = .01$, and total number of visits to the dentist, $r(45) = .25, p = .09$, were not statistically significant with age partialled. There was a trend towards working memory (an age-standardized score) being related to accuracy levels, $r(48) = .24, p = .1$.

Examination of Factors Relevant to Pediatric Health Psychology

Internal and External Factors Influencing Pain Scores

One of the research goals of the present study was to examine factors that influence children's recall of their self-reported pain (research questions #5 & 6). The individual difference factors examined were temperament, previous experience with dental procedures and anxiety. No specific hypothesis was offered due to the current lack of research, thus these analyses were exploratory. The external factors examined were preparatory information provided by parents, parental dental anxiety and temporal delay. The key research question was: What will be the effect of a 6-8 week delay on children's recollections of their pain/distress level? It was predicted that children would accurately recall their initial self-report of pain/distress (within one face on the FPS-R). This hypothesis is based on previous research demonstrating good recall over long delays (e.g., Badali et al., 2000).

To examine the relationship between children's pain reports over time, the percentage of children who accurately, at the long delay, recalled the amount of

pain/distress they reported immediately following the procedure was calculated. Recollections were considered accurate if they were within one face of their original report. Eighty-five percent of children correctly recalled their pain reports. In order to examine accuracy more stringently, the criteria were modified such that in order to be considered accurate, the pain score at the long delay had to be exactly the same as was provided immediately following the event. Using this more conservative criterion, children were still found to be highly accurate, with 60% of children recalling the exact level of pain initially reported.

To examine how scores changed over time the difference of FPS-R means from scores provided immediately following the procedure, during the phone interview and at the delayed interview, was examined via a repeated measures ANOVA. Data from the three periods was available for 32 children. Results showed that over time, there was a trend towards lower mean FPS-R scores, $F(1.22,29) = 3.23, p = .06, \eta^2 = .10$. Mean pain/distress scores over time, along with ranges and standard deviations, are presented in Table 3.4. The mean score of 2.56 is considered a mild amount of pain or distress. This mean is comparable to those of other studies examining children's procedural distress (e.g., Cohen et al., 2001; Fradet et al., 1990). In order to investigate internal factors influencing children's memory for pain, a correlation matrix was first examined using the individual difference factors and the dental variables (i.e., amount of information parent's provided to children about the procedure, parental dental anxiety, number of previous negative dental experiences and total number of dental visits). See Table 3.5 for the correlation matrix. The only significant factor related to children's self-reported pain was trait anxiety, and this was significant only at the long delay interview. To determine if this effect was

Table 3.4. Means, standard deviations and ranges for children's FPS-R scores.

	Mean	Std. Deviation	Range
FPS-R (N = 32)			
Immediate	2.56	2.84	0-10
Short Delay	2.38	2.71	0-10
Long Delay	1.63	2.12	0-8

Table 3.5. Correlation matrix for internal factors related to children pain scores.

	1	2	3	4	5	6	7	8	9	10
1. FPS-R -IMMED	--	.490** (36)	.18 (42)	.10 (34)	-.07 (42)	-.11 (42)	.03 (42)	.05 (40)	-.12 (42)	.02 (42)
2. FPS-R DELAY		--	.27* (54)	.12 (47)	-.09 (54)	.02 (54)	.16 (54)	-.08 (51)	.07 (54)	-.05 (55)
3. ANX-TR			--	.05 (57)	-.26* (65)	.11 (65)	-.05 (65)	.05 (65)	.05 (65)	-.21 ^t (66)
4. ANX-ST				--	-.03 (57)	.12 (57)	.44*** (57)	.05 (56)	.03 (57)	-.15 (58)
5. SOCB					--	-.33** (66)	.13 (66)	.11 (63)	-.23 ^t (35)	-.11 (66)
6. SHY						--	.01 (66)	-.06 (63)	.25* (66)	-.09 (66)
7. #NEG.DENT							--	.22 ^t (64)	.06 (67)	-.28* (67)
8. FREQ DENT								--	.11 (64)	-.01 (64)

Table 11. (CON'T)

9. AMT INFO R'CVD	--	.14 (67)
10. PAR.DENT.ANX		--

Note. FPS-R IMMED = Pain Score at Time 1; FPS-R DELAY= Pain Recall at Time 2 (6-8 week delay); ANX-TR = Trait Anxiety; ANX-ST = State Anxiety; SOCB = Sociability Dimension of Temperament; SHY = Shyness Dimension of Temperament; #NEG DENT = Number of Previous Negative Dental Reactions; FRQ.DENT = Frequency of Previous Dental Procedures; AMT INFO R'CVD = Amount of information parents provided children about the procedure; PAR.DENT.ANX = Parental dental anxiety

*** $p < .001$; ** $p < .01$; * $p < .05$, ^t $p < .1$.

independent of the child's age, partial correlation analyses between trait anxiety and pain scores (controlling for age) immediately following the procedure, and again at the long delay interview, were examined. Trait anxiety was not related to pain scores provided immediately following the procedures, however, trait anxiety was significantly related to pain scores at the long delay interview, $r(33) = .52, p = .001$. Therefore, children who tend to be more anxious do not report more pain immediately following the procedure, but do so after a 6-8 week delay.

There were other significant findings in the correlation matrix. First, parents tended to provide more information about the dental procedure, before visiting the dentist, to shyer children. This finding was significant with age controlled, $r(63) = .25, p = .05$. In contrast, a trend showed that parents provided less information to children they reported as being more sociable. When age was statistically controlled, the association decreased, $r(63) = -.20, p = .10$. Children who reported more anxiety immediately before the procedure also had parents who reported that their children tended to react more negatively to dental visits. Finally, Table 3.5 also shows that parents self-reported dental anxiety was significantly related to the number of negative previous experiences they reported their children as having, and the table also shows a trend for parental dental anxiety to be related to children's self-reported overall levels of anxiety.

Chapter 4: Discussion

The overall goals of the present study were twofold. First, the study examined the effect of external factors (question types and temporal delay) and internal factors (temperament, anxiety, pain/distress level, working memory, previous dental experiences) on children's suggestibility and accuracy scores for a dental procedure they experienced. Second, the effect of external (temporal delay) and internal (e.g., temperament, anxiety, working memory, previous experience) factors on children's memory for their self-reported pain/distress following a dental procedure was also examined.

Examination of Factors Relevant to Eyewitness Testimony Research

One of the most prominent areas of interest among child eyewitness memory research over the past two decades has been the examination of factors that may make children susceptible to interview suggestions. The results from the present study showed that children respond more accurately, and with less suggestibility, to yes/no questions than to multiple-choice questions. Boys, and younger children, evidenced higher rates of suggestibility. After a 6-8 week delay, children's accuracy scores decreased and suggestibility scores increased. Children who were reported to be more anxious, less sociable and to have reported higher levels of pain were also found to exhibit higher levels of suggestibility. Children who were reported to be more sociable evidenced higher accuracy scores. These findings provide some new evidence of the effects of

forced choice questions and individual difference factors on children's memories for, sometimes distressful, dental procedures. The findings and their implications are discussed below.

External Factors Influencing Suggestibility and Accuracy

Effect of Question Type and Delay on Suggestibility and Accuracy Scores

A child's open-ended narrative response when questioned about an event, although highly accurate, is often not sufficient evidence for a forensic investigation. Although use of open-ended questioning with minimal use of forced-choice questions is recommended, investigative practices often do not conform to these recommendations. For instance, Brainerd and Reyna (1996) cite a case where 100% of the responses that formed the basis of an investigation involving a 2-year-old were answers to yes-no questions. Many trained professionals who interview alleged child victims use predominantly forced-choice questions, especially yes-no questions (McGough & Warren, 1994).

One of the goals of the present study was to extend the findings of Peterson and Grant (2001) to a personally relevant potentially distressful event that was more likely to elicit varying degrees of distress, thereby making it more comparable to forensic settings. Another goal was to provide theory-driven hypotheses. The present study examined, in addition to accuracy, children's levels of suggestibility across question type. It was predicted, based on the principles of FTT, that children would display increased accuracy and decreased suggestibility when responding to yes/no questions, than when responding to multiple-choice questions (see "Research Questions" section in the introduction for a

detailed description of predictions).

As expected, multiple-choice questions were more problematic than yes/no questions, with both accuracy and suggestibility scores. Recall that three types of yes/no questions were asked, “yes,” “no,” and “absent feature” and three types of multiple choice questions were asked, “choice 1,” “choice 2,” and “neither choice.” In general, the most problematic question types were “no” and “neither” questions. These findings are consistent with those of Peterson and Grant (2001), Peterson and Biggs (1997) and Peterson et al. (1999). “Neither” choice questions were found to elicit the highest suggestibility and lowest accuracy scores. Overall, children incorrectly responded to 58% of the “neither” choice questions. The effects were more pronounced after a delay. Indeed, “neither choice” questions were the only ones to show significant increases in suggestibility and decreases in accuracy from the short delay to the long delay interviews. The inclusion of a delay is important in such studies, as long delays between the experienced event and questioning are common in forensic settings.

Peterson and Grant (2001) argued that yes/no questions are more problematic than multiple-choice questions because of the children’s bias toward responding “yes” to these questions. They found that when the correct answer was “no,” almost half of children’s responses were wrong. As noted by these researchers, this level of accuracy is similar to that of a coin toss – which is an unacceptable error rate in present-day forensic interviews. In the present study, only 26% of children’s responses to “no” questions were incorrect. The higher accuracy rate in our sample may be due to the larger age range studied or perhaps due to the salience of the dental event for the children.

Peterson and Grant (2001) suggested that “neither” choice questions are just as likely to elicit errors as “choice 1” and “choice 2” questions. They found no response bias for answering multiple-choice questions. Such a response bias could take one of two forms: (a) children might always choose the last of the stated options or, (b) for questions where none of the stated options were correct, they might still choose an option, rather than stating that none, or neither, was correct. Given that no response bias was found, the authors concluded that including a multiple-choice question where neither of the stated options was correct does not seriously jeopardize children’s responses. The results of the present study contradict their suggestions. As described, 6-8 weeks following the dental procedure, “neither choice” questions elicited the most suggestible responses. If it were possible for interviewers to confirm that the target detail, or true event, is included as one of the multiple-choice options (i.e., “choice 1” or “choice 2” questions) then multiple-choice questions are less problematic. However, such a scenario would eliminate the need for interrogative questioning. Interviewers seldom know the target detail they are pursuing. Thus, if a child is asked, “Did the man you saw have dark coloured hair or light coloured hair?” and, in fact, the man was bald, then children are likely to incorrectly accept one of the provided options.

Another difficulty with the use of multiple-choice questions was found in the present study. Specifically, a response bias was found for the “choice 1” and “choice 2” questions, but only at the long delay interview. Similar to previous research (Walker, Lunning & Eilts, 1996, as cited in Peterson & Grant, 2001), children were more likely to erroneously choose the second option when the first option was correct in 2-option

multiple-choice questions (e.g., Did the dentist brush your teeth or did she floss your teeth?). The same outcome was not reported in Peterson and Grant's (2001) study. It is possible that following their one-week delay children's memories may still have been highly accurate and there may have not been sufficient variability to detect this effect. Of course, a similar response bias was found for yes/no questions, with children more likely to incorrectly respond to "no" questions for both interviews.

More specific hypotheses were made based on tenets of FTT. Specifically, it was predicted that suggestibility scores would vary according to the type of question asked in the following order (from lowest to highest scores): "absent feature," "choice 1/choice2," "no," and "neither." Results were generally consistent with these predictions. "Absent feature" questions had low levels of suggestibility, as did "choice 1" and "choice 2" questions during the first interview. "No," and especially, "neither" questions had high rates of suggestibility. Contrary to expectations, following the delay, "choice 2" questions were more problematic than "choice 1" questions. According to FTT, the presentation of the target detail in these questions should cue verbatim memory (if still available) and lead the child to accept the correct detail. Given that the significant difference between the two question types was evident only following the delay, it is possible that memory for many of the verbatim details may have completely faded for most children, and thus children may have been more likely to simply guess at the correct option. When guessing occurs children are more likely to choose the most recently presented option, choice 2.

In regards to accuracy scores, it was expected that they would vary according to the type of question asked in the following order (from highest to lowest scores): "yes,"

“choice1/choice2,” “absent,” “no,” and “neither choice.” Results were not exactly as predicted. Both “yes” and “absent feature” questions elicited the highest levels of accuracy. Based on FTT, we would expect “yes” questions to be highly accurate because the presented item cues verbatim memory, while the “absent feature” questions present misinformation. Perhaps the plausibility of questions used made the distractor very easy for the children to reject. As Mazzoni, Loftus, and Kirsch (2001) have demonstrated, an increase in plausibility of suggested experience renders individuals more easily misled than the suggestion of implausible experiences. Thus, the “absent feature” questions, some of which were quite implausible (e.g., “Did the dentist give you a hug when you were done?”) may have not have been misleading and, instead, it may have been quite easy for most children to correctly respond “no.”

Again, contrary to predictions, “choice 1” and “choice 2” questions showed differential rates of accuracy at the short and long delay interviews, with children demonstrating a response bias towards the second presented option. Consistent with predictions, “no” and especially “neither” questions evidenced the lowest levels of accuracy.

The present study also demonstrated that the effect of question type was not uniform across age groups. Specifically, the youngest group of children evidenced higher suggestibility scores than the oldest group with “no,” “neither” and “absent feature” questions. Thus, for the most suggestive of question types (no, neither and absent feature) the youngest children are more likely to go along with the suggested inferences. This finding is consistent with previous research demonstrating that younger children have

particular difficulty in rejecting falsely presented information (see Ceci & Bruck, 1993 for a review). This finding speaks to the importance of avoiding any suggestive questioning with young children who appear more likely to accept statements with low plausibility (e.g., Did the dentist tickle your eyes when she put the eyedrops in?).

One of the research objectives was to examine the effect of a 6-8 week delay on children's memories for the dental event. As expected, suggestibility scores increased over time and accuracy scores decreased over time. The present findings are consistent with previous research (e.g., Peterson & Bell, 1996; Poole & Lindsay, 1995). Based on FTT, after a delay, children would be relying on gist memories because their verbatim memories will have faded. Thus when questioned about a verbatim detail, they would be likely to acquiesce to the interviewer's suggestion if the suggestion is consonant with their gist memories. When examination of how the accuracy and suggestibility of specific question types changed over a 6-8 week delay was conducted, it was found that responses to "neither" choice questions showed significant decreases in accuracy and increases in suggestibility, when compared to other question types. This finding, again, speaks to the obvious difficulties in using these types of questions and underscores the importance of avoiding them in interrogative interviewing.

In sum, the findings do not support a switch to the use of multiple-choice questions in forensic interviews. On the contrary, the present data suggest that following a delay, which is typical in forensic interviewing procedures, "neither choice" questions were more problematic than "no" questions.

Internal Factors Influencing Suggestibility and Accuracy

Within any age-matched sample, and any given context, there are usually marked differences in children's suggestibility (Pipe & Salmon, 2002; Quas et al., 1997). Some children provide very accurate accounts of previous experiences and are highly resistant to interviewer suggestions, whereas others recall very little information and are easily misled. The present study examined the effects of five individual difference factors in relation to suggestibility and accuracy, namely: anxiety, temperament, experienced pain, previous experience with dental procedures and working memory. Child sex was also examined in relation to memory for the event. Because of equivocal previous research no significant findings were expected, however, results indicated that boys evidenced higher suggestibility scores than did girls. After controlling for the effect of child age, three other individual difference factors were significantly related to suggestibility: the sociability dimension of temperament, trait anxiety, and pain severity. Sociability was the only internal factor significantly related to accuracy. These results provide insight into why, across studies, children's memory capabilities and susceptibility to false suggestions appear to vary quite substantially.

Effect of Child Sex

Although previous researchers have not focused on sex differences in suggestibility, when differences have been reported, results have been equivocal (e.g., Daneilsson, Sigurgeirsdottir, Einarsdottir & Haraldsson, 1993; McFarlane, Powell & Dudgeon, 2002). As such, a relationship between sex and suggestibility was not predicted. However, contrary to expectations, in the present sample, boys evidenced

higher suggestibility scores than did girls. Similar to our findings, Daneilsdottir et al. (1993) noted that boys were more vulnerable to suggestion than girls, although this finding was only revealed for 8-year-olds (no effect of gender was found for the 6-, 10- and 12-year old samples). In contrast to our findings, McFarlane et al. (2002) found girls (aged 3-5) to be more suggestible than same aged boys, when responding to misleading yes/no questions on the Yield subscale of the Video Suggestibility Scale for Children. A possible explanation for our findings may be that boys have a stronger need to reduce anxiety or uncertainty or they fear negative evaluation. This explanation would be consistent with Gudjonsson and Clark's (1986) socially based model of suggestibility. Because the three interviewers in the present study were female, it is not possible to determine whether sex of the interviewer may have influenced boys' susceptibility to misleading questions.

Effect of Anxiety

It was predicted that children with higher self-reported anxiety would exhibit decreased recall and increased suggestibility. Researchers have begun to explore the effect of anxiety on recall, however, to date there are no studies that have specifically examined the effects of anxiety on suggestibility. In adults, research has linked acquiescence/compliance to acceptance of misinformation (e.g., Gudjonsson, 1986; Eisen et al., 1999, as cited in Eisen, Winograd & Quin, 2002), but no research has yet examined the effects of anxiety on misinformation acceptance.

The present study found no relationship between children's self-reports of state anxiety and recall accuracy for a dental procedure. This finding is consistent with the lack

of significant findings of Chen et al. (1999) and Vandermaas et al. (1993). Specifically, when Chen et al. (1999) controlled for child age, the effects of self-reported state anxiety (i.e., the child's anxiety immediately prior to the procedure) on recall were not significant, and when Vandermaas et al. (1993) controlled for the effect of children's familiarity with the dentist, observed anxiety scores were not related to accuracy. Although children's state anxiety in the present study did not affect memory or suggestibility, it is noteworthy that the mean of state anxiety scores for the sample relatively low ($M = 31.6$, $SD = 4.7$, scores can range from 20-60). To ease administration, the questions were administered orally. It is possible that the children did not feel comfortable telling the researcher the amount of anxiety they were feeling. Anecdotally, a few parents reported that their children were not being honest when they reported not feeling 'nervous' or 'scared.'

In contrast to the above-mentioned findings, Merritt et al. (1994) found that fear levels in children (observed by the technologist) were associated with decreased accuracy of details of a VCUG both immediately following the procedure and again at a six-week delay. A strength of the sample in the Merritt et al. study was the restricted age range, which allowed for more robust analysis of factors other than age. However, it is noteworthy that the authors found no significant relationship between anxiety scores and accuracy when using parental ratings or the observational scale of behavioural distress (OSBD). The OSBD is a commonly used observer-report measure that provides an operational definition of behaviours thought to reflect anxiety and pain. Because the measurement provided by the technologist was reflective of a more global construct (i.e.,

a 5-point Likert rating scale was used), it is not clear what behaviours the technologist was using to assess fear. For example, facial expressions, crying, and attempts to avoid the situation may all be reflective of fear. If the technologist was using behaviours of attempts of avoidance or eye closing, then it is quite likely that children scoring highly on the scale would have less opportunity to encode pertinent event details.

The previous studies mentioned focussed on state anxiety. The present study also assessed children's dispositional or trait anxiety. It was found that the effect of trait anxiety was significantly positively related to suggestibility. Therefore, children who self-reported that they tend to be more anxious generally, were also more likely to be susceptible to interviewers' misleading questions. This finding was also significant with age partialled. It is possible that a reporting bias exists. For example, perhaps children who are more likely to report increased levels of anxiety are also more likely to exaggerate details and concede to events that did not occur. However, studies have found that decreased self-esteem has been related to increased levels of suggestibility in children (Murch & Slater, as cited in Bruck et al., 1997) and in adults (Gudjonsson & Singh, 1984) and Bruck et al. (1997) suggested that it was possible that the anxiety associated with low self-esteem interferes with encoding or retrieval of the information. Another possibility is that increased anxiety may directly influence motivational factors, reducing or inflating one's efforts to comply with suggestions offered about the event. The latter possibility appears more consistent with the results of the present study, because anxiety was not related to accuracy, but rather to suggestibility.

Effect of Temperament

It was predicted that children with temperaments characterised as shy would exhibit decreased memory accuracy. This prediction was not confirmed. In contrast to our findings, Roebbers and Schneider (2001) found that children's accuracy scores for a videotaped event were significantly related to teacher ratings of shyness. In their study, shyness was collected on a 7-point scale that averaged the ratings from five items describing shy behavior in school and social situations. The teachers had known the children for 1.5-2 years. Most studies in this domain use parent reports of temperamental dimensions. Indeed, the evidence to date is supportive of the use of parent-report measures of temperament, as they provide a useful perspective on the personality of children, because parents can see a wide range of child behaviors and they have established a fair degree of objective validity (Rothbart & Bates, 1998). Given that the Roebbers and Schneider (2001) study used a non-validated measure of shyness, it is possible that the construct being measured is more related to the construct of sociability. This suggestion would seem particularly apt when considering the Buss and Plomin (1984) constructs of shyness. Buss and Plomin refer to shyness as behaviour with strangers or casual acquaintances, whereas sociability refers to the tendency to be with people generally. Presumably children in the same classroom are not strangers, and therefore teacher ratings are more likely to be measuring sociability.

It was also predicted, in the present study, that children who are more sociable would exhibit higher rates of accuracy. This hypothesis was confirmed, with child age partialled, children whose mothers reported them to be more sociable also evidenced

higher rates of accuracy. As mentioned, the dimension of shyness, which is considered a derivative of sociability, was not significantly related to accuracy. The fact that sociability, but not shyness, was related to accuracy, suggests that the key difference between the two dimensions may be influencing children's likelihood of accurate responses. The suggestion is consistent with Buss and Plomin's (1984) argument that the two are distinct (albeit related) traits. They argued that sociable people can also be shy, and some shy people are sociable. The correlation between the two scales has been found to be about $-.30$ (Cheek, 1981, as cited in Buss & Plomin, 1984), consistent with the finding of the present study ($-.34$). According to Buss and Plomin (1984), sociability refers to the general tendency to want to be with people; sociable children prefer group play, like to sleep with others in the same room and in general value interaction with others over the benefits of privacy whereas shyness, on the other hand, is more specific in nature. Shyness is considered a tendency to be tense and inhibited with strangers or other acquaintances. The findings of the present study suggest that children who are more sociable and tend to engage with others in their environment may be more likely to attend to and encode details of the procedure.

Of the few studies that have examined the relationship between temperament and accuracy two studies have found that children scoring higher on the dimension of "approach" to new situations also evidenced increased accuracy in responding to questions about a previously experienced medical procedure (Gordon et al., 1993; Merritt et al., 1994). The temperament dimension of sociability (as measured in the present study) and approach/withdrawal (as measured in two of the above-mentioned studies)

appear to be conceptually related. Young children who are sociable also should approach new situations more easily. Such children would be expected to be generally more open, outgoing and talkative. Therefore, they should adapt faster to an interview situation and report more items correctly than should same-age peers who are not at all social and who withdraw from situations involving new people. Thus, it is possible that the findings of Gordon et al. (1993) and Merritt et al. (1994) confirm those of the present study.

Consistent with the view that sociable children are more likely to approach new situations easily and exhibit higher recall, a recent study examining factors associated with children's long-term recall following a VCUG found that children's procedure-related talk was positively related to the correct information reported in free recall (Salmon et al., 2002). It is likely that children who are more sociable ask more questions during the procedure, which may increase encoding of the event details; this assumption would be consistent with the findings of Salmon et al. (2002).

It was also predicted that children who were reported to be more sociable would also exhibit decreased suggestibility scores. This prediction was confirmed. Results showed that children who were rated by their parents as more sociable responded with decreased levels of suggestibility to interviewer questioning. This finding was also significant when the influence of child age was statistically controlled. Earlier research had suggested that temperamental dimensions could be related to susceptibility to misleading questions. When reviewing the findings of Schacter et al. (1995) that children who were inhibited in temperament (highly reactive and irritable) during their infancy

were more obedient and less likely to refuse the experimenter's request, Bruck et al. (1997) suggested that these inhibited children might also be reluctant to resist adults' suggestions or directions, even if aware that they are wrong.

Consistent with the findings of the present study, Roebers and Schneider (2001) found that, in response to misleading, closed questions (e.g., "The boy was wearing a red sweater wasn't he?") shy children were more likely to be misled. As mentioned above, although the researchers were attempting to use the construct of shyness, their measure may have been more similar to measures of sociability. Therefore, their results may be consistent with those of the present study. It is possible that children who are less social perceive and feel the demand characteristics of the interview situation more strongly. This finding is of importance for forensic cases. If less sociable children are questioned via specific forced choice questions, which are already known to have detrimental effects on suggestibility, these detrimental effects are likely to be exacerbated. Although the questions used in the present study (e.g., "Did the boy wear a red sweater or a blue sweater?") were less suggestive than those used by Roebers and Schneider (e.g., "The boy wore a red sweater didn't he?"), our results also suggest a negative relationship between sociability and suggestibility. The present findings do not imply that the credibility of less sociable children is to be questioned in general. Nevertheless, forensic interviewers should be aware of possible interactions between temperament variables and eyewitness performance.

Effect of Self-Reported Pain/Distress

The association between children's self-reported pain/distress and accuracy and

suggestibility was examined in an exploratory fashion and no specific hypothesis was offered. It was found that children's ratings of pain/distress (averaged across the short delay and long delay interviews) were not related to children's accuracy scores. However, pain scores were significantly related to suggestibility scores. This result remained significant with child age partialled. Previous research examining the role of pain scores on memory has been equivocal. There is a paucity of published research to date on the role of pain scores and suggestibility during interrogative interviews.

The results from previous research examining the relationship between children's pain/distress and accuracy for a medical event (e.g., Bruck et al., 1995; Goodman et al., 1997; Merritt et al., 1994; Oates & Shrimpton, 1991; & Steward et al., 1996) appear to be inconsistent. Bruck et al. (1995) and Oates and Shrimpton (1991) found no relationship. Merritt et al. (1994) found a significant relationship only when observer ratings of distress, rather than self-report pain ratings, parental ratings or salivary cortisol levels, were examined. Goodman et al. (1997) found a significant negative relationship using observer ratings of child stress, and Steward and Steward (1996) found a significant positive relationship between distress and memory.

The findings among the studies appear more consistent when we examine the methods used to measure pain or distress. In the present study, as well as in the Bruck et al. (1995), Merritt et al. (1994), and Oates and Shrimpton (1991) studies, pain was not significantly related to accuracy scores when using children's self-reported pain. In contrast, in the two studies finding a negative relationship between pain and accuracy, observer reports of child distress were used. Consistent with these findings, the

examination by Salmon et al. (2002) of factors affecting children's recall for a VCUG, showed that observer reports of crying during the VCUG were negatively associated with correct information reported in prompted recall.

The findings of a positive relationship between pain/distress and memory by Steward and Steward (1996) can be explained by the particular research question asked. Specifically, this study explored the relationship between children's reports of painfulness during a medical check-up and the accuracy and completeness of recalling body touch (where on the body the child was touched during the examination). Therefore, children's reports of pain/distress were significantly related to how well they recalled body touch. Pain/distress ratings were not examined with respect to their association with accuracy for recall of details of the medical exam. These patterns of results suggest that detectable relations between distress and memory may be dependent on the type of distress measure employed in the study.

As mentioned, there has been little documented research on the question of whether pain scores influence suggestibility. The results of the present study suggest that children who report experiencing more pain during a potentially distressful procedure are also more likely to erroneously concede to interviewer's suggestions about the event. Somewhat consistent with our findings, Bruck et al. (1995) found that 5-year-old children who took longer to calm following an inoculation were also more likely to be misled by interviewer suggestions. The findings of the present study indicate that pain experienced during the to-be-remembered event may interfere, not with actual accuracy of the information, but rather with their ability to resist adult suggestions during interviewing.

As was suggested with trait anxiety, a possible explanation for these findings is that a reporting bias exists. For example, perhaps children who are more likely to report higher levels of pain or distress are also more likely to exaggerate details and concede to events that did not occur. This possible pathway could be mediated by children's attention seeking. Indeed, research has shown that parents who report higher levels of encouragement of illness behaviours (e.g., providing extra attention or treats when the child complains of pain) are more likely to have children who exhibit increased illness behaviours (e.g., pain complaints) (Osborne, Hatcher & Richtsmeier, 1989; Walker & Zeman, 1992). Perhaps children who report more pain are also likely to seek extra attention from adults by conceding to events that did not happen (e.g., Did the dentist give you a hug when you were all done?). The addition of a more objective measure of pain behaviour (e.g., Facial Action Coding) to the present study may have helped to examine this possibility.

Our findings are consistent with the assumption that high pain/distress levels lower the efficiency with which information is processed (Bruck et al., 1995), making children more susceptible to suggestibility. However, the lack of a significant association between pain reports and accuracy suggest that this relationship may be more complex. Perhaps children who are more likely to report pain (an individual difference factor) are more likely to concede to interviewer suggestions. It would behoove future researchers to elucidate the mechanisms involved in this relationship.

Effect of Previous Dental Experiences

The quality, or nature, of previous experience was expected to affect recall.

Children having higher rates of negative previous experiences were expected to exhibit decreased recall and higher levels of suggestibility, possibly due to the presumed pain/distress and/or anxiety that these children experienced, which would consequently interfere with encoding of the event. This expectation would be consistent with the findings of Chen et al. (1999) that increased expectation of pain/distress was related to decreased accuracy. Perhaps children who have experienced previous negative experiences come to expect more distress from a subsequent procedure. Children who had experienced more dental visits were expected to exhibit increased accuracy and decreased suggestibility, as they were expected to have more knowledge of dental procedures. Neither prediction was confirmed.

When Vandermaas et al. (1993) examined the quality of previous experience with the dentist and accuracy of recall, they found inconsistent results. Specifically, they found a positive correlation between prior negative experience with a dentist and free recall in 4-5 year-old children in a teeth-cleaning event. However, the same result was not found for 6-7 year old children or for children who underwent operative dental procedures. Thus, it is not clear why children with more negative previous experiences did not exhibit decreased recall or suggestibility. Perhaps the key variable influencing how previous negative experiences are encoded is via the pain or anxiety experienced during the event, or the methods of coping used (e.g., distraction). Presumably, the questions parents responded to reflect their perceptions of their child's previously exhibited anxiety and pain. However, the questions did not specifically tap these constructs and perhaps were not specific enough. That is, a 7-point Likert scale ranging from 1 (happy/pleased) to 7

(distressed) was used. Given that parents have been shown to be accurate at anticipating their children's distress (Bennet-Branson & Craig, 1993, Fradet et al., 1990), asking parents to rate their children's anxiety and pain from previous dental experiences may have been more appropriate.

The amount of previous exposure to dental visits did not influence accuracy or suggestibility scores when children's age was accounted for. This finding is consistent with those of Goodman et al. (1994) and Salmon et al. (2001), who found that the number of prior VCUGs was not a significant predictor of memory performance. Instead, knowledge provided by parental explanation played a more important role. In the Goodman et al. (1997) study, children's lack of knowledge about the VCUG procedure did not significantly relate to memory errors. It is possible that a child will have an accurate memory for what occurred during the procedure, but still make errors in answering suggestive questions due to social factors, such as wanting to please the interviewer.

Effect of Working Memory

Children with poorer working memory capacities were expected to exhibit decreased recall and increased suggestibility. This expectation was based on the premise that the ability to correctly reject misinformation presented in the memory questions would be facilitated by enhanced abilities to hold and process multiple memory traces (e.g., verbatim and gist). Results showed no relationship between working memory and suggestibility in the present study. Assessment of working memory via telephone may have compromised validity of the measure. The child may have written the numbers

down as the researcher stated them, or may have been less likely to devote full attention to the task than if the investigator had been physically present. In addition, distractions from the environment such as other family members or the television could not be controlled. Nevertheless, when the average raw scores for each age are calculated, the results are very comparable to those achieved in the normative sample collected for the Children's Memory Scale.

Given some of the methodological problems in the present study (e.g., Numbers Backward scale was administered over the telephone; see "Limitations" section for a description of possible effects) the findings do not rule out the possibility that cognitive individual difference factors such as working memory, or processes underlying working memory, may play a role in children's suggestibility. Processes underlying working memory may be useful in predicting individual differences in suggestibility, rather than working memory per se. For instance, strategy use is an important aspect of effective problem-solving (Newell, Shaw, & Simon, 1958). Teaching a child the use of an effective strategy has been demonstrated to reduce the amount of information the child is required to retain in working memory (Cohen, 1997). It may be that use of an effective strategy would allow for an increase in performance on tasks involving complex cognitive skills, such as problem-solving, reasoning, and the ability to resist suggestive influence. Another candidate cognitive process for explaining developmental changes in suggestibility is temporal ordering. The ability to sequence events is a major component of working memory (Cohen, 1997) and may allow a child to be better able to disambiguate the past and present, which better able to resist suggestive influence.

Given that theory (FTT) suggests that in order to correctly reject false information the individual must “keep track” of stored traces as well as the suggestive experience, it would follow that proficient working memory capacity would render an individual better able to correctly reject false information (distractors) on a recognition test. Therefore, although results of the present study do not confirm that working memory capacities are related to suggestibility, the premise remains to be more appropriately tested. In addition, it is possible that working memory capacity interacts with other cognitive factors such as strategy use to differentially predict suggestibility effects.

In summary, examination of the internal factors influencing accuracy in the present study showed that, as predicted, children who are rated by their mothers as more sociable tend to display higher rates of accurate recall in response to closed questions. Shyness, anxiety, previous dental experiences, working memory capacity and pain scores were not related to accuracy. As predicted, children reporting higher pain scores, higher trait anxiety levels, and whose parents characterize them as less social, were more likely to be misled by interviewer’s forced choice questions. Hypotheses regarding the effects of state anxiety levels, shyness, previous dental experiences and working memory on suggestibility were not confirmed.

Researchers have argued that the interaction among various individual difference factors (e.g., cognitive, biological, and social-personality) in predicting suggestibility must be considered (Muir-Broaddus et al., 1998; Reyna et al., 2001). The inconsistent findings to date in relation to individual differences in children’s accuracy and

suggestibility may be due in part to the fact that most studies have used bivariate correlational designs. These designs can demonstrate an association between two variables, but not the degree to which one particular factor can be predicted from another or several other factors (Tabachnick & Fidell, 1996). It would behoove future researchers to adopt larger scale investigations that may reveal the combined and independent contributions of various interrelated factors.

Results of the present study, combined with previous research, are beginning to elucidate some of the temperament/personality and social factors that influence children's suggestibility. There exist several areas for future research into the relationship between internal factors and suggestibility. Investigation into these processes promises to yield important information on how memory may falter, and why it does so for some individuals but not others. The importance of this topic, and its potential to uncover the foundations of individual differences in suggestibility, render it an important and interesting area of investigation in the field of cognitive development.

Examination of Factors Relevant to Pediatric Health Psychology

In the pediatric pain literature, only a few studies have examined children's memories for painful procedures (Ornstein et al., 1999). Studies of children's memories of medical and dental events have important clinical implications. Memories are related to children's expectations prior to medical stressors (e.g., Lander et al., 1992; Ornstein et al., 1999). Recollections of procedural anxiety and pain/distress can influence future anxiety and pain/distress reactions during medical/dental events (Peterson & Rideout,

1989). In fact, recall of positive aspects of procedures improves coping and decreases distress during upcoming events (Bruck et al., 1995; Chen et al., 1999). Also, memories of prior medical/dental events influence future health care attitudes and behaviours (Pate et al., 1996). Finally, diagnoses and treatment decisions for a wide range of psychological and medical difficulties are based on patients' recall of prior distress and pain symptoms (Eich et al., 1985; Ornstein et al., 1999; Zonneveld et al., 1997).

Results from the present study indicated that, over time, children's pain scores tended to decrease. In addition, children's trait anxiety was related to pain scores at the long delay interview. Parents of shyer children reported providing more information about the procedure before visiting the dentist. Children who reported more anxiety immediately before the procedure had parents who reported that their children tended to react more negatively to dental visits. These findings provide some preliminary evidence of the effects of internal and external factors on children's memories for dental procedures.

Effect of Delay and Individual Difference Factors on Pain Scores

Results showed that over time, there was a trend towards children recollecting lower pain/distress scores. Thus, as time passes, children appear to underestimate the intensity of pain/distress experienced during their previous dental visit. This positive distortion may be considered a useful coping strategy. Given that children will likely have to visit the dentist again at some point, distorting memories to reflect decreased pain/distress may help the children to cope better with subsequent procedures. This suggestion is consistent with the findings of Bruck et al. (1995) who found that children

who were provided with positive feedback regarding their performance during an inoculation (e.g., “You’re shot didn’t seem to hurt you at all. You were brave.”) reported less pain than did children who were not given this feedback. The finding from the present study suggesting that children may spontaneously distort pain recollections in a positive way is new to the literature. The few previous studies examining children’s memory for pain have been mixed.

Some studies find that children accurately recall pain experienced in hospital settings (Zonneveld et al. 1997), pain due to cold-pressor test (Badali et al., 2000) and discomfort in dental settings (Huq et al., 1992). In contrast, Cohen et al. (2001) found that, with typical care, children actually recalled more immunization pain following a 6-month delay than they reported experiencing immediately following the procedure. However, Cohen et al. found that in the two intervention conditions (distraction and EMLA cream), children’s recall of pain actually decreased over time. The authors suggested that the interventions may have buffered the children from negative distortions of pain that occurred without intervention.

In the present study, no intervention was provided and children’s memories were not negatively distorted. Instead, pain scores tended to suggest the presence of a positive distortion over time. The discrepancies between the Cohen et al.(2001) study and the present study are interesting. The Cohen et al. study used a small (n=22) homogenous sample – African American, urban, low-income families. The mean pain rating for the injection (26/100; measured via Visual Analogue Scale) is similar to the mean pain rating (2.56/10) found in the present study. Both indicate, on average, a mild amount of self-

reported pain/distress. The delay in the Cohen et al. study was certainly longer (six months) than that of the present study (two months), however memory traces remaining at two months (delay used in the present study) may not be expected to decay much after this time. It is possible that the question asked of the children at six months in the Cohen et al. study was slightly suggestive and may have pulled for higher pain scores. Specifically, children were asked, “When you did *not* use the white cream or watch the movie, how much did the shot hurt?” The first half of the sentence seems to reorient the child to the fact that no intervention was received and the child may thus re-evaluate his/her pain recollection with that information in mind. It will remain for future research to confirm or disconfirm the findings of the present study. Specifically, it will be important to investigate whether the overall decrease in pain/distress scores occurs with other types of procedural distress (e.g., lumbar punctures), and whether developmental differences exist. For example, perhaps some children recall less distress from procedures they will have to experience again (e.g., dental visits, repeated lumbar punctures), which may be an adaptive coping mechanism for them.

The analysis of psychosocial factors influencing children’s recollections of pain/distress suggests that children reporting higher levels of trait anxiety may negatively distort their recollections of pain/distress. Specifically, the present study found that children who self-reported higher levels of anxiety do not report more pain/distress immediately following the procedure, but do so after a 6-8 week delay. This finding is in contrast to those of Zonneveld et al. (1997), who found that, following one week, children accurately recalled pain intensity, and accuracy was not related to anxiety. Trait

anxiety in the Zonneveld et al. study was measured using the Revised Children's Manifest Anxiety Scale (Reynolds & Richmond, 1985). However, the authors reported that, although the anxiety questionnaire was intended to measure trait anxiety, many children seemed only to be able to indicate their anxiety in their present situation. As such, their answers likely reflected state, rather than trait anxiety. In the present study, the trait anxiety measure was administered on the telephone following the event, and was unlikely confounded with state anxiety.

The present study suggests that trait anxiety, rather than state anxiety, is an important contributor to how children reconstruct their memories of pain. Another difference in the two studies was that the correlations examined in the Zonneveld et al. (1997) study were between anxiety and inaccuracy, and were found to be weak. In contrast, the present study examined correlations between children's pain ratings and anxiety.

Our findings are consistent with the notion that increased emotionality may distort recollections of pain/distress (e.g., Jamison et al., 1989). It is possible, then, that children with higher trait anxiety may be an appropriate group for whom to tailor treatment interventions. For example, Cohen et al. (2001), as described above, found that children remembered feeling significantly less pain/distress during an immunization when a pharmacological or psychological intervention was implemented. In addition, research has found that positively reframed memories have been shown to decrease distress during future medical procedures (e.g., Bruck et al., 1995; Chen et al., 1999). Thus, distress management interventions aimed at current procedural distress may have delayed benefits

and positive influences on future pain/distress. Based on the results of the present study, children who are self-reported to be more anxious may be an appropriate target group for such efforts. This study is, to date, one of the first to document psychosocial correlates of accuracy in recollection of children's pain/distress.

Other correlation analysis showed that parents tend to provide more information about the dental procedure, before visiting the dentist, to shyer children. This finding was significant with age controlled. Vandermaas et al. (1993) examined the effect of parental preparation for the dental visit and found that parents provided more information to younger children. The present study, using the same question as Vandermaas et al. (1993), found no significant relationship between child age and amount of information received by children. The mean age of children in the two studies was slightly different: participants in the Vandermaas et al. study were approximately 6.5 years, versus a mean age of 8 years in the present study. Consistent with our findings, Vandermaas et al. found that parental preparation did not appear to affect children's recall of the dental event. The present study also found that children who reported more anxiety immediately before the procedure also had parents who reported that their children tended to react more negatively to dental visits. The method variance used (e.g., anxiety was self report and previous reaction was parental report) strengthens the validity of this finding, and suggests that parents are in tune with their children's previous reactions to dental procedures. Indeed, this is consistent with prior research. For example, research has shown that mother's predictions of uncooperative behavior and a history of prior surgery were the best predictors of children's presurgical anxiety (Lumley, Melamed & Abeles,

1993).

Finally, a trend for parents' self-reported dental anxiety to be related to children's self-reported overall levels of anxiety was also found. Children's caregivers likely influence their development of anxious or coping responses. Children may learn from their parents via modeling, providing information, reinforcement or even by more subtle forms of communication (Greenbaum, Cook, Melamed, Ables & Bush, 1986). Indeed, an examination of differences between children who were clinically anxious regarding dentistry, and those who were not, found that children in the anxious group had mothers with higher state anxiety scores (Townend, Dimigen & Fung, 2000). The study also found that non anxious children perceived their dentists to be significantly more empathetic than did anxious children and that anxious children had experienced more traumatic visits to the dentist than non anxious children. It is possible that parents with higher state anxiety may also exhibit higher levels of trait anxiety, For example, Brown, Wright and McMurray (1986) found that the factor most predictive of dental fear was level of general anxiety, and Murray, Lunk, Harkiss and deFranco (1985) found that children with dental fear were generally more fearful in novel situations of any kind. The finding that there is often a significant positive relationship between parent and child anxiety ratings would help to explain our findings. However, in the Townend et al. study, maternal trait anxiety was not predictive of children's dental anxiety. The present study did not assess parental trait anxiety (assessed state anxiety for dental procedures) and therefore, direct comparison to the Townend et al. study cannot be made and the implications of this finding are unclear.

It was expected that children who had previous negative experiences with dental procedures would recall more distress at the 8-week delay, irrespective of how much pain they reported experiencing immediately following the procedure. This prediction was not confirmed. The argument proposed was that the memory of the previous negative experience causes anxiety about subsequent procedures. This anxiety might influence the degree of pain the child feels during these later procedures. Indeed, a previous study (Weisman et al., 1998) found that children who did not receive adequate analgesia during initial painful procedures, but did so during follow-up procedures, reported higher pain than children who initially received adequate analgesia. However, within our sample there was little variability on this measure. In fact, 63% of children, according to parental report, had never had a previous negative experience during a dental procedure. Another 20% of children had one previous negative experience. As such, it is possible that we were not able to adequately test this hypothesis. On a positive note, the findings suggest that, on average, the group of children sampled in this study do not find dental visits distressing.

Our finding of no relationship between state anxiety and accuracy of recalled pain is consistent with those of previous work (Huq et al., 1992), but in contrast to the findings of Lander et al. (1992) who found that children with higher state anxiety scores tended to overestimate pain ratings.

Limitations and Strengths of the Present Study

It is important to note some of the limitations in the current study. First, it is not directly comparable to a forensic interview. Children participated in their dentists' offices

and the interviews were conducted by telephone. It is not clear how telephone interviews would compare to in-person interviews. It is possible that children were less likely to devote full attention to the task than if the investigator had been physically present. Also, in-person interviews may be expected to elicit increased suggestibility scores. That is, based on Gudjonsson and Clark's (1986) model, perhaps the social pressure to acquiesce to interviewer suggestion would be greater.

For 12 of the children, the first (short delay) telephone interview was conducted more than 24 hours following the procedure and these children's memories for the procedure may have faded more than those who were interviewed the same day, perhaps resulting in increased variability in the short delay accuracy and suggestibility scores.

The small sample size in the present study precluded examination of the possible interaction of internal and external factors on accuracy and suggestibility. It is possible that stronger statistical relations would have been found among the variables studied if a larger number of children had been included. The interaction among different contextual, cognitive, biological, and social factors in predicting suggestibility continues to be an important area for study. Indeed, this is the current perspective among researchers in the area of memory (e.g., Muir-Broaddus et al., 1998; Reyna et al., 2001). Given the small sample size and large number of analyses conducted in the present study, the probability of a Type I error increases, thus, one has to be cautious when interpreting these results.

Another limitation of the present study was that the measure of pain/distress during the procedure was taken following the event. For events that have multiple components or are longer, it is possible that there exist differential relations between

pain/distress and memory, depending on when stress is measured. Therefore, multiple measures of children's pain/distress during the procedure may have helped to elucidate whether pain/distress levels vary within the event and whether these varying levels correspondingly vary in relation to memory and suggestibility. Nevertheless, previous research with adults has demonstrated that retrospective evaluations of painful events are predicted by the final moments of the procedure (Kahneman, Fredrickson, Schreier & Redelmeier, 1993). That is, the duration of the procedure plays little role in evaluations of aversive experiences and people tend to remember the discomfort at the worst and final moments of procedures.

Consideration should also be given to issues of generalizability in the present study. Although children were recruited from both urban and rural areas in Saskatchewan, and 95% of families approached agreed to participate, it is noteworthy that the proportion of aboriginal people in the sample likely under-represents the proportion of aboriginal people in the general Saskatchewan population. Overall, the obtained sample is representative of Caucasian middle-class families.

Another potential difficulty of the present study is the variability in procedures experienced by the children. Several dental practitioners performed the procedures and therefore, intra-individual variance in how the procedure is conducted was inevitable. In addition, various procedures were examined, each having different components. The findings may have been clearer if it had been possible to study a more specific procedure in dentistry (e.g., examination of fillings).

In addition, it is important to note that some of the distractor items introduced in

recognition tests may present information that the child cannot know. For example, when the dentist rubs something on the child's gum and it tastes like toothpaste, the child might justifiably assume that it was toothpaste and erroneously accept the misinformation. This might be particularly true for younger children who likely have relatively low levels of knowledge about dental routines. For example, some children may have recognized that the distractor features referred to dentally related possibilities, but they might not have understood fully that these features referred to unlikely dental events. If this were the case, then the differences in younger children's knowledge about dental events would serve to make the recognition task functionally more difficult for them. To explore this possibility, one would need to replicate the present study with a set of questions in which the dental distractors were those that children at all ages would be equally familiar with.

On a similar note, it is also possible that some of the children did not know the meaning of some words used in questioning (e.g., "Did the dentist take your blood pressure?"). Again, younger participants level of language development may have rendered at least some of the questions difficult to comprehend. For this reason, it is important for interviewing protocols to inform children that if they are not sure of an answer or they do not know an answer, they are to report that this is the case, which was done in the present study.

Because the present study examined children's memory and suggestibility for a naturally occurring, potentially stressful event, assigning children randomly to different distress conditions was not possible. Instead, comparisons were made between those who

reported being more versus less distressed during the same event. This approach, unfortunately, does not allow for evaluations of the causal effects of distress on memory. Only the correlations between stress and memory can be ascertained. There may exist other characteristics among children that affect both how distressed they become during a procedure or event and their delayed recall of that event. For example, it is possible that a significant correlation between pain scores and suggestibility in the present study was due to both factors being influenced by a third variable, such as knowledge about dental procedures or child temperament.

It is important to note that the goal of the present study was not to assess false memory, but rather suggestibility. Therefore, whether or not children's memories of the event actually changed was not measured. Instead, children's reports of the event in response to a recognition memory test were assessed.

Despite some of the limitations of the present study, several strengths can also be identified. There exist benefits to conducting the study in a naturalistic setting; specifically, children were affected by the details probed in the present study, as opposed to watching a video of a child undergoing some stressful procedure. Thus, naturalistic settings increase the ecological validity of the study. Furthermore, a 6-8 week delayed interview is more comparable to real-world forensic settings. In addition, the high rates of parental agreement to participate also suggest that a representative sample of children who visit the dentist was obtained.

This study allows for different types of questions to be systematically compared. Because forced-choice questions are so prevalent in investigative and courtroom

interviews, the comparisons examined here can add valuable information to the current database. In addition, because the questions in the present study were counterbalanced, our accuracy rates are not inflated by the “yeah” saying bias, which has been a methodological problem in other studies. It would behoove researchers aiming to quantify the extent of children’s memory for events via use of forced-choice questions to counterbalance across yes/no questions. This study has also provided preliminary data of some individual difference factors seldom investigated with regard to suggestibility (e.g., pain, anxiety).

This study also provides some new findings in the area of pediatric pain research. Research has not yet examined the role of individual difference factors in children’s memory for pain, thus the finding that trait anxiety scores influence recollection of pain is new to the literature. The finding of a decrease in children’s recollection of pain/distress scores over time has also not been reported in previous work.

Suggestions for Further Research

The results of this study highlight several avenues for future inquiry, within both eyewitness testimony and pediatric health psychology domains. First, within the eyewitness testimony research, it is important that the finding that choice 1 and choice 2 questions elicit particularly high levels of suggestibility be replicated. Our findings do not support the suggestions of Peterson and Grant (2001) that forensic interviewers use multiple-choice questions in place of yes/no questions. However, replication of these findings, as well as extension to other to-be-remembered events, would strengthen confidence in the conclusions.

In research on individual difference factors as predictors of memory and suggestibility, additional work is needed to elucidate the precise conditions under which the various individual difference factors predict memory and suggestibility and the mechanisms underlying the observed associations. Given that the results of the present study are correlational in nature, it is unclear how pain/distress scores, trait anxiety and sociability ratings actually influence suggestibility scores. The development of studies designed to determine why certain individual difference characteristics are positively or negatively related to children's memory or suggestibility would be helpful. In addition, because much of this research to date has been preliminary and exploratory, further research is needed to confirm associations that have been found in one or two studies and determine how generalizable they are to children of varying ages and to various types of to-be-remembered events (e.g., stressful events versus all types of events).

Although not assessed in the present study, future research would benefit from larger scale examinations that reveal the combined and independent contributions of various interrelated factors. As new findings arise, researchers will be in a position to develop more complex theoretical models (e.g., which could be tested via structural equation modeling and path analysis) which can explain the specific factors that give rise to suggestible effects in children and form the basis of recommendations for interviewers, lawyers and other forensic professionals.

Next, within the pediatric health psychology domain, several avenues for future development may be fruitful. It is important to have replication of the finding that children's pain scores tend to decrease over time. If this result is robust, it suggests that

children may be spontaneously using strategies to help minimize future distress. The finding that anxious children overestimate experienced pain after a delay should be replicated with other procedures and age groups. If indeed these children tend to negatively distort pain memories over time, then an intervention such as that posed by Chen et al. (1999) may be helpful for this targeted group.

The examination of other psychosocial correlates of accuracy might help identify those children with the most negatively distorted predictions and memories. Studies such as these should help in the development of appropriate interventions to reduce negatively inflated memories. Investigations of children's memories at varying ages might help to determine the age at which children are able to accurately predict and recall procedural distress.

Consideration should be given to directly targeting memories as part of a pharmacologically or psychologically based distress management intervention. Such interventions may help children to have more positive health care attitudes, experiences and coping behaviours. In addition, studies examining how and why children have negative memories might help illuminate methods of changing these perceptions.

Although the present study has reviewed two seemingly disparate domains of research (i.e., eyewitness testimony and pediatric health psychology), some convergence of the two is achieved here. Learning more about the ontogeny of children's abilities to understand and remember events that are physically painful/distressful, will contribute to our basic understanding of children's cognitive development and will also inform research and practice in terms of the clinical care of children in settings where they

experience and remember pain/distress.

Summary

In conclusion, when children were questioned about potentially stressful events (dental procedures) significant effects of external factors (question type, delay) and internal factors (age, self-reported pain scores, trait anxiety, temperament) on accuracy and suggestibility were apparent. The results of this study indicate that careful attention must be placed on determining individual sources of variation that influence children's reports of personally experienced events. A new and intriguing addition to the eyewitness testimony research is the finding that a child's self-report of pain and anxiety, and parental reports of sociability were related to his/her suggestibility score. If further research can determine, more precisely, the individual difference factors that predict inaccuracies and outline interview techniques beneficial to particular children, then we will be in a better position to assist legal professionals to target, and appropriately question, children prone to incorporating false information into their reports.

The finding that children's level of general anxiety influences pain scores, but only after a delay is an interesting, and new, finding relevant for the pediatric health psychology literature. It appears that anxious children may exhibit a bias towards recalling more pain than they initially reported experiencing. Perhaps treatments designed to reframe children's memories, particularly children with high levels of general anxiety, may be useful with clinical forms of pain (e.g., medical, dental, acute and chronic). Given that pain in children has been demonstrated to be poorly managed, and that improving

pain management has many benefits (e.g., reduced hospital stays, minimizes development of chronic pain states, decreases school absenteeism), such interventions may be important in the prevention of maladaptive pain states.

Chapter 5: References

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Appendix A
Counterbalanced question formats for forced choice questions
Example: Versions A-D for fillings

Questions – open-ended (all children)

- Hi _____ (child's name). My name is _____. Remember when you went to visit the dentist today I was there. I asked you some questions about how you were feeling
- I said that I would phone you to get some more help with my homework project.
- _____ (child's name) tell me everything you can remember about what happened when you visited the dentist today. (prompts: Can you tell me some things that happened when you came to the dentist today? What else happened? What happened next? What else can you remember/tell me about what happened?)

Fillings – Template - Set A

Yes (1,21,10,3)

1. Did the dentist rub a Q-TIP on your gum?
2. Did it hurt when the dentist put the plastic piece on your mouth?
3. Were there ___(insert correct number) windows in the room?
4. Did you get the Mr. Slurpee in your mouth to get the bad taste out?

No (5,2, 14,7)

Did the dentist prepare the tools?

Did the dentist take the temperature in your mouth?

Did it feel good when the dentist gave your mouth a poke?

Did you feel happy about seeing the dentist today? (if they were really happy –you would replace “happy with “scared”)

Choice 1 (9.19.18.11)

Did you visit the dentist in the _____(correct one) or in the _____? (morning , afternoon)

Did you hold a mirror or a spoon in your mouth?

Did someone put cotton or wool in your mouth?

Was the chair you were sitting in _____(correct colour) or blue (wrong colour)?

Choice 2 (13.6.22.15)

Was the dentist’s helper’s hair _____ (wrong colour) or _____ (correct colour)?

Did you spend 2 hours (wrong) in the dentist’s chair or ½ hour (correct) in the dentist’s chair?

Did it feel good (wrong) or did it hurt (correct) when the dentist drilled your tooth?

Did the dentist use a tooth mixer (wrong) or a tooth smoother (correct) on your teeth?

Neither (4,12, 27, 23)

Did someone rinse your mouth with fruit juice or with alcohol?

Was the dentist’s hair black or brown? (neither choice is correct)

Did the dentist wear a hat or an apron?

Did you have 2 or 3 teeth filled? (both wrong)

Absent (1,5,3,2)

Did the dentist’s helper get mad at you because she thought you were scared?

Did the dentist’s helper tickle your eyes when she put the eye drops in?

Did the dentist give you a hug when you were all finished?

Did the dentist say a bad word because s/he had a hard time getting the filling in?

Fillings – Template - Set B

Yes (2.22.11.4)

Did the dentist give you a poke in your mouth?

Did it hurt when the dentist drilled on your tooth?

Was the chair you were sitting in _____? (insert correct colour)

Did someone rinse your mouth with water?

No (6.3.15.8)

Did you spend 2 hours in the dentist's chair?

Did you get the electric disc in your mouth to get the bad taste out?

Did the dentist use a tooth mixer on your teeth?

Was the dentist named Dr. Jones?

Choice 1 (10.20.19.12)

Was there _____ window (correct answer) or 2 windows in the room?

Did the dentist put in a filling or did s/he give you a fluoride treatment

Did you hold a mirror or a spoon in your mouth?

Was the dentist's hair _____ (correct colour) or black?

Choice 2 (14.7.23.16)

Did it feel good or did it hurt when the dentist gave your mouth a poke?

Were you happy or were you scared to see the dentist today?

Did you have 2 or _____ (correct number) teeth filled?

Did the dentist wear an apron or a mask?

Neither (5.13.17.18)

Did the dentist or did the receptionist prepare the tools?

Did the dentist's helper have black or blond hair? (neither choice is correct)

Did the dentist blow foam or grit on your teeth?

Did someone put wool or yarn in your mouth?

Absent (2.6.4.3)

Did the dentist say a bad word because s/he had a hard time getting the filling in? or the tooth out?

Did the dentist take your temperature?

Was the sucker the dentist gave you when you were all done tasty?

Did the dentist give you a hug when you were all finished?

Fillings – Template - Set C

Yes (3,23,12,5)

Did you get the Slurpee in your mouth to get the bad taste out?

Did you have _____ (correct #) teeth filled?

Did the dentist have _____ (correct colour) hair?

Did the dentist's helper prepare the tools today?

No (7,17,27,9)

Did you feel happy about seeing the dentist today? (the correct answer should be "NO")

Did the dentist blow foam on your teeth?

Did the dentist wear a hat?

Did you visit the dentist in the _____? (wrong time of day-morning/afternoon)

Choice 1 (11,4,20,13)

Was the chair you were sitting in _____ (correct colour) or blue?

Did someone rinse your mouth with water or with fruit juice?

Did the dentist put in a filling or did he give you a fluoride treatment

Was the colour of the dentist's helpers hair _____ (correct colour) or _____ (wrong colour)

Choice 2 (15, 8, 1,18)

Did the dentist use a tooth mixer or a tooth smoother on your teeth?

Was the dentist's name Dr. Jones or Dr. _____ (correct name)

Did the dentist rub fluoride or a Q-TIP on your gum?

Did someone put wool or cotton in your mouth?

Neither (6,19,2,29)

Did you spend 20 minutes or 2 hours in the dentist's chair? (neither option correct)

Did you hold a spoon or a toothbrush in your mouth?

Did the dentist take the temperature in your mouth or did s/he take x-rays in your mouth?

Was there a fire extinguisher in the room or was there a bookshelf in the room?

Absent (3.1.5.4)

Did the dentist give you a hug when you were all finished?

Did the assistant get upset at you because s/he thought you were scared?

Did the dentist's helper tickle your eyes when she put the eye drops in?

Was the sucker the dentist gave you when you were all done tasty?

Fillings – Template - Set D

Yes (4.1.13.6)

Did someone rinse your mouth with water?

Did the dentist rub a Q-TIP on your gum?

Was the dentist's helpers hair _____ (correct colour)?

Did you spend about ½ hour (correct time) in the dentist's chair?

No (8.18.17.10)

Was the dentist's name Dr. Jones?

Did someone put wool in your mouth?

Did the dentist blow foam on your teeth?

Were there 2 (wrong number) windows in the room?

Choice 1 (12.5.21.14)

Was the Dentist's hair _____ (correct colour) or brown?

Did the dentist's helper or the dentist prepare the tools?

Did it hurt or did it feel good when the dentist put the plastic piece on your mouth?

Did it hurt or did it feel good when the dentist gave your mouth a poke?

Choice 2 (27,9,2,23)

Did the dentist wear a hat or a mask?

Did you visit the dentist in the _____ (wrong) or in the _____ (correct)?
(morning/afternoon)

Did the dentist take the temperature in your mouth or did s/he give you a poke in your mouth?

Did you have ____ (wrong #) or _____ (correct #) teeth filled

Neither (3,11,19,20)

Did you get the electric disc or the fluoride mixer in your mouth to get the bad taste out?

Was the chair you were sitting in yellow or blue? (neither colour should be correct)

Did you hold a spoon or a toothbrush in your mouth?

Did the dentist give you a fluoride treatment or a root canal?

Absent (4,2,6,5)

Was the sucker the dentist gave you when you were all done tasty?

Did the dentist say a bad word because s/he had a hard time getting the filling in?

Did the dentist take your temperature?

Did the dentist's helper tickle your eyes when she put the eye drops in?

Fillings - Set A

Now I have some questions maybe you can help me with. Just try your best to remember what happened. If you don't know the answer, you can say that you don't know.

1. Did the dentist wear a hat or an did s/he wear an apron? (neither correct)
2. Did the dentist rub a Q-TIP on your gum?
3. Was the dentist's hair _____ or was it _____?
(neither colour is correct)
4. Did you feel (happy/nervous) _____ about seeing the dentist today?
(insert correct feeling)
5. Did it feel good when the dentist gave your mouth a poke?
6. Did the dentist take the temperature in your mouth?
7. Did the dentist use a tooth mixer or did s/he use a _____ (correct) on your teeth?
(dentist's word for drill, eg. Tooth smoother)
8. Did it feel good or did it hurt (correct) when the dentist drilled your tooth?
9. Did someone put cotton or did someone put wool in your mouth?
10. Did you get the (Mr. Slurpee) _____ in your mouth to get the bad taste out?
(correct name for suction)
11. Did someone rinse your mouth with fruit juice or did they rinse with alcohol?
12. Did you hold a mirror or did you hold a spoon in your mouth?

13. Did it (hurt/feel good) _____ when the dentist put the plastic piece on your mouth?
(correct feeling)
14. Did the dentist say a bad word because s/he had a hard time getting the filling in?
15. Did you have _____ or _____ teeth filled? (both wrong #'s)
16. Was the dentist's helper's hair _____ or was it _____?
(wrong colour) (right colour)
17. Did the dentist prepare the tools? (NO)
18. Did the dentist's helper get mad at you because she thought you were scared?
19. Did the dentist's helper tickle your eyes when she put the eye drops in?
20. Were there _____ windows in the room?
(insert correct number)
21. Was the chair you were sitting in _____ or was it _____?
(correct colour) (wrong colour)
22. Did you spend ___ hour(s) in the dentist's chair or was it ___ hour(s) in the dentist's chair?
(wrong) (correct)
23. Did you visit the dentist in the _____ or was it in the _____?
(correct) (wrong) (e.g., morn//after/eve)
24. Did the dentist give you a hug when you were all finished?

Fillings – Set B

Now I have some questions maybe you can help me with. Just try your best to remember what happened. If you don't know the answer, you can say that you don't know.

1. Did the dentist wear an apron or a did s/he wear a mask?
2. Was the dentist named Dr. Jones? (wrong name)
3. Was the dentist's hair _____ (correct colour) or was it black?
4. Were you happy or were you scared to see the dentist today?
5. Did the dentist give you a poke in your mouth?

6. Did it feel good or did it hurt when the dentist gave your mouth a poke?
7. Did the dentist take your blood pressure?
8. Did the dentist use a tooth mixer on your teeth?
9. Did it hurt when the dentist drilled on your tooth?
10. Did someone put wool in your mouth or did they put yarn in your mouth?
11. Did you get the electric disc in your mouth to get the bad taste out?
12. Did someone rinse your mouth with water?
13. Did you hold a mirror in or mouth or did you hold a spoon in your mouth?
14. Did the dentist blow foam on your teeth or did he blow grit on your teeth?
15. Did the dentist say a bad word because s/he had a hard time getting the filling in?
16. Did the dentist put in a filling or did s/he give you a fluoride treatment
17. Did you have _____ or _____ (correct number) teeth filled?
18. Did the dentist prepare the tools or did the receptionist prepare the tools?
19. Did the dentist's helper have _____ hair or did she have _____ hair?
(wrong) (wrong)
20. Was there _____ window or _____ windows in the room?
(correct #) (wrong #)
21. Was the chair you were sitting in _____? (insert correct colour)
22. Did you spend _____ hours in the dentist's chair? (insert wrong answer)
23. Did the dentist give you a hug when you where all finished?
24. Was the sucker the dentist gave you when you were all done tasty?

Fillings –Set C

Now I have some questions maybe you can help me with. Just try your best to remember what happened. If you don't know the answer, you can say that you don't know.

1. Did the dentist wear a hat?
2. Was the dentist's name Dr. Jones or was it Dr. _____ (correct name)
3. Did the dentist have _____ (correct colour) hair?
4. Did you feel (happy/nervous) _____ about seeing the dentist today?
(insert wrong answer)
5. Did the dentist rub fluoride on your gum or did s/he rub a Q-TIP on your gum?
6. Did the dentist take the temperature in your mouth or did s/he take x-rays in your mouth?
7. Did the dentist use a tooth mixer or a did s/he use a tooth smoother _____ on your teeth?
(word for drill)
8. Did someone put wool in your mouth or did they put cotton in your mouth?
9. Did you get the Slurpee _____ in your mouth to get the bad taste out?
(correct term)
10. Did someone rinse your mouth with water or did they rinse with fruit juice?
11. Did you hold a spoon or did you hold a toothbrush in your mouth?
12. Did the dentist blow foam on your teeth?
13. Did the dentist put in a filling or did s/he give you a fluoride treatment
14. Did you have _____ (correct #) teeth filled?
15. Did the dentist's helper get upset at you because s/he thought you were scared?
16. Did the dentist's helper prepare the tools today?
17. Was the colour of the dentist's helpers hair _____ or was it _____ ?
(correct colour) (wrong colour)
18. Did the dentist's helper tickle your eyes when she put the eye drops in?
19. Was there a fire extinguisher in the room or was there a bookshelf in the room?
20. Was the chair you were sitting in _____ or was it _____ ?
(correct colour) (wrong colour)
21. Did you spend _____ or _____ in the dentist's chair?
(neither option correct: hours or minutes)
22. Did you visit the dentist in the _____? (wrong time of day-morn/after/eve)
23. Did the dentist give you a hug when you were all finished?
24. Was the sucker the dentist gave you when you were all done tasty?

Fillings –Set D

Now I have some questions maybe you can help me with. Just try your best to remember what happened. If you don't know the answer, you can say that you don't know.

1. Did the dentist wear a hat or did s/he wear a mask?
2. Was the dentist's name Dr. Jones? (wrong name)
3. Was the Dentist's hair _____ or was it _____?
(correct colour) (wrong colour)?
4. Did the dentist rub a Q-TIP on your gum?
5. Did the dentist take the temperature in your mouth or did s/he give you a poke in your mouth?
6. Did it hurt or did it feel good when the dentist gave your mouth a poke?
7. Did someone put wool in your mouth?
8. Did the dentist take your blood pressure?
9. Did you get the electric disc or did you get the fluoride mixer in your mouth to get the bad taste out?
10. Did someone rinse your mouth with water?
11. Did you hold a spoon or did you hold a toothbrush in your mouth?
12. Did the dentist blow foam on your teeth?
13. Did it hurt or did it feel good when the dentist put the plastic piece on your mouth?
14. Did the dentist say a bad word because s/he had a hard time getting the filling in?
15. Did the dentist give you a fluoride treatment or did s/he give you a root canal?
16. Did you have _____ or did you have _____ teeth filled
(wrong #) (correct #)
17. Was the dentist's helper's hair _____ (correct colour)?
18. Did the dentist's helper prepare the tools or did the dentist prepare the tools?
19. Did the dentist's helper tickle your eyes when she put the eye drops in?
20. Were there _____ (wrong #) windows in the room?
21. Was the chair you were sitting in _____ or was it _____?
(neither choice correct)
22. Did you spend about _____ in the dentist's chair?
(correct amount of time)
23. Did you visit the dentist in the _____ or was it in the _____?
(wrong: morn/after/eve) (correct: morn/after/eve)
24. Was the sucker the dentist gave you when you were all done tasty?

Appendix B
Faces Pain Scale – Revised (FPS-R)

Faces Pain Scale – Revised (FPS-R)

In the following instructions, say "hurt" or "pain," whichever seems right for a particular child.

"These faces show how much something can hurt. This face [point to left-most face] shows no pain. The faces show more and more pain [point to each from left to right] up to this one [point to right-most face] – it shows very much pain. Point to the face that shows how much you hurt [right now]."

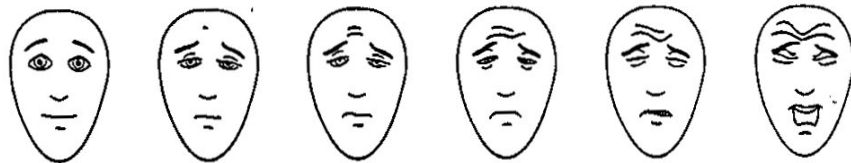
*Score the chosen face 0, 2, 4, 6, 8, or 10, counting left to right, so '0' = 'no pain' and '10' = 'very much pain.'
Do not use words like 'happy' and 'sad'. This scale is intended to measure how children feel inside, not how their face looks.*

Hicks CL, von Baeyer CL, Spafford P, van Kester I, Goodenough B. The Faces Pain Scale – Revised: Toward a common metric in pediatric pain measurement. *Pain* 2001;93:173-183.
Scale adapted from: Bierl D, Reeve R, Chumpton GD, Adcock L, Ziegler J. The Faces Pain Scale for the self-assessment of the severity of pain experienced by children: Development, initial validation and preliminary investigation for ratio scale properties. *Pain* 1990;41:139-150.

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0 2 4 6 8 10

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Appendix C
Examples from the State-Trait Anxiety Inventory – Child Version (STAI-C)

HOW-I-FEEL QUESTIONNAIRE
Examples from the State Form

1. I feel	very calm	calm	not calm
2. I feel	very jittery	jittery	not jittery
3. I feel	very scared	scared	not scared
4. I feel	very relaxed	relaxed	not relaxed
5. I feel	very worried	worried	not worried
6. I feel	very happy	happy	not happy
7. I feel	very good	good	not good
8. I feel	very bothered	bothered	not bothered

HOW-I-FEEL QUESTIONNAIRE
Examples from the Trait Form

1. I worry too much	hardly ever	sometimes	often
2. I am shy	hardly ever	sometimes	often
3. I feel troubled	hardly ever	sometimes	often
4. I worry about school	hardly ever	sometimes	often
5. I have trouble deciding what to do	hardly ever	sometimes	often
6. I notice my heart beats fast	hardly ever	sometimes	often
7. I am secretly afraid	hardly ever	sometimes	often
8. I worry about what others think of me	hardly ever	sometimes	often

Appendix D
EAS Temperament Survey

- These are statements often used to describe children.
- Please rate each of the statements for your child on the scale provided below. (circle one number)

	Not characteristic or typical of my child		Sometimes characteristic of my child		Very characteristic of my child	Not observed
Child tends to be shy.	1	2	3	4	5	0
Child cries easily.	1	2	3	4	5	0
Child likes to be with people.	1	2	3	4	5	0
Child is always on the go.	1	2	3	4	5	0
Child prefers play with others rather than alone.	1	2	3	4	5	0
Child tends to be somewhat emotional.	1	2	3	4	5	0
When child moves about, s/he usually moves slowly.	1	2	3	4	5	0
Child makes friends easily.	1	2	3	4	5	0
Child is off and running as soon as he wakes up in the morning.	1	2	3	4	5	0
Child finds people more stimulating than anything else.	1	2	3	4	5	0
Child often fusses and cries	1	2	3	4	5	0
Child is very sociable.	1	2	3	4	5	0
Child is very energetic.	1	2	3	4	5	0
Child takes a long time to warm up to strangers.	1	2	3	4	5	0
Child gets upset easily.	1	2	3	4	5	0
Child is something of a loner.	1	2	3	4	5	0
Child prefers quiet, inactive games to more active ones.	1	2	3	4	5	0
When alone, child feels isolated.	1	2	3	4	5	0
Child reacts intensely when upset.	1	2	3	4	5	0
Child is friendly with strangers.	1	2	3	4	5	0

PARENT'S Previous Dental & Medical Experiences

- When you visit the dentist to have your teeth cleaned or fixed, how nervous or anxious do you usually get? (circle one)
 - (a) not anxious
 - (b) extremely low
 - (c) moderately low
 - (d) moderately high
 - (e) extremely high

- When you visit the medical DOCTOR or nurse to have a needle, how nervous or anxious do you usually get? (circle one)
 - (a) not anxious
 - (b) extremely low
 - (c) moderately low
 - (d) moderately high
 - (e) extremely high

◆ THANK YOU FOR PARTICIPATING IN THIS STUDY!

◆ IF YOU ARE INTERESTED IN RECEIVING A COPY OF THE RESULTS OF THIS STUDY, PLEASE WRITE YOUR MAILING ADDRESS BELOW

Appendix F

Examples from Numbers Backward Subtest of the Children's Memory Scale

- Ok _____ (child's name) we have one more thing to do. I've got a short number game to play. I'm going to say some numbers out loud. When I finish saying them I'd like you to say them back to me out loud – but in reverse order – so backwards.
- Let's try a practice one: If I say 5-1, what would you say? Answer: 1-5
- If first practice is correct move to item 1, if not correct: I said 5-1, so if you say it backward, or in reverse order, it would be 1-5.
- Then move to item 1. Discontinue after 2 failures on an item.

Item	Correct Response	Response	Score (0 or 1)
ITEM 1			
Trial 1: 3-8	8-3		
Trial 2:			
ITEM 2			
Trial 1: 4-8-3	3-8-4		
Trial 2:			
ITEM 3			
Trial 1: 5-2-9-6	6-9-2-5		
Trial 2:			
ITEM 4			
Trial 1: 4-7-1-5-3	3-5-1-7-4		
Trial 2:			
ITEM 5			
Trial 1: 1-8-6-9-5-2	2-5-9-6-8-1		
Trial 2:			
ITEM 6			
Trial 1: 8-2-5-4-9-3-2	2-3-9-4-5-2-8		
Trial 2:			

Appendix G
Ethics Approval Form



**UNIVERSITY ADVISORY COMMITTEE
ON ETHICS IN BEHAVIOURAL SCIENCE RESEARCH**

NAME: Tammy Marche
Department of Psychology

BSC#: 2001-205

DATE: December 19, 2001

The University Advisory Committee on Ethics in Behavioural Science Research has reviewed the revisions Application for Ethics Approval for your study "Children's Memories for Distressful Dental Procedures: Effects of External and Internal Factors" (01-205).

Your study has been APPROVED subject to the following minor modifications:

- The child's verbal assent protocol should emphasize that he/she does not have to take part, and that they may quit at any time.

Please send one copy of your revisions to the Office of Research Services for our records. Please highlight or underline any changes made when resubmitting.

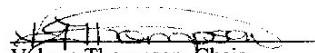
The term of this approval is for 5 years.

This letter serves as your certificate of approval, effective as of the time that you have completed the requested modifications. If you require a letter of unconditional approval, please so indicate on your reply, and one will be issued to you.

Any significant changes to your proposed study should be reported to the Chair for Committee consideration in advance of its implementation.

In order to maintain ethics approval, a status report must be submitted to the Chair for Committee consideration within one month of the current expiry date each year the study remains open, and upon study completion. Please refer to the following website for further instructions: <http://www.usask.ca/research/ethics.shtml>.

I wish you a successful and informative study.


Valerie Thompson, Chair
University Advisory Committee
on Ethics in Behavioural Science Research

VT/bk

Office of Research Services, University of Saskatchewan
Kirk Hall Room 210, 117 Science Place, Saskatoon SK S7N 5C8 CANADA
Telephone: (306) 966-8576 or (306) 966-2084 Facsimile: (306) 966-8597 <http://www.usask.ca/research/>

Appendix H
Recruitment Letter to Dentists

Dear Dentists,

I am a Ph.D. candidate in Clinical Psychology at the University of Saskatchewan, currently being supervised by Dr. Tammy Marche. My doctoral research will examine children's memories for, and responses to, dental fillings and extractions.

The purpose of the research will be twofold. First, we will be asking the children what they remember about the event using different types of questioning techniques, in order to determine what types of questions elicit the most accurate responses from children. The results of this part of the research will help forensic interviewers develop interview protocols for children involved in the judicial system. The second purpose of this research is to learn about what children remember from experiencing potentially stressful procedures. Such knowledge may help tailor treatment regimens to avoid the development of negative memories and aid in the prevention of procedural distress and later medical and dental avoidance. The University of Saskatchewan Advisory Committee on Ethics in Behavioural Science Research has approved this project.

I am looking for parents and children (aged 4-12) interested in participating in the study. Participation would involve the parent filling out some brief questionnaires that take about 10 minutes, and could be completed while the parent waits for their child. Before the procedure children will be asked to rate their level of nervousness. When we were developing the study, some dentist we spoke to wondered if asking children this question beforehand might increase the child's anxiety during the procedure. Carlson and colleagues (1993) conducted a study to examine this issue and found that pre-treatment questions had no effect on the child's experience of distress. In fact, they found that pre-treatment questions actually served to decrease the child's anxiety about dentistry. Thus, we feel that asking children questions their anxiety may actually decrease their nervousness.

During the procedure children will be given an inflatable grip device to measure any discomfort during the procedure (the dial on the grip device will be videotaped to later transcribe the data points). Later that evening children will be telephoned at home and be asked about what they remembered about the procedure with 25 questions. A pedodontic specialist at the University of Saskatchewan's Dental Clinic has reviewed the interview questions. It is expected that the only staff time needed would be to inform the researcher about the particular days and times that children are scheduled for fillings and extractions.

Children who participate will be given a package of Trident gum and the names of families who participate will be put into a draw for a \$100 prize. I will be forwarding a copy of the results to dentists who participate, as well as any families interested in the results.

If your practice is in the Saskatoon region, and your office might be interested in having your patients participate in this research, or for more information about the study, please have someone from your office call 966-8959. Kindly leave your name and number and I will get back to you promptly.

Yours sincerely,

Elizabete Rocha, M.Sc.
Ph.D. Candidate in Clinical Psychology

Lab Number: 966-8959
email: e.rocha@usask.ca

Children's Reports of their Experiences with Dental Procedures

We are conducting a study to look at what factors influence how children remember dental procedures. Some children are more likely to go along with questions about things that did not happen and we're interested in finding out what types of factors influence this tendency to go along with questions about things that did not happen. Children will be asked what they remember about the dental procedure and then will also be asked specific questions. For example, we might ask children about events that did happen (e.g., "Did you sit in an orange chair?"). We will also ask questions about things that did not happen (e.g., Did the dentist take your blood pressure?). Through this research we hope to find good methods of interviewing children about events they experience. We also hope to find out how to help children cope with medical procedures that they may find distressful. Because it could bias the study, we please ask that you not tell your children that the study involves memory or that we will be asking about events that did and did not happen, until their participation in the study is over.

Participation will involve:

- Parents will fill out some brief questionnaires, which take about 10 minutes, and ask about you and your child, and your child's past dental and medical experiences. Before the dental procedure, children will complete one questionnaire, which takes about 5 minutes.
- After the dental procedure, children will be telephoned at home and asked questions about their dental visit. This interview will take about 10 minutes.
- 6-8 weeks after the procedure, a researcher will telephone you to arrange a time to telephone your child to ask him/her the same questions that were asked during the first phone interview. This is done to see how children's views change over time.
- Parents who are interested in knowing the results of the study will be sent a letter at the end of the study to tell them what we have found.

Risks/Benefits. We know of no specific benefits of the study for you or your child, we also know of no risks that participation may involve to you or your child.

Freedom to Withdraw. Your participation, and your child's, in this project is completely voluntary and you are free to withdraw at any time for any reason. Should you wish to do so, any test materials already completed will be destroyed. Withdrawal from this study will not affect your child's dental treatment. (if child is recruited from schools then add: nor will it affect your child's grades at school.)

Confidentiality. All information that you and your child provide will remain completely anonymous and confidential. All parent and child responses will be labelled with code numbers rather than names and information will be stored in locked files for a minimum of five years.

Use of Research Findings: Information collected during this study may be published or presented at a future date. However, only group information, not individual scores, will be reported.

The University of Saskatchewan Advisory Committee on Ethics in Behavioural Science Research approved this project in January 2002.

You are encouraged to ask any questions that you may have about your child's participation in this study at this time. If you have any questions about this study or your child's rights as a participant in a research study, you may contact either Liz Rocha, research co-ordinator, University of Saskatchewan (e.rocha@usask.ca or 966-8959), Tammy Marche, Department of Psychology, St. Thomas More College, University of Saskatchewan (tammy.marche@usask.ca or 966-8915) or the Office of Research Services at 966-4053.

I, _____, have read the contents of this form and understand
completely

(Please print your name)

what the participation of my child in this study involves. I have had the opportunity to ask any questions relevant to my child's participation, and have had them answered to my satisfaction. I now consent to allow my child, _____, to participate in
(Please print your child's name)

this study. I have received a copy of this form for my records.

Signature of Parent

Signature of Researcher

Date

Child Assent – Verbal description

Hello – we’re doing a project on what it’s like for children when they go and visit the dentist. We would like to know if you want to help us with the project. Helping out would mean that I would ask you a few questions about how you are feeling before you visit with the dentist. That takes about 5 minutes.

Later on when you’re at home I’ll phone to talk to you about your visit to the dentist. Then in a few weeks, I’ll phone you at home again.

If you decide not to participate with the project, that is fine. You can stop whenever you want.

Does that sound okay to you?

Do you have any questions?

- Child’s phone number and time of call: _____
- FPS-R

Immediately following (0-10) _____

1st Phone Interview (0-10) _____

2nd Phone Interview (0-10) _____