

**A DIRECT COMPARISON OF CHILDREN'S RECALL  
OF STRESSFUL AND NON-STRESSFUL EVENTS**

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## Abstract

In many criminal investigations, the testimony of a witness is critical to establishing that an illegal act occurred. Research on children's event memory has largely been based on recall of neutral or positive experiences. Understanding the differences, if any, between memory for stressful events and neutral events is essential for interpreting children's testimony. The present research explored the malleability of children's memory for an instance of a repeated anxiety-provoking event. The basic event was private swimming lessons for beginners that, because of natural variation in children's fear of the water, were experienced as stressful for some children and not stressful for others. In both the stressful and non-stressful conditions, children who experienced a single-lesson were more correct and less suggestible than children who experienced repeated-lessons. There was little evidence for a unique effect of anxiety on recall. Implications for children's memory for stressful events and repeated-events are discussed.

Keywords: memory, children's testimony, stress and memory, repeated events.

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## Introduction

In many criminal investigations, the testimony of witnesses is critical to establishing that an illegal act occurred. Particularly in allegations of child sexual abuse, the child and perpetrator are often the only witnesses to the alleged offence. Many factors can influence the accuracy and credibility of a child witness including the level of emotional arousal experienced during the event (Christianson, 1992), the frequency of experienced instances (Connolly & Lindsay, 2001; Powell, Roberts, Ceci, & Hembrooke, 1999; Price & Connolly, 2004), and exposure to misinformation either prior or subsequent to the experience (e.g., Ceci & Bruck, 1993; Leichtman & Ceci, 1995). Historically, much of the research addressing witness-related issues has been based on recall of a single, passively experienced event in which a participant observes stimuli and is later asked to recall the stimuli under varying conditions. Memory measures often include accuracy and completeness of recall. However, there may be substantial differences in the way that events are recalled when experienced passively versus actively (Baker-Ward, Hess, & Flannagan, 1990; Gobbo, Mega, & Pipe, 2002; Murchaver, Pipe, Gordon, Owens, & Fivush, 1996; Rudy & Goodman, 1991; Thierry & Spence, 2004; Tobey & Goodman, 1992). For instance, Rudy and Goodman (1991) found that participation in an event reduced children's susceptibility to suggestion compared to children who had simply observed an event and Murchaver et al. (1996) found that participation in an event led to more complete, accurate, and organized reports of experiences than did observing or hearing about an event. Empirical research has thus shifted to more active participation in to-be-remembered events (e.g., Connolly & Lindsay, 2001; Powell et al., 1999; Price & Connolly, 2004) and to enhancing the

ecological validity of stimuli in other ways (e.g., Goodman, Hirschman, Hepps, & Rudy, 1991; Shrimpton, Oates, & Hayes, 1998). Two recent and important focuses for increasing the ecological validity of such research have been the examination of both memory for emotionally arousing events and memory for events that occur repeatedly.

### *Emotional Arousal*

Research on children's event memory has largely been based on recall of neutral or positive experiences (e.g., Farrar & Boyer-Pennington, 1999). Although valuable and necessary in many ways, such events lack some real-life qualities of stressful events (e.g., personal threat, personal touch; Fivush, 2002; Yuille & Tollestrup, 1992). Given the stressful nature of most crimes that bring children to court to testify as witnesses, understanding the differences, if any, between memory for negatively emotionally arousing or stressful events and neutral events is essential for interpreting children's testimony. If memory for stressful events is qualitatively different from memory for neutral experiences (Christianson, 1992; Yuille & Tollestrup, 1992), the vast literature based on memory for neutral events may not generalize to memory for stressful events. Conversely, if the differences are quantitative (Pezdek & Taylor, 2002; Porter & Birt, 2001) or non-existent, existing theories may be useful in understanding memory for negative emotional events. Many scholars have called for further scientific investigation on this important question (e.g., Christianson, 1992; Fivush, 2002; Goodman & Quas, 1997; Pezdek & Taylor, 2002). Terminology usage in this area has been somewhat inconsistent. Much of the recent literature has used the term "emotional arousal" to describe many experiences involving stress, anxiety, and fear. In the present paper, to avoid the more cumbersome terminology of "negative emotional arousal," the term

“stress” will be used to describe much of the research that involves negatively emotionally arousing events.

Conclusions from the extant research on the difference between memory for stressful and neutral events have been inconsistent. Some researchers have found that children’s recall of stressful events is superior to their recall of neutral or positive events (e.g., Goodman et al., 1991; Shrimpton et al., 1998), while others have found the opposite (e.g., Bugental, Blue, Cortez, Fleck, & Rodriguez, 1992). Still others have found no differences between stressful and neutral or positive events (e.g., Ornstein, Gordon, & Larus, 1992; Vandermaas, Hess, & Baker-Ward, 1993).

It has been suggested that differing findings in comparisons of stressful and neutral or positive experiences may arise when researchers focus on different event details. Specifically, Christianson (1992), relying on Easterbrook (1959), suggested that recall of stressful events may be less accurate for details that are peripheral to the event than those central to the event due to a “narrowing” of attention that increases focus on details central to the event at the expense of attending to peripheral details, while this was not as prominent in recall of neutral events. In one example of such findings, Christianson (1984) found that participants who viewed an emotional slide sequence reported more of the central features of the depicted event than those who viewed a neutral slide sequence. This distinction between central and peripheral details provides a way of explaining conflicting findings in the literature because some research has focused on central details of an event and found superior memory for stressful events relative to neutral events (e.g., Goodman et al., 1991), while other work focusing on peripheral details has found a negative impact of stress on memory (e.g., Peters, 1991). Indeed,

researchers have found that when evaluating children's recall of a stressful event (e.g., a physical injury), children showed better recall of central than peripheral details (e.g., Howe, Courage, & Peterson, 1996; Peterson & Bell, 1996; Peterson & Whalen, 2001) and this memory advantage for central details is apparent over long periods of time (Burgwyn-Bailes, Baker-Ward, Gordon, & Ornstein, 2001; Peterson, 1999). Despite the potential explanatory power of a central-peripheral distinction, the inconsistent definitions of each of these terms and/or participant interpretations of the centrality of particular details raises concerns. Christianson (1992) noted the difficulty of making an *a priori* determination of centrality which he presumes to rest on a central-to-peripheral continuum and be subject to individual differences. This challenge may be magnified when an event is outside of a strictly controlled laboratory. In his 1992 review, Christianson defined a central detail as one that was connected to the source of the emotional arousal, while a peripheral detail was irrelevant or "spatially peripheral" to the arousal source. Similarly, Heuer and Reisberg (1990) defined central details as ones that related to the basic story of the stimuli, while peripheral details were ones that were not essential to the story (see also Roebbers & Schneider, 2000). Definitions like the ones presented above are common in the literature; however, in less experimentally controlled events, this distinction may not be as easily made. Furthermore, in a criminal investigation, determining the centrality of a particular detail may be even more difficult. For example, in a case of child sexual abuse, is the perpetrator's clothing central to the event of abuse? It may or may not be essential to the story (depending perhaps upon whether or not the clothing was removed), but many defence attorneys would consider

this “central” information that should be recalled by a complainant and would likely attempt to use a memory failure on such a detail to discredit a child.

Another explanation for the discrepant findings in the literature is the varying strategies used to measure and define levels of stress and emotional arousal. Consider the Yerkes-Dodson Law (Yerkes & Dodson, 1908) which suggests that recall of stressful events can be described with an inverted U-shaped function, such that recall is superior at a moderate level of arousal, while extremely high and low levels of arousal result in poor recall (a concept with some empirical support, but see Christianson, 1992). There is some evidence that children’s memory for events with varying levels of arousal may conform to this function (e.g., Bahrick, Parker, Fivush, & Levitt, 1998), but this has not been extensively examined. In much of the extant research, the point at which an event becomes “highly arousing,” versus “moderately arousing” is undefined; thus, the same actual level of arousal may be defined as “high” by some researchers and “moderate” by others.

This problem is clearly articulated by Deffenbacher and colleagues (Deffenbacher, Bornstein, Penrod, & McGorty, 2005) in a recent meta-analysis. Deffenbacher et al. discuss the difference between two independent modes of attention control: arousal and activation. The arousal mode is conceptualized as an orienting response, the reaction to a situation relatively low in emotional arousal. The physiological result is a decrease in readiness (i.e., in heart rate, blood pressure, muscle tone) that is present during basic perceptual observation. In this decreased readiness mode, attention is focused on the most central elements of the stimuli and it is proposed that memory will be enhanced for the central elements at the expense of memory for peripheral details.

Conversely, the activation mode is described as a physiological defensive response to external stimuli and is manifested in an increase in physiological preparedness (i.e., in heart rate, blood pressure, muscle tone) when the environment indicates a need for action (i.e., escape, avoidance). The activation mode, which is elicited in highly emotionally arousing situations, predicts that memory performance for all information will be slightly enhanced until arousal reaches a certain level (i.e., of cognitive anxiety and physiological activation), at which point performance is substantially impaired. Thus, according to Deffenbacher et al., arousal can have a positive influence on memory for all types of information, but only until it reaches a certain peak point, after which the impact of stress on memory is disastrous. The activation mode, Deffenbacher et al. argue, is the mode that most closely parallels the actual eyewitness experience, but is not always represented in the empirical work on memory for arousing experiences. Deffenbacher et al. propose that the level of arousal labelled as “high” may be relatively low in some studies as compared to some other recent research that elicited higher levels of emotional arousal more akin to what an eyewitness in a forensic context would experience. The implications for the literature of the inconsistent determination of what constitutes “high” arousal are obvious.

Important insights into the investigation of children’s recall of stressful events came when researchers began examining children’s memory for medical experiences (Goodman et al., 1991). As a naturally occurring event with many elements consistent with forensic allegations of abuse (e.g., personal touch, feelings of betrayal, physical discomfort), this is an excellent way to examine children’s memory for stressful events. Subsequent research has explored children’s recall of routine physical examinations (Baker-Ward, Gordon, Ornstein, Larus, & Clubb, 1993), inoculations (Goodman et al.,



1991), visits to the emergency room (Peterson & Bell, 1996), and the dentist (Vandermaas et al., 1993), and experience with invasive, painful, and frightening medical procedures such as the voiding cystourethrogram (VCUG; Merritt, Ornstein, & Spicker, 1994; Quas, Goodman, Bidrose, Pipe, Craw, & Ablin, 1999). Using these paradigms, researchers are often able to determine precisely what occurred during the experience and can compare children's recall with an objective record, though not with a group of children that is comparable on all other event characteristics except the level of stress. Unfortunately, beyond a finding that children's memory can be generally accurate for stressful events (Pezdek & Taylor, 2002), no other clear pattern of findings has materialized (see Fivush, 2002).

Arguably, child sexual abuse (CSA) is unique and memory for medical procedures may not generalize to memory for CSA, which may involve some emotional components that are lacking in medical experiences (e.g., betrayal, secrecy). Ideally, therefore, researchers would study children's memory for CSA. Of course, in most cases of sexual abuse, base truth is unavailable so assessing the accuracy and completeness of a child's recall of an event is more difficult. However, there are a few very unique and informative case studies that have obtained at least partial base truth of what occurred when a child was sexually abused. Jones and Krugman (1986) examined the testimony of a three year-old girl who had been abducted, sexually assaulted, and left for dead by an adult male perpetrator. As corroborated independently by the perpetrator, the young girl was consistently accurate in her identification of his vehicle, description of the offence, and identification of the perpetrator himself. She maintained her story through multiple interviews and identifications of the suspect, including rejecting line-ups in which the

perpetrator was not present. Orbach and Lamb (1999) examined an audio recording of the last incident of repeated sexual abuse of a 13 year-old girl by her grandfather. Over 50% of the details reported by the young girl were corroborated on audiotape, and only 7% of what the authors considered verifiable details reported by the child were uncorroborated. Finally, Bidrose and Goodman (2000) studied the detailed testimonies of four young girls (aged 8 to 15 years) and corroborating photographic (623 photographs) and audiotaped (77 tapes) evidence of their involvement as victims of a 'sex ring' carried out by adult males. The authors found audio or photographic support for 85% of the girls' sexual allegations, and found that most errors were ones of omission rather than commission.

These case studies and research on memory for medical procedures taken together indicate that children are capable of reporting a stressful and emotional event very accurately (although the number of omission errors suggests the reports are not complete). However, one substantial problem is that a strictly controlled comparison between a neutral or positive event and a negative or stressful event has been very difficult to obtain. Only one study was located that examined a personally experienced, stressful, experimentally controlled event (Peters, 1997), and this study found a negative effect of stress on memory. Some scholars have made an effort to compare a stressful and neutral event (e.g., Lindberg, Jones, McComas Collard, & Thomas, 2001), but in all such studies the stressful and neutral events were different events, leaving open the possibility that differences in memory were a function of the nature of the event itself. In the present study, we directly compared stressful (anxiety-provoking) and non-stressful (non-anxiety-provoking) events using the same basic activities, either a single or repeated

private (one-on-one) swimming lessons for children who were and were not afraid of the water.

### *Suggestibility*

One of the most oft-discussed cases when considering concerns about children's experiences in the justice system is the case of *State of New Jersey v. Michaels* (see Bruck & Ceci, 1995). In this case, multiple children alleged sexual abuse by an employee (Kelly Michaels) at their preschool centre. Children alleged that Michaels raped them with knives, licked peanut butter off of their genitals, and engaged in many other sex acts, which resulted in Michaels being charged with 115 counts of sexual abuse. These allegations were implausible given the lack of supporting physical evidence, but investigators pursued them vehemently, apparently without consideration for alternative explanations for the allegations. The coercive strategies used by interviewers in this case were called into question, videotapes of the interviews were examined by child development professionals, and Kelly Michaels has since been exonerated after spending years in prison.

A commonly cited concern about inappropriate interviewing comes as a result of the vast literature on children's suggestibility (Bruck & Ceci, 1999; Ceci & Bruck, 1993 for reviews, see Saywitz & Camparo, 1998 for methods of reducing suggestibility). Generally, the suggestibility paradigm involves three phases: presentation of a target (to-be-remembered) event, presentation of erroneous suggestions, and a final memory test (Ceci & Bruck, 1993). A suggestibility effect is observed when children report (above chance levels) that suggested details occurred during the target event. It is well-demonstrated that children, especially preschoolers, are susceptible to incorporating

information that they have only heard into reports of their experiences. There is debate as to whether this is a result of a change in the underlying memory based on the incorporation of new information (McCloskey & Zaragoza, 1985) or a result of consciously or unconsciously complying with demand characteristics (i.e., reporting what they think the interviewer wants them to say). Regardless of the origin of the effect, its pervasive nature highlights the special importance of being extraordinarily careful in interviews with children in order to avoid implanting suggestions.

A potential advantage of using the suggestibility paradigm in children's memory research is that it may serve as a measure of memory strength. The *memory trace strength theory* proposes that weaker memories are more susceptible to suggestion than stronger memories (e.g., Pezdek & Roe, 1995). However, some research has indicated that the relationship between suggestibility and memory strength may be more complicated than this (e.g., Howe, 1991). For example, if memory for the general content of an event is strong, suggestions that are consistent with the general event representation, but not actually experienced may be even more likely to be accepted as experienced than if suggestions are consistent with a general event representation, but memory for that representation is weak (see Connolly & Price, 2006; Roberts & Powell, 2006).

Although limited research has been conducted on suggestibility for stressful events, that which has been done has found that more stressful events tend to result in a decrease in suggestibility (Goodman et al., 1991; Ridley, Clifford, & Keogh, 2002; Shrimpton et al., 1998). For instance, Shrimpton and colleagues (Shrimpton et al., 1998) examined children's recall of having a sample of blood taken (venipuncture) to children's recall of participating in a demonstration of venipuncture. Children who had received the

venipuncture gave fewer incorrect and more correct responses overall, and responded with fewer incorrect responses to suggestive questions.

### *Event Frequency*

In addition to the increasing focus on memory for stressful events, scholars have recognized the need for research into memory for repeated events. A principle of fundamental justice states that a criminal charge must be specific enough for the accused to raise a defence. This may require a complainant who has witnessed or experienced a repeated offence to provide details of a specific instance of that offence. Much of what brings children to court is repeated (e.g., physical or sexual abuse, witnessing domestic violence; *R. v. B. (G.)*, 1990), but most research into children's recall has been focused on reports of single events. There is a growing body of literature that indicates that children remember repeated events differently than they remember unique events (e.g., Connolly & Lindsay, 2001; Connolly & Price, 2006; Farrar & Boyer-Pennington, 1999; Fivush & Hudson, 1990; Hudson, 1990; Nelson, 1986; Price & Connolly, 2004; Roberts & Powell, 2006), which indicates that event frequency may be an important distinction.

When instances are repeated, experienced details can be either fixed or variable. Fixed details are those that are experienced in exactly the same way during each encounter with the event (e.g., during the routine of getting dressed, people generally wear a top of some sort each day). Variable details are ones that change between the instances of a repeated event (e.g., the colour of a shirt worn each day). The ways that variable details can be expressed, for instance the different shirt colours, are called options. Differences in memory for single and repeated events are apparent in memory for both fixed and variable details. Memory for details of a unique event is generally

weaker than memory for comparable fixed details of a repeated event, but stronger than memory for variable details of a repeated event (e.g., Connolly & Lindsay, 2001; Pezdek & Roe, 1995; Powell et al., 1999). Very few events recur in exactly the same way, and thus, the focus of the present work is on memory for variable details.

Researchers exploring children's suggestibility for variable details of an instance of a repeated event have found somewhat inconsistent patterns of recall. Some researchers have found that children who repeatedly experienced an event were more suggestible for variable details than children who had not had prior similar experiences (e.g., Connolly & Lindsay, 2001; Connolly & Price, 2006; Powell & Roberts, 2002; Price & Connolly, 2004; Roberts & Powell, 2006). In contrast, others have found few differences (Powell & Roberts, 2002; Powell et al., 1999). Partial explanation for these differences has thus far been found to lie in methodological variability. Connolly and Price (2006; see also Roberts & Powell, 2006) found that when the relationship between variable details across multiple highly similar experiences was strong and recognized as such (in this case by older, compared to younger children), heightened suggestibility, compared to details of a unique event, resulted. However, when the relationship between variable details was weak, the difference in suggestibility between single- and repeat-event children was minimized. Price, Connolly and Gordon (submitted) examined the effect of varying the temporal spacing of repeated instances on children's recall, as this had been inconsistently manipulated in previous research. Price et al., found heightened suggestibility for repeated, compared to single events, but only when events were distributed over a longer period of time (4 days and 10 days versus 1 day), although this effect was only evident at a one-day (Study 1), not a one-week (Study 2) delay.

Three theories are reviewed below that may be used to predict heightened suggestibility for variable details of a repeated event versus a unique event: script theory, fuzzy trace theory, and source-monitoring theory.

*Script theory.* Script theory, a sub-type of schema theory, is concerned with recall of routine experiences (see Alba & Hasher, 1983). Script theory asserts that when an event is repeatedly experienced, a cognitive representation, or script, of what typically occurs develops (Alba & Hasher, 1983). The resulting script is a spatially and temporally organized memory representation with permissible variations and expectations of what will transpire when the routine is encountered in the future (Nelson, 1986; see Alba & Hasher, 1983 for a discussion). This general event representation, or script, can develop after only one experience with an event and future experiences are then expected to occur in a manner similar to the previous encounter (Fivush, 1984).

Over time, a script becomes more general and with repeated similar experiences, recall of a script-consistent instance evolves from more reproductive to more reconstructive memory (Slackman & Nelson, 1984). That is, details that are common to the structure of an event need not be encoded and stored for each particular instance because they can be derived from the general script. Therefore, what is encoded and stored in memory will be heavily influenced by the content of the guiding script (Alba & Hasher, 1983). Details that vary across instances, variable details, are represented as list-like sets of experienced options that are not tightly associated with any one instance, and these options provide expectations about the characteristics of future options (Fivush, 1984; Hudson, Fivush, & Kuebli, 1992). What results is a dynamic structure that is prepared to accommodate new information, while concurrently maintaining a set of

standard expectations. Importantly, script acquisition may reduce instance access, but does not mean that access to a particular instance is lost (Nelson, 1986). Individual instances are accessible through specific details that vary from script expectations which, when combined with general script knowledge, can constitute recall of a complete instance (Nelson, 1986). Of course, the reconstructive nature of this recall may lead to reporting errors.

The proposed structure of a script has important implications for children's suggestibility for variable details of an instance of a repeated event. Specifically, if variable details are represented in a list-like format of permissible options, then as long as a suggestion is consistent with expectations, it may be readily accepted as experienced by a rememberer. That is, during the presentation of a script-consistent suggested detail, that detail may be recognized as permissible and added to the list-like set of options. Then, at retrieval of an instance, that detail may be just as, or perhaps even more (depending upon, for example, the recency of the presentation of the suggested detail), likely to be misattributed as an experienced detail. Because scripts and their respective details expand and include more information over time, compared to suggestibility for details of a unique event, a heightened suggestibility effect should occur for variable details of a repeated event if suggestions match the expected characteristics for permissible options as established by previous experiences. This is because even if a general event representation, or script, is developed for a singly occurring event, the limits on permissible options are likely to be more restricted, and suggestions are then less likely to be accepted.



*Fuzzy-trace theory.* According to fuzzy-trace theory (e.g., Brainerd & Reyna, 1995, 2002; Reyna, Holliday, & Marche, 2002), two memory traces are formed when an event is encountered: a verbatim trace and a gist trace. A verbatim trace contains the precise details, or surface structure, of the event and it is matched to retrieval cues based on a pure identity judgement (i.e., a precise match). Resemblance to the cue does not increase the likelihood of a match between a retrieval cue and a verbatim trace. A gist trace, conversely, contains the general meaning of the event and is matched to cues based on a relative similarity judgement. The more overlap between a retrieval cue and the content of the gist trace, the more likely the gist trace is to be identified as the target. Verbatim and gist traces are stored in parallel; each is accessed independent of the other.

Whether or not a person will misidentify exogenous misinformation as experienced will depend, at least partially, on whether the true verbatim or gist trace is activated by the retrieval cue. If the verbatim trace for the true event is accessed, rejection of misinformation is highly likely. However, if the gist trace is accessed and the misinformation shares the meaning or ‘gist’ of the true event, the misinformation is likely to be accepted as accurate. Importantly, verbatim traces are said to decay more quickly than gist traces, so if recall takes place after a delay (the precise length of which is not clear), gist is more likely to be accessed, leading to higher suggestibility. The quicker decay of verbatim memory also has implications for the timing of the presentation of misinformation. If gist-consistent misinformation is presented after the verbatim trace has decayed, the likelihood of its acceptance as accurate is increased due to the forgetting of the original verbatim trace. Therefore, presentation of misinformation farther from the experienced event, and closer to the recall test, may even result in the formation of a

detailed verbatim trace for the misinformation (Brainerd & Reyna, 1998) and a resulting higher suggestibility effect.

Fuzzy-trace theory does not specifically deal with repetition of complex experiences. However, we can surmise that when several similar instances of an event are encountered, a verbatim trace is created during each encounter with the routine, but each instance also activates the same gist trace. Of course, repetition of identical information across multiple experiences (i.e., fixed details) will result in strengthening of both the verbatim and gist traces for that information, but the concern in the present research is with details that vary across similar experiences. When variable details occur across repeated similar experiences, each instance will create a distinct verbatim trace, but as long as each instance is highly similar, each experience should also activate the same gist trace (see Connolly & Price, 2006; Roberts & Powell, 2006). Each time a similar instance is experienced, the gist trace is activated and strengthened, thereby increasing the likelihood that it will be accessed (as opposed to a single verbatim trace). Given that retrieval of a gist trace is more likely to result in susceptibility to suggestion, children should be more suggestible after experiencing repeated similar instances than after experiencing only one instance, in which case the likelihood of retrieving a verbatim versus a gist trace is more equivalent (unless a long delay is implemented).

*Source-monitoring theory.* When an event is encountered, information about where and/or how it was encountered is stored in memory, along with details of the experience (Johnson, Hashtroudi, & Lindsay, 1993). When a memory for a particular experience is retrieved, so is the information that can help determine the source of that memory. Source-monitoring is the process(es) by which one makes attributions about the

source, or origin, of memories. Most source decisions are made rapidly and automatically, without a considered decision-making process. However, some decisions require more cognitive effort. Source-monitoring theory (SMT) proposes that the determination of the source of a memory is made through an attribution of information retrieved at recall, rather than a kind of source-tag that is encoded during the experience (Johnson et al., 1993). This attribution of a memory to its source is based on an evaluation of the characteristics of the retrieved memories. This means that the success of the attribution process is necessarily dependent upon the quality of the encoding process and the decision making process engaged in at retrieval. That is, anything that compromises the encoding process (e.g., stress, divided attention) will also lead to an attenuation in the quality of information that is later available to attribute the information to its source (Johnson et al., 1993). The effort and/or skill at the time of attribution may also affect the accuracy of the source judgement.

There are three distinctions of interest in source-monitoring: between internal and external sources, between two or more internally derived sources, or between two or more externally derived sources. Memories of externally experienced events are proposed to contain relatively more perceptual, affective, contextual, and semantic information than internally-generated (e.g., dreams, fantasies; Johnson et al., 1993) experiences. Thus, the decision of whether an event was externally or internally experienced should be relatively straightforward. However, the process of distinguishing between multiple externally experienced (or multiple internally experienced) events is not quite as simple. When multiple externally experienced events are encoded in memory, there may be little perceptual and other detail that distinguishes each experience from the others. Thus,

discriminating source after experiencing multiple similar experiences may be quite challenging as there are likely to be fewer cues that will discriminate one experience from another. In fact, a number of studies have demonstrated that it is more difficult to distinguish between memories for events that are similar than events that are dissimilar, and this difficulty may be magnified in young children (e.g., Lindsay, Johnson, & Kwon, 1991). The concern in the present work is on details that are highly similar across instances (and to suggested information that is presented), and thus, that is the focus in this discussion.

Source-monitoring theory has been used to explain part of the suggestibility effect as a misattribution of suggested information to an experienced event (e.g., Lindsay, 1990). When the memory for an experienced event is brought to mind during the presentation of suggested information (a biasing interview), there is an opportunity for suggested information to be misattributed to the experienced event during a subsequent retrieval (Roberts, 2002). In order for the experienced event to be brought to mind during a biasing interview, there must be a link between the experienced event and the suggestive information. That is, the listener should be aware of the experienced event during the biasing interview. The link between the biasing interview and experienced event may be particularly strong if the content of both is highly similar (see Lindsay, Allen, Chan, & Dahl, 2004). Connolly and Price (2006; see also Roberts & Powell, 2006) proposed that, relative to a single-event, repeated similar experiences with an event strengthens general event knowledge in memory. Thus, the sense of similarity or familiarity for details experienced in a particular instance of a repeated event is stronger than for comparable details of a single-event. Familiarity often leads to more shallow

processing of new, related information (e.g., Farrar & Goodman, 1992) which results in less context and source information being encoded. Thus, after a repeated event, the information that assists in discriminating between the experienced events and the suggested information is reduced. With less source information available at retrieval, source misattribution errors are more likely to occur. Therefore, presentation of suggestions that are highly similar to experienced details may be more likely to result in suggestibility after a repeated than single event.

A second mechanism that may be used to predict more source misattributions after repeated than single events takes place at retrieval. Source misattributions are more likely when the source judgement is made quickly and relatively effortlessly (Lindsay, 1994). These attributions are more common when information carries a strong sense of familiarity. For reasons described above, suggested details that are consistent with past experiences may feel more familiar after repeated than single events. Given that familiarity judgements are often less accurate than deliberate judgements (Lindsay, 1994), children who have experienced a repeat-event may be more suggestible than single-event children for suggestions that are consistent with previous experiences.

These theories and subsequent research suggest that children's memory for variable details of repeated events may be more malleable than their memory for comparable details of a single event under particular circumstances. However, we do not yet know the potential influence of stress on this complex interaction. It may be the case that the patterns currently being established in the repeated event literature also depend on the level of arousal experienced by an individual during the to-be-remembered event. Hypotheses about recall of stressful, repeated events are difficult to develop. On the one

hand, central details of an event are said to become more salient and so suggestibility may decrease when an event is stressful. On the other hand, variable details are generally less well-remembered when an event is repeated (as evinced by greater suggestibility and more errors) and this should lead to heightened suggestibility.

Goodman and colleagues conducted one of the rare studies examining children's memory for a repeated, stressful event compared to children's memory for the same single, stressful event (Goodman, Quas, Batterman-Faunce, Riddlesberger, & Kuhn, 1994; see also Goodman & Quas, 1997). Goodman et al. (1994) examined children's recall of an embarrassing and stressful medical experience, a voiding cystourethrogram (VCUG), which involves lying on a medical table, catheterization, filling of the child's bladder, and voiding, all while x-rays are taken. Some children experienced the VCUG for the first time and others had previously experienced a VCUG one or more times. These authors found that previous experience with the VCUG did not influence children's ability to recall the experience. Quas and colleagues (Quas et al., 1999) conducted a similar study and found a positive correlation between the number of VCUG's a child had previously experienced and the amount of correct information provided during a free recall task. Unfortunately, due to the number of participants in each of these studies, it was likely not possible to further discriminate between groups within the "repeated" group (i.e., children who had experienced two versus 10 VCUG's). An important limitation of these studies is that because VCUG's are highly similar across occurrences, many (perhaps even most) details will be fixed, which will enhance children's ability to report correct information (e.g., Connolly & Lindsay, 2001).

### *The Present Study*

The primary goal of the present research was to study children's memory for instances of repeated stressful and non-stressful events compared to a unique event. Although there are excellent studies of children's recall of naturally occurring repeated events and studies of stressful events, there has been no systematic study of variable details of repeated stressful events. The protocol developed and implemented in this study is an effective and ethical way to study memory for repeated stressful events. The basic event was either one or four private swimming lessons for beginners that, because of natural variation in children's fear of the water, were experienced as anxiety-provoking for some children and not anxiety-provoking for others. This event has been used to observe fear in children for other research purposes (i.e., phobias; Prins, 1986; Utlee, Griffioen, & Schellekens, 1982). Children were then read suggestive information by their parents and participated in a recall test. There are many different labels used when describing stressful experiences, each with its own connotations. As the most accurate representation of children's personal experiences in the present research, we describe the children as either "anxious" or "non-anxious."

## Method

### *Participants*

Ninety-six children aged 4 to 5 years ( $M = 58.35$  months,  $SD = 7.88$ ;  $n = 45$  males) were recruited from Vancouver area elementary schools, preschools, and daycares by distribution of information pamphlets and advertisement in local newspapers. Parents were requested to contact the lab if their child was afraid of the water or had little water experience and they were interested in participating in a study of memory for swimming lesson(s). Children received either one or four private (one-on-one, though other patrons were present in the pool) swimming lessons, free passes to the recreation facility, and a small prize. Children randomly assigned to the one-lesson condition were compensated with a certificate for an additional free swimming lesson. Children were primarily Caucasian (63%), with no other ethnic group representing more than 8.6% of participants (Asian). Age and gender distribution were equal in all conditions with the exception that children in the anxious condition were significantly younger ( $M = 56.18$ ,  $SD = 7.54$  months) than children in the non-anxious ( $M = 60.58$ ,  $SD = 7.68$  months) condition,  $F(1, 76) = 6.44$ ,  $p < .05$ ,  $\eta^2 = .08$ , although the size of the age difference was very small. Once children arrived at the swimming pool, no child withdrew from the study.

### *Materials*

*Water Experiences Questionnaire.* A screening questionnaire was developed to assess children's eligibility for the study, their level of experience with water, and to make an initial placement of children into an anxiety condition. Questions were adapted from previous research involving children's swimming lessons (Cox, Borger, & Enns, 1999) or were created for the current research (see Appendix A). To be eligible,



parents/caregivers must have indicated that their child had “some” to “no” water experience and had participated in two or fewer sets of swimming lessons in his/her lifetime.

*Individual Difference Measures.* Because it was anticipated that personality, behaviour, and temperament differences may influence children’s tendency to be fearful generally, and thus more likely to result in assignment to a particular anxiety condition, we also included two measures of individual differences.

Parents/caregivers were asked to complete the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997) to assess children’s social and emotional difficulties. The SDQ has five scales, each with five items: hyperactivity, emotional symptoms, conduct problems, peer problems, and prosocial behaviour (see Appendix B). The scale has been highly correlated with the well-established Rutter questionnaires (Elander & Rutter, 1996) for detection of emotional and behavioural disturbances (Goodman, 1997) and has demonstrated good agreement with behavioural observations (Hughes, White, Sharpen, & Dunn, 2000). Some terminology in the SDQ was slightly modified for consistency with Canadian language norms.

Parents also completed the Very Short Form of the Children’s Behavior Questionnaire (CBQ). The CBQ was designed for use with 3-7 year old children and is available in various lengths (36 to 195 statements). Due to the already extensive time commitment required of parents, the Very Short Form (36 statements) of the CBQ was selected (Putnam & Rothbart, 2003; Appendix C). Although the full-length form has demonstrated good internal consistency and reliability, there is no research yet on the validity and reliability of the Very Short Form of the CBQ. Parents/ caregivers responded

to each statement by providing a rating on a scale from 1 (extremely untrue of your child) to 7 (extremely true of your child). CBQ scores were summed to represent three broad measures of temperament (12 questions each): extraversion (surgency), negative affect, and effortful control.

*Anxiety Measures.* Stress or anxiety is usually measured by self-report (e.g., Christianson & Hübner, 1993), observer report (e.g., Alexander et al., 2002), and/or physiological measures (e.g., Bugental et al., 1992; Merritt et al., 1994). In this study, most accessible physiological measures (e.g., heart rate, blood pressure, skin conductance) were inappropriate because children engaged in physical activity during the lessons. Therefore, we relied on self and observer ratings to evaluate children's level of anxiety. Following the first or only lesson, parents/caregivers and instructors completed a scale of child anxiety that ranged from not at all anxious (1) to extremely anxious (9). An excerpt from the Koala Fear Questionnaire (Muris et al., 2003) which is designed for use with 4 to 12 year-old children, was also used, wherein children were retrospectively asked how they felt before and during the lesson by pointing to a diagram of one of three koala faces that exhibited varying levels of anxiety (see Appendix D).

An independent rater viewed the target lesson videotapes and coded the lessons for specific behaviours expected to be indicative of children's anxiety. First, the coder rated the child's level of apprehension prior to entering the water on a scale from 1 (not at all apprehensive) to 9 (extremely apprehensive) to assess the child's emotions. Next, for six different behaviours, the coder provided a simple frequency count and a global rating of overall presence (from 1-never to 5-often). Three behaviours were expected to be representative of children's comfort in the lesson: engagement behaviours (willingness to

initiate participation in activities), laughter/ broad smiling, and brave activities (going under water, splashing, putting face in water). The remaining three activities were expected to be indicative of discomfort or anxiety in the water: physical avoidance (cringing, moving away, turning away, closing eyes), clinging (to stable items such as wall, teacher, railing), and resistance/ refusal of activities. Finally, the coder rated the child's overall level of anxiety on the same 1 to 9 scale that parents and instructors used. Two coders, both senior graduate students who had previous training and experience in coding non-verbal behaviours, coded 10% of the videos and the remainder were coded by one coder. Interrater reliability ( $ICC_1$ ) between independent video coders for the general engagement ratings in each category ranged from "good" to "excellent" ( $>.75$ ; Cicchetti & Sparrow, 1981): .92 for apprehension, .77 for engagement, .82 for laughter, .88 for brave activities, .71 for avoidance, .80 for clinging, .84 for resistance, and .94 for anxiety.

Children were placed in one of two anxiety conditions: anxious or non-anxious. Initial placement was based on responses to the screening questionnaire (WEQ). As a result of "excellent" (.83; Cicchetti & Sparrow, 1981) interrater reliability ( $ICC_2$ ) between the instructor and independent rater evaluations of children's anxiety (on the 1 to 9 scale of anxiety) and the hands-on nature of the instructor-child interaction, we relied exclusively on instructor evaluations to determine children's final placement into an anxiety condition. Children's ratings of their own anxiety and parental ratings of children's anxiety were excluded from the determination of children's anxiety condition based on the limited range of children's own assessments (80% of children selected 'not at all anxious,' even if crying and refusing to get into the water) and a lack of attention to their child from many parents during the swimming lesson.

Children who received a rating of 1 ( $n = 26$ ) or 2 ( $n = 15$ ) out of 9 from their instructor were placed into the “non-anxious” condition, while children who received a 4 or above ( $n$ 's: 4 = 13; 5 = 9; 6 = 7; 7 = 4; 8 = 4; 9 = 3) were placed into the “anxious” condition. This resulted in removal from the study of 14 children who received a rating of 3 out of 9 on the anxiety scale. A further three children were excluded from the analyses: One because a disability prevented him from giving his attention to the lesson, and two others because they spent more than 50% of their time horizontally (i.e., eyes and/or ears were under the water and thus, attention was not on the instructor), when the lessons were designed as primarily vertical (for beginners). Thus, of the 98 children who participated fully in the study, 81 were included in the analyses. At random, half of the children in each anxiety condition as initially assessed (as determined by the WEQ because assignment to a frequency condition was made before the child's behaviour in the water could be observed) were assigned to experience one lesson, and half to experience four similar lessons prior to participating in a memory interview. After reassignment to the final anxiety condition, there were 25 non-anxious single-lesson children, 16 anxious single-lesson children, 18 non-anxious four-lesson children, and 22 anxious four-lesson children.

### *Design and Procedure*

This study was a 2 (Frequency: single, repeated) x 2 (Anxiety: anxious, non-anxious) x 2 (Detail: suggested, control) x 2 (Centrality: central, peripheral) mixed factorial design. Frequency and anxiety were between-subjects variables and detail and centrality were within-subjects variables. At the outset of the study, a third between-subjects variable was included in the design. Children were randomly assigned to a

“challenge” condition in which half of the children were to be highly challenged with the activities s/he experienced in the target event and half of the children were to be minimally challenged. This condition was included in order to exert some control over the level of anxiety children experienced. The activities in the high and low challenge conditions were the same, but involved varying levels of difficulty (e.g., jump off the wall into shallow or deeper water). However, based on observer impressions and instructor comments, this manipulation did not result in the desired variability in children’s experiences due to their own limitations in willingness and ability to engage in particular activities. That is, children who were comfortable in the water naturally engaged in activities to the highest level possible, while those who were not comfortable in the water did not respond to challenging instructions (instructors also reported feeling uncomfortable issuing such instructions). As a result, all analyses are conducted collapsed across the challenge conditions.

*Lessons.* The first lesson began with the introduction of the instructor and progressed through a scripted set of activities. The instructor was always one of five women qualified to teach swimming by the Red Cross. All sessions were conducted at Hyde Creek Recreation Centre in Port Coquitlam, British Columbia. In the repeat-event condition, the four lessons took place over the course of two weeks. All lessons involved eight activities always presented in the same order and each with one critical (to-be-remembered) central detail and one critical peripheral detail. Details are described below, with central details indicated with a “C” and peripheral details indicated with a “P.” Central details were defined as ones that were essential to complete the activity, while peripheral details were ones in the child’s environment that the child may interact with,

but were not essential to the completion of the activity. In the four-lessons condition, all 16 critical details varied between repeated lessons (i.e., the way the detail was experienced changed across lessons) and were brought to the attention of the children through repeated reference by the instructor. Where possible, items for each activity were linked thematically and were selected from the Price and Connolly (in press) category norms. The type and order of activities was the same each day. If children were unable to perform an activity, the instructor demonstrated the activity twice.

Children began the lesson with the instructor introducing herself and explaining that it was Flower Day. The instructor then pointed out her bathing cap colour (P - red, white, black, blue, or green) and the insect badge (P - ant, ladybug, spider, bee, or butterfly) she wore on her bathing suit. Next, the instructor discussed some safety issues around the pool (C - pool orientation, calling for help, personal floatation devices, safe water entries, or pool rules) and then led the child to the edge of the pool where they played a game to enter the water (C - tree game, crab walk, alligator crawl, Simon says, or speckled frogs) while a “friend” (P - shark, whale, duck, fish, or dolphin) floated in the pool. Once in the water, children warmed up by painting a part of their bodies (C - face, bum, legs, arm, or tummy) with water, while a lucky number floated in the pool (P - 2, 8, 7, 3, or 5). Children then played a game (C - motorboat, what time is it Mr. Shark?, hokey pokey, purple soup, or fishy in the middle) while wearing a special wrist band (P - Bugs Bunny, Tweety Bird, Daffy Duck, Scooby-Doo, or Spongebob). Children splashed their instructor to get her wet (C - with hands, squirty toy, sponges, kicking, or buckets) and then hunted for treasure at the bottom of the pool (C - ring, ball, dice, puck, or horseshoe) while their instructor played a musical instrument (P - guitar, tambourine, maraca,

cymbal, or drums). Children then moved through the water in a special way (C - running, back float, front float, creeping, or hopping) and finished with performing a trick in the water (C - spin, jump in, touch hands on bottom of pool, sit on bottom of pool, or blow bubbles). At the conclusion of the lesson children stood on a foam mat of a particular shape (P - triangle, square, circle, rectangle, or octagon) and received a small sticker of a fruit (P - orange, banana, grapes, pear, or watermelon). The order of activities was always the same but the order of presentation of options was partially counter-balanced (i.e., two random orders of options were created and half of the children received each order; see Table 1 for a sample order).

In an attempt to take into account the likely decline in anxiety over the course of the four lessons in the repeat-event group, the target instance was the first in the series of lessons. Focusing on recall of the first instance may also be most ecologically valid because some research suggests that the first instance in a series is often recalled the best (e.g., Hudson, 1990) and thus, children may be more likely to report a first instance when reporting an instance of repeated abuse. The target instance was the same for the single and repeat-event conditions. The target day was tagged by having the swimming instructor wear a special flower on her swim suit, so the instance could later be referred to as “Flower Day.” At the first (or only) lesson, parents received an information package including a demographics questionnaire, the Children’s Behavior Questionnaire and the Strengths and Difficulties Questionnaire which they were asked to return at the interview. Parents/caregivers were asked to refrain from taking their children swimming until the final interview had been conducted, but to keep a record if they did.

*Interview.* Following the lessons, children were read a story by their parents/caregivers that contained presentation of biasing information about the target lesson on three separate occasions: 1) two and a half weeks after the target lesson; 2) one week following the first reading; and again 3) one week following the second reading, two days before the final memory interview (see Appendix E for a sample biasing book). Reading dates were provided to parents on the back of the biasing book and parents were asked to record the actual dates the book was read. Parents/ caregivers were told that the information contained in the book may or may not have been experienced by their child, but that at least some of it was experienced (as per Poole & Lindsay, 1995, 2001). Children were simply told that they would be reading a book about a swimming lesson. The book contained a personal story about the child participating in a swimming lesson and used the child's name. Of the critical experienced details, half were misrepresented in the book (i.e., suggested) and half were control (suggested details are in bold in Appendix E). Each suggestive detail was presented three times in the story. This strategy of parental biasing has been used in previous research and was found to have a particularly strong suggestive effect (Poole & Lindsay, 1995, 2001).

Assignment of details as suggested/control was counterbalanced such that each detail served as a suggested detail for half of the children and a control detail for the other children. The suggestions were specific details the children did not experience during any lessons (e.g., "While they painted, Allison got to have a dolphin floating friend in the swimming pool with her."). Control details were discussed in the story similarly to suggested details, but they did not include any incorrect suggestive information (e.g.,



“While they painted, Allison got to have a floating friend in the swimming pool with her.”).

Two days following the final presentation of the biasing information, a female interviewer (blind to the child’s condition) conducted the memory test. To begin, the interviewer established rapport with the child. The interviewer then ensured that the child correctly identified the target lesson (Flower Day) and understood that all questions should be answered by considering that instance only. Interviews commenced with a set of scripted instructions (see Appendix F for a sample interview). The interviewer began with an explanation that a range of responses may be appropriate (e.g., “sometimes the right answer is ‘no,’” “it’s okay to say ‘I don’t know’”). The interviewer then instructed the child that even though s/he may be asked questions about the things s/he had already discussed, this was not an indication that the child’s previous response was incorrect. The interviewer then continued with identification of the target instance and the substantive portion of the interview.

For all children, the interview began with free recall, progressed to cued recall, and ended with recognition questions. Free recall consisted of an open-ended question requesting the child to describe everything s/he remembered about the target day. Three non-directive prompts were then used to assist the child in recalling more information in free recall (e.g., “Did anything else happen?”). Once the child appeared to have exhausted his/her ability to recall more information, the interviewer proceeded to ask one follow-up prompt for each detail mentioned by the child in free recall (e.g., “You said you played a game, can you tell me more about that?”). Then, the interviewer progressed to cued recall in which the child was asked a specific question regarding each of the

critical details (e.g., “On Flower Day you played a circle game. What circle game did you play?”). If the child did not provide an answer to a cued recall question, one prompt was asked. Next, for each critical detail, two recognition questions were asked: one regarding the experienced detail and the other about the suggested detail. The correct answer to one question was “yes” and the other one “no.” Two random orders of correct responses to recognition questions were created and half of participants received each order. The interview was audio recorded and videotaped. Children were told they were very helpful in helping the interviewer to understand what happened on Flower Day, were thanked for their participation, and were given a small prize.

## Coding

Audio recordings of final interviews were transcribed and each critical detail was coded as one of five responses:

- i) Correct response: correct critical detail.
- ii) False suggestion: reported detail was a suggested detail.
- iii) External intrusion error: a new detail that was not experienced or suggested.
- iv) Internal intrusion error: detail was experienced, but not in the target session.
- v) Other response: detail was indiscernible, off-topic or the child responded with silence or “I don’t know.”

Responses classified as “other” were not analyzed due to difficulty in identifying individual units of off-topic speech. Only critical details were coded. The reasons for coding only critical details were threefold. First, non-critical details were infrequently reported: Children reported an average of 1.47 specific non-critical details in free recall, of which 51.3% were theoretically verifiable with our videotapes of the target lesson (verifiable: “I walked into the water”, “I put my head under water”; not verifiable: “I heard tapping under water”, “I wore my bathing suit under my clothes”). There was an average of 0.74 verifiable non-critical details per child. Second, because only the target lesson was videotaped, it was not possible to corroborate children’s reports of non-critical details that may have occurred during one of the lessons, but not the target lesson (i.e., internal intrusions). This would have meant that it was possible to incorrectly attribute a detail as an incorrect response, when it may have occurred during a non-target lesson. That is, if a child reported that she put her head under the water, but this occurred in the second lesson, we could not accurately code this information. Finally, because our goal in

the videotaping of the target lesson was to be as unobtrusive as possible, there was often interference for short periods of time throughout the lesson which obstructed the camera view of the child in the pool. For example, it was not uncommon for an unsuspecting pool patron to stand between our camera and the child for a period of time, leaving us unable to see the child until we were able to reposition the camera. Therefore, even those non-critical details that were considered theoretically verifiable may have occurred, but we were unable to determine their occurrence conclusively. This means that we could have only been able to code correct details that occurred in the target lesson (with no comparison of inaccuracy), and only those correct details that were, by chance, visibly verifiable and also represented in our videos. Interview intercoder reliability was 85.3% based on 20% of the transcripts. All tests were two-tailed and alpha levels were set to .05.

## Results

### *Anxiety Conditions*

Recall that children were placed into anxiety conditions based on their instructors' rating of their anxiety. To further explore children's specific behaviours during the lesson, a more detailed coding of children's behaviour was also conducted by an independent video coder (with each of the below categories rated out of 5). Two children's videos were not codeable due to technical problems (though ratings of apprehension were possible). According to the independent video coder ratings, children in the anxious condition engaged in the following behaviours significantly more often than children in the non-anxious condition: avoidance behaviours ( $M = 3.63$ ,  $SD = 1.10$ ; and  $M = 2.00$ ,  $SD = 0.89$ , respectively),  $t(77) = 7.25$ ,  $\eta^2 = .40$ , clinging behaviours ( $M = 3.66$ ,  $SD = 1.32$ ; and  $M = 2.12$ ,  $SD = 1.23$ , respectively),  $t(77) = 5.36$ ,  $\eta^2 = .26$ , and resistance or refusal to engage in activities ( $M = 3.39$ ,  $SD = 0.75$ ; and  $M = 2.00$ ,  $SD = 0.74$ , respectively),  $t(77) = 8.28$ ,  $\eta^2 = .46$ . Anxious children were also significantly less likely than non-anxious children to engage in activities generally ( $M = 3.45$ ,  $SD = 0.80$ ; and  $M = 4.07$ ,  $SD = 0.82$ , respectively),  $t(77) = 3.44$ ,  $\eta^2 = .12$ , and to engage in brave activities throughout the lesson (e.g., go under water, jump into the pool;  $M = 2.16$ ,  $SD = 0.49$ ; and  $M = 3.63$ ,  $SD = 1.18$ , respectively),  $t(77) = 7.16$ ,  $\eta^2 = .46$ . Anxious children were rated as significantly more apprehensive (from 1-9) at the beginning of the lesson ( $M = 5.50$ ,  $SD = 2.33$ ) than non-anxious children ( $M = 2.78$ ,  $SD = 1.98$ ),  $t(79) = 5.66$ ,  $\eta^2 = .29$ .

Children who were afraid of the water may have been either fearful or timid generally, and/or have had previous negative experiences with water. First, to examine

whether or not anxious and non-anxious children differed on specific personality measures, we compared the scores on each of the dimensions of the Children's Behavior Questionnaire and the Strengths and Difficulties Questionnaire for each anxiety condition (see Tables 2 & 3). Anxious and non-anxious children did not differ significantly on any of the scales. Second, in the initial screening interview, parents were asked to indicate whether or not their child had previously gotten into trouble around the water to the extent that s/he required help. Most parents (72.8%) reported that their child had not gotten into trouble around the water before and reports of past water trouble were no more common among children in the anxious ( $n = 9$ ) than non-anxious conditions ( $n = 8$ ),  $\chi^2(1, n = 17) = 0.06$ .

#### *Interview Coding*

Each category of responses in free and cued recall (correct, suggestion, external intrusion, internal intrusion) and each response category in recognition (correct 'yes', incorrect 'yes') was analyzed with a 2 (Frequency: single, repeated) x 2 (Anxiety: high, low) x 2 (Detail: suggested, control) x 2 (Centrality: central, peripheral) ANOVA. The maximum possible number of correct responses was 16 (there were 16 critical details), suggested responses was 8, and there was no maximum number of internal or external intrusions due to the potential for multiple such responses to a single question. In the analyses of recognition responses, only children's correct and incorrect 'yes' responses were analyzed because also analyzing correct and incorrect 'no' responses would have been redundant. That is, a single question about an experienced detail can have only *either* a correct 'yes' or an incorrect 'no' response. Likewise, a question about a control or suggested detail can have only *either* an incorrect 'yes' or a correct 'no' response.

Therefore, only the most interesting response of each pairing (i.e., the 'yes' responses) was analyzed. Correct 'yes' responses represent children's affirmation of the presence of details that were experienced, clearly an interesting question when one is interested in what children are able to recall about an experience. Incorrect 'yes' responses are children's affirmations of details that were not experienced, but were only suggested to them. Such responses are of obvious interest, particularly when one is interested in the forensic implications of such research. Means and standard deviations for free, cued, and recognition responses for each response category are in Tables 4 through 9.

### *Correct Responses*

Children were reasonably able to report correct details after a one month delay. Fifty-two percent of children reported at least one correct detail in free recall, 95% reported at least one correct detail in cued recall (25% responded correctly to half or more of the cued recall questions), and in recognition all children responded correctly to at least four (of 32) questions and most children (62%) responded correctly to half or more of the recognition questions (one child responded correctly to 91% of the questions). Table 4 displays the descriptive information across conditions for children's responses in free and cued recall.

In free recall, there was a main effect of frequency,  $F(1, 77) = 12.05, \eta^2 = .14$ ; children who experienced one lesson reported more correct details ( $M = 1.28, SD = 1.47$ ) than children who experienced four lessons ( $M = 0.37, SD = 0.49$ ). There was a main effect of centrality,  $F(1, 77) = 8.38, \eta^2 = .10$ , that was qualified by a Detail x Centrality x Anxiety interaction,  $F(1, 77) = 3.60, \eta^2 = .05$ . To explore this interaction, we examined the simple Anxiety x Centrality interaction for suggested and control details separately.

For suggested details (both central and peripheral) and for control peripheral details there were no significant differences ( $p$ 's > .24). However, as can be seen in Figure 1, for control central details, non-anxious children reported more correct details ( $M = 0.22$ ,  $SD = 0.47$ ) than anxious children ( $M = 0.05$ ,  $SD = 0.22$ ),  $F(1, 80) = 4.21$ ,  $\eta^2 = .05$ .

In cued recall, there was a main effect of frequency,  $F(1, 77) = 42.90$ ,  $\eta^2 = .36$ ; children who experienced only one lesson reported more correct details ( $M = 6.49$ ,  $SD = 2.45$ ) than children who experienced four lessons ( $M = 2.89$ ,  $SD = 2.26$ ). There was a main effect of detail,  $F(1, 77) = 25.93$ ,  $\eta^2 = .25$ , and a main effect of centrality,  $F(1, 77) = 25.93$ ,  $\eta^2 = .25$ ; these were both qualified by a Detail x Centrality interaction,  $F(1, 77) = 8.96$ ,  $\eta^2 = .10$ . To explore this interaction, we examined the effect of details for central and peripheral details separately. For central details, children were equally likely to report suggested ( $M = 0.88$ ,  $SD = 0.87$ ) and control ( $M = 0.85$ ,  $SD = 1.06$ ) details,  $t(80) = 0.20$ . For peripheral details, children were significantly more likely to report correct information to control ( $M = 1.83$ ,  $SD = 1.44$ ) than suggested ( $M = 1.23$ ,  $SD = 1.19$ ) details,  $t(80) = 3.54$ . There was also a Frequency x Centrality interaction,  $F(1, 77) = 7.97$ ,  $\eta^2 = .09$ ; to explore this interaction, we examined the effect of frequency for central and peripheral details separately. Children in the single lesson condition were more likely than children in the repeated lesson condition to report correct central details,  $F(1, 79) = 10.53$ ,  $\eta^2 = .12$  ( $M = 2.23$ ,  $SD = 1.63$ ;  $M = 1.16$ ,  $SD = 1.31$ , respectively). The same pattern was observed for reports of correct peripheral details,  $F(1, 79) = 42.57$ ,  $\eta^2 = .35$ ; children in the single lesson condition reported more correct peripheral details ( $M = 4.26$ ,  $SD = 1.89$ ) than children in the repeated lesson condition ( $M = 1.74$ ,  $SD = 1.54$ , respectively). A t-test conducted on the difference scores for each of central and



peripheral details indicated that the difference between single- and repeated-lesson children's reports of correct details was larger for peripheral ( $M = 2.51$ ,  $SD = 2.34$ ) than central details ( $M = 1.14$ ,  $SD = 2.25$ ),  $t(42) = 2.90$ .

For children's correct 'yes' responses in recognition, the only significant effect was a Detail x Centrality interaction,  $F(1, 76) = 48.00$ ,  $\eta^2 = .39$  (see Table 5). To explore this interaction, we examined the effect of details for central and peripheral details separately. For central details, children responded with a correct 'yes' more often to suggested ( $M = 2.93$ ,  $SD = 1.32$ ) than control ( $M = 2.37$ ,  $SD = 1.22$ ) details,  $t(80) = 3.13$ . For peripheral details, the opposite pattern was observed, with children responding with a correct 'yes' more often to control ( $M = 3.15$ ,  $SD = 1.15$ ) than suggested ( $M = 2.23$ ,  $SD = 1.17$ ) details,  $t(80) = 6.36$ .

#### *Suggested Responses*

Thirty-eight percent of children reported a suggested detail in free recall, 78% in cued recall, and 98% of children responded with at least one incorrect 'yes' response in recognition. Table 6 displays the descriptive information for children's responses in free and cued recall.

In free recall, there was a main effect of centrality  $F(1, 77) = 5.27$ ,  $\eta^2 = .06$ ; children reported more suggestions to central ( $M = 0.42$ ,  $SD = 0.59$ ) than peripheral ( $M = 0.23$ ,  $SD = 0.51$ ) details. There was also a main effect of detail,  $F(1, 77) = 17.92$ ,  $\eta^2 = .19$ , that was qualified by a Detail x Anxiety interaction,  $F(1, 77) = 6.20$ ,  $\eta^2 = .08$ . To explore this interaction, we examined the difference between suggested and control details (i.e., the suggestibility effect) in each anxiety condition. As can be seen in Figure 2, non-anxious children evinced a significant suggestibility effect,  $t(40) = 4.55$ , by reporting

more suggestions to suggested ( $M = 0.71, SD = 0.93$ ) than control ( $M = 0.02, SD = 0.16$ ) details. Conversely, anxious children evinced no differences in suggestibility in their reports of suggested ( $M = 0.38, SD = 0.63$ ) and control ( $M = 0.20, SD = 0.52$ ) details,  $t(39) = 1.42, p = .16$ .

In cued recall, there was a main effect of detail,  $F(1, 77) = 59.48, \eta^2 = .44$ ; that was qualified by a Detail x Centrality interaction,  $F(1, 77) = 4.65, p = .05, \eta^2 = .06$ . To explore this interaction, we examined the effect of details for central and peripheral details separately. Both comparisons were statistically different [central,  $t(80) = 7.99$ ; peripheral,  $t(80) = 5.39$ ], and children reported more suggestions to suggested than control details for central (suggested,  $M = 1.15, SD = 1.10$ ; control,  $M = 0.10, SD = 0.30$ ) and peripheral (suggested,  $M = 0.93, SD = 1.05$ ; control,  $M = 0.21, SD = 0.49$ ) details. A t-test conducted on the detail (suggested/control) difference scores for each of central and peripheral details indicated that the difference between mean reports of suggested and control details was larger for central ( $M = 1.05, SD = 1.18$ ) than peripheral details ( $M = 0.72, SD = 1.20$ ),  $t(80) = 2.30$ .

For a child to report a suggested response in recognition, he or she would reply with an incorrect 'yes' to a question about a detail that was suggested to them (see Table 7). There was a main effect of detail,  $F(1, 77) = 49.00, \eta^2 = .39$ ; and a main effect of centrality,  $F(1, 77) = 73.69, \eta^2 = .49$ ; that were qualified by a Detail x Centrality interaction,  $F(1, 77) = 30.84, \eta^2 = .29$ . We explored this interaction by examining the effect of detail for central and peripheral details separately. For central details, there was a suggestibility effect,  $t(80) = 9.29$ , because children were more likely to respond to questions about suggested details ( $M = 3.06, SD = 1.25$ ) with an incorrect 'yes' than to

questions about control details ( $M = 1.69$ ,  $SD = 1.17$ ). For peripheral details, there was no difference in children's incorrect 'yes' responses to suggested ( $M = 1.68$ ,  $SD = 1.34$ ) and control ( $M = 1.47$ ,  $SD = 1.48$ ) details,  $t(80) = 1.43$ ,  $p = .16$ . There was a main effect of frequency,  $F(1, 77) = 7.55$ ,  $\eta^2 = .09$ ; that was qualified by a Frequency x Centrality interaction,  $F(1, 77) = 14.98$ ,  $\eta^2 = .16$  (Figure 3). To explore this interaction, we examined the effect of frequency for each of central and peripheral details. As can be seen in Figure 3, children in the repeat-lesson condition were more likely than children in the single-lesson condition to respond with an incorrect 'yes' to peripheral details ( $M = 4.21$ ,  $SD = 2.71$ ;  $M = 2.21$ ,  $SD = 1.87$ , respectively),  $F(1, 79) = 15.22$ ,  $\eta^2 = .16$ . There was no significant difference between frequency conditions in the reporting of incorrect 'yes' to central details,  $F(1, 79) = 7.88$ ,  $p = .17$ ,  $\eta^2 = .02$  (repeated,  $M = 5.08$ ,  $SD = 2.32$ ; single,  $M = 4.47$ ,  $SD = 1.70$ ).

#### *External Intrusion Errors*

Sixteen percent of children reported at least one external intrusion in free recall, and 78% did in cued recall. Recall that recognition questions were structured in such a way that we were only able to assess children's correct and incorrect responses, not reports of details that did not occur during the target event. Table 8 displays the descriptive information for children's external intrusion errors in free and cued recall.

In free recall, there were no significant effects. In cued recall, there was a marginally significant main effect of frequency,  $F(1, 77) = 3.59$ ,  $p = .06$ ,  $\eta^2 = .04$ ; children in the repeated lesson condition reported more external intrusions ( $M = 3.00$ ,  $SD = 2.93$ ) than children in the single lesson condition ( $M = 2.05$ ,  $SD = 2.22$ ). There was a main effect of detail,  $F(1, 77) = 11.84$ ,  $\eta^2 = .13$ ; children reported more external intrusion

errors to control ( $M = 1.52, SD = 1.70$ ) than suggested ( $M = 0.98, SD = 1.21$ ) details.

There was also a marginally significant main effect of centrality,  $F(1, 77) = 5.10, p = .06, \eta^2 = .06$ ; children reported more external intrusions to central ( $M = 1.44, SD = 1.53$ ) than peripheral ( $M = 1.05, SD = 1.14$ ) details.

#### *Internal Intrusion Errors*

Twenty-two percent of children reported at least one internal intrusion in free recall, and 57% did in cued recall. As with external intrusions, it is not possible to analyze recognition question responses for internal intrusions. Table 9 displays the descriptive information for children's internal intrusion errors in free and cued recall.

Although internal intrusions are only truly possible in the repeated lesson condition, the single lesson condition was included in these analyses as a measure of children 'guessing' (i.e., reporting by chance) the particular internal intrusions. This was particularly likely in the present study due to the strong categorical association between many of the critical details experienced across lessons (and heard in the biasing book). In free recall, there were no significant effects. In cued recall, there was a main effect of frequency,  $F(1, 77) = 49.88, \eta^2 = .39$ ; children in the repeated lesson condition reported more internal intrusions ( $M = 2.94, SD = 2.05$ ) than children in the single lesson condition ( $M = 0.44, SD = 1.01$ ). There was a main effect of centrality,  $F(1, 77) = 28.48, \eta^2 = .27$ ; children reported more internal intrusions to peripheral ( $M = 1.14, SD = 1.44$ ) than central ( $M = 0.48, SD = 0.82$ ) details. There was also a Frequency x Centrality interaction,  $F(1, 77) = 13.19, \eta^2 = .15$ . To explore this interaction, we examined the effect of frequency for central and peripheral details separately. Children in the repeated lesson condition were more likely ( $M = 0.89, SD = 0.92$ ) than children in the single lesson

condition ( $M = 0.12$ ,  $SD = 0.50$ ) to report internal intrusions to central details,  $F(1, 80) = 23.00$ ,  $\eta^2 = .23$ . This pattern was also observed for peripheral details; repeated-lesson children reported more internal intrusions ( $M = 2.05$ ,  $SD = 1.54$ ) than single-lesson children ( $M = 0.33$ ,  $SD = 0.64$ ),  $F(1, 80) = 45.13$ ,  $\eta^2 = .36$ . A t-test conducted on the difference scores for each of central and peripheral details indicated that the difference between single- and repeated-lesson children's reports of internal intrusions was larger for peripheral ( $M = 1.70$ ,  $SD = 1.64$ ) than central details ( $M = 0.84$ ,  $SD = 1.09$ ),  $t(42) = 3.27$ .

## Discussion

This study examined children's recall of an instance of a repeated versus single, stressful or non-stressful event. Children experienced one or four swimming lesson(s), in which half of the children were anxious and half of the children were non-anxious. Within each lesson, half of the experienced details were central and half were peripheral to the event, of which half of each were later incorrectly represented (suggested) to the children. Consistent with much previous research, anxiety-related differences in children's recall were uncommon and there was a clear disadvantage of repeated (versus single) events on recall. Both anxious and non-anxious children who experienced a single-event were more correct and less suggestible than children who experienced a repeated-event. These findings have implications for the generalizability of the current literature on children's memory for neutral or positive events to memory for stressful events and as well for generalizing research on memory for unique events to memory for repeated events.

### *Anxiety*

The present study evinced two significant effects of anxiety, each of which is indicative of a different influence of anxiety on recall. First, in free recall non-anxious children evinced a significant suggestibility effect whereas anxious children did not. As such, consistent with the findings of many scholars, anxiety may have had a strengthening effect on memory for a target event in that anxious children were less suggestible than non-anxious children (e.g., Goodman et al., 1991; Ridley et al., 2002; Shrimpton et al., 1998). Contrary to this explanation, in free recall, for central control details, non-anxious children reported more correct details than anxious children. This

finding indicates that for a very specific subset of information anxiety did not benefit recall and, in fact, appears to have had a deleterious impact on children's reports. A negative impact of anxiety on memory, too, is consistent with some previous literature (e.g., Bugental et al., 1992). It is important to note, though, that both effects of anxiety were present only in free recall, and were not found when retrieval cues were more specific, in cued recall and recognition questions.

Notwithstanding the differences discussed above, there were few differences in correct responses or reports of suggestions and no differences in internal and external intrusion errors between anxious and non-anxious children. This pattern of results indicates that the literature on children's memory for emotionally neutral or positive autobiographical events may indeed apply to children's memory for stressful events. This lack of differences between anxiety conditions is in keeping with some of the literature on children's memory for anxiety-provoking or stressful events (e.g., Ornstein et al., 1992; Pezdek & Taylor, 2002; Vandermaas et al., 1993). However, it is also inconsistent with research that has found an impact of anxiety on recall (e.g., Bahrack et al., 1998; Cahill & McGaugh, 1995; Davidson, Lou, & Burden, 2001). As previously discussed, these differences may well be due to varying definitions and measurements of stress. For instance, some researchers may classify stress as "high," while others may classify the same arousal level as "moderate." Such differences make cross-study comparisons extremely difficult. This problem may be compounded when measures of stress also vary. For example, as Peters (1997) reports, in Deffenbacher's (1983) review of 12 articles on adult memory and arousal, two included no measure of arousal, two included nonvalidated self-report measures, and eight included state (current) or trait (personality)

anxiety measures. As Fivush and Sales (2004) acknowledge, because different measures of stress often do not correlate well with one another, it is to be expected that anxiety or stress conditions resulting from these measures do not have a consistent impact on memory, if there is an effect of anxiety on memory at all. Unfortunately, attempts to discern a pattern among studies with common findings of either no impact, a positive impact, or a negative impact of arousal on memory have been unsuccessful (e.g., Peters, 1997).

We argue that the level of anxiety experienced by children in the current study is substantial enough to warrant comparison to some experiences about which children would be required to testify in court. However, given the few differences observed between anxiety conditions, it is important to address the possibility that the present study simply did not elicit anxiety differences sufficient to observe an effect or did not have sufficient power to detect a difference between anxiety conditions.

First, with respect to level of anxiety, there is evidence that children in our anxious condition differed behaviourally from children in our non-anxious condition. Although we did not code for the specific frequency of such behaviours, many of the anxious children cried and physically trembled. Anxious children were significantly more likely than non-anxious children to manifest other specific anxious behaviours (e.g., avoidance, clinging, resistance) such as refusal to leave the relatively secure locations in the pool (stairs, railing, poolside) to engage in activities. Conversely, the children rated as non-anxious were more likely to display positive emotive behaviours (e.g., engaging in brave activities that included spontaneously submersing themselves). In the present study, children were classified “anxious” or “non-anxious” as rated by their instructors ( $ICC_2 =$



.83). Children for whom anxiety level was more ambiguous (those who received a 3 out of 9) were not included in any analyses. This decision to exclude these children was a further attempt to maximize the chance of finding an anxiety difference between the two groups, if one existed. We believe that the level of anxiety (or stress) experienced by the “anxious” children in the present study is comparable to that found in many of the medical experience studies as well as to some children involved in forensic investigations. We had excellent intercoder agreement on ratings of these behaviours as well as on the global ratings of anxiety.

Second, we conducted an *a priori* power analysis to determine how many children would be required to reveal a main effect of anxiety, if it was present. A power analysis using the *fpower* macro for SAS (Friendly, 2006) indicated that in a 2x2 factorial ANOVA with alpha set at .05, a cell sample size of 16 would detect a main effect with a medium effect size. With a minimum of 16 children in each of our between-subjects cells, if there was a medium effect of anxiety, it is likely that we would have found it. It is arguable that if the effect size of the differences between the anxious and non-anxious conditions is small, it may not be substantial enough to change the conclusions that experts currently reach about children’s memory.

In sum, there was little evidence of an influence of anxiety on recall in the present study; the two effects of anxiety that were observed each indicated a different influence of anxiety on recall. The behavioural differences between anxious and non-anxious children, in combination with our sample size of 40 and 41 for each anxiety condition, leave us moderately comfortable concluding that the anxious children did not differ qualitatively in their recall of the target lesson from the non-anxious children.

### *Event Frequency*

The findings regarding event frequency are generally consistent with a large body of research that suggests that recall of an instance from a series of similar instances is difficult for children. Children who experienced a repeated event were less likely than children who experienced a single event to report correct information in free and cued recall, more likely to report incorrect information in cued recall (internal and external intrusion errors), and were more suggestible in response to recognition questions about peripheral details. That single-lesson children reported more correct information than repeated-lesson children was anticipated given much previous research that has found that a unique event is better recalled than an instance of a repeated event (e.g., Farrar & Goodman, 1992; Fivush, Hudson, & Nelson, 1984; Hudson, 1990).<sup>1</sup> This finding is also consistent with theoretical expectations of memory for a single, compared to a repeated event. Script theory, fuzzy-trace theory, and source-monitoring theory all predict difficulty in precise recall or source attribution of a particular instance when it is embedded among several other similar instances.

Although children who received four lessons were not as accurate as children who received one lesson, many errors reported by children in the repeated lesson condition were reports of details that had occurred, but not on the target day. This finding is consistent with the expectation of confusion between instances predicted by the findings in previous research on repeated events (e.g., Connolly & Price, 2006; Powell & Roberts,

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<sup>1</sup> As previously mentioned, there is one exception in the literature to this finding. When details remain constant across repeated experience (i.e., are fixed), the memorial advantage for single over repeated-events no longer holds. In fact, children who experience a repeated event recall more information about fixed details than children who experience the event once (Connolly & Lindsay, 2001). However, variable details (ones that vary across instances) are likely more forensically relevant given the likelihood that naturally-occurring events will contain details that vary between similar instances, and these are the subject of the present investigation.

2002; Powell et al., 1999; Price & Connolly, 2004; Roberts & Powell, 2006) and provides evidence that a substantial challenge faced by children in the repeated event condition is discriminating between experienced instances. This finding is interpretable with script theory because the relatively large number of internal intrusions reported is consistent with the expectation that children stored the variable details in list-format in memory. Then, when asked about a particular instance, children retrieved a detail in memory without knowing precisely the instance in which it occurred. Further, fuzzy trace theory posits that after repeated similar experiences, the gist trace for the general event will be relatively stronger than any of the individual verbatim traces. With a stronger gist than verbatim trace, it is likely that a retrieval cue would elicit recall of the gist trace, which increases the likelihood that any of the individual instance details would be recalled. According to source-monitoring theory, discriminating between the sources of multiple similar experiences can be especially challenging because there may be few perceptual, contextual and other detail *differences* stored in memory that will help to discriminate one experienced instance from another experienced instance.

The difficulty in discriminating between experienced events is different from erring by reporting external information (which repeated-lesson children also did more often than single-lesson children), because internal intrusions are essentially partially correct responses. The identification of which variable detail occurred during a particular instance is cognitively challenging and may be especially so for young children. The greater difficulty in discriminating highly similar events from less similar events has been empirically demonstrated (e.g., Lindsay et al., 1991) and may have contributed to children's reports of details from instances other than the target.

Finally, children who experienced repeated lessons were more likely than children who experienced a single lesson to report suggestions in recognition of peripheral details. As discussed in the introduction, increased suggestibility after experiencing repeated events compared to experiencing a unique event is consistent with expectations developed from script theory, fuzzy-trace theory, and source-monitoring theory, as well as with some previous research (Connolly & Lindsay, 2001; Connolly & Price, 2006; Powell & Roberts, 2002; Price & Connolly, 2004; but see Powell & Roberts, 2002; Powell et al., 1999), in that suggestions that are consistent with expectations developed from repeated experience are more likely to be accepted by repeat-event children than single-event children.

It is important to note, however, that there was only evidence of heightened suggestibility for repeat-lesson compared to single-lesson children in response to recognition questions about peripheral details, not in free or cued recall. Why might the present study have failed to find greater suggestibility in children who experienced a repeated event, compared to children who experienced a unique event in free and cued recall? There are at least two potential explanations.

The first explanation has to do with the specific design of the present study. Recall that the delay to memory test was four weeks from the target lesson for both the single- and repeated-lesson children. Because the delay from the target lesson to recall was held constant, the repeat-lesson children participated in lessons in the interim between the target lesson and recall, while single-lesson children did not. This resulted in more recent exposure to the experimental environment for the repeat- versus the single-lesson children which may have had one of two possible effects. The lessons experienced

in the interim by the repeat-lesson children could have interfered with memory of the target event. However, this would likely have resulted in an increase in suggestibility for the repeat-lesson compared to the single-lesson children. Alternatively, the more recent exposure could have enhanced the memory for the target lesson for repeat-lesson children because subsequent lessons may have acted as a retrieval cue and consequent rehearsal of the target event. Generally, more rehearsal results in better recall of a target event, which is usually attributed to stronger memory for the event (Hudson, 1990). According to the memory trace strength hypothesis (Pezdek & Roe, 1995), stronger memory for an event should lead to greater resistance to suggestions. If subsequent lessons acted as reminders of the target lesson, memory for the target lesson may have been strengthened, thereby decreasing suggestibility in the repeat-lesson condition relative to the single-lesson condition. Further, because the readings of the biasing book were consistently spaced in both frequency conditions, the delay from the final (or only) lesson to the first reading of the biasing book was two and a half weeks in the single-lesson condition, and only half a week in the repeated-lesson condition. This difference may have also served to increase the relative suggestibility of the single-lesson children, as the memory trace for the target lesson was not as fresh when they received the misinformation (Brainerd & Reyna, 1998; Melnyk & Bruck, 2004).

However, one of the primary reasons for including the lengthy delay to recall in the present study (four weeks) was to minimize any impact that this variable exposure may have had. That is, given that forgetting is expected to occur in a non-linear fashion with most forgetting occurring soon after the event (e.g., Rubin & Wenzel, 1996), we anticipated that the differential delays between the target lesson and the initial

presentation of the misinformation would be minimized with a delay of four weeks from the target lesson to the final memory test. If this was the case, children in the repeated lesson condition in the present study would have been more resistant to suggestions than children in the single lesson condition. Given that we often find a larger suggestibility effect in repeated-event children compared to single-event children (e.g., Connolly & Lindsay, 2001; Connolly & Price, 2006; Powell & Roberts, 2002; Price & Connolly, 2004; Roberts & Powell, 2006), the shorter delay for the repeated-lesson children in the present study may have reduced their suggestibility to the point that it was comparable to single-lesson children's suggestibility, at least in free and cued recall.

The second explanation has to do with the serial position of instances in a series and the influence of that position on recall. Generally, researchers find recall of first instances from a series superior to that of other instances in the series (e.g., Hudson, 1990; Powell, Thomson, & Ceci, 2003). Contrary to much of the previous children's repeated-event memory research which has focused on recall of the final instance in a series, and for reasons described above, children in the repeated lesson condition in the present study were asked to recall the first instance. This, too, may have resulted in stronger memory in the repeated-lesson condition than ordinarily observed in similar studies and, thus, in the lack of differences in suggestibility between the single and repeated lesson conditions in free and cued recall.

The finding of greater suggestibility for repeated-lesson children, compared to single-lesson children in recognition to peripheral details should not, however, be minimized. In fact, this pattern of suggestibility has previously been found in children's reports of single and repeated events (Powell & Roberts, 2002). Use of recognition

questions in eliciting reports of events has been criticized because of the respondent's potentially diminished cognitive demands and higher reliance on social cues (e.g., demand characteristics; Waterman, Blades, & Spencer, 2001). Open-ended and cued recall questions elicit more accurate information, compared to recognition questions which more often result in acquiescence, susceptibility to suggestion, and contradictory statements (e.g., Bruck & Ceci, 1999; Lamb & Fauchier, 2001; Orbach & Lamb, 2001; Ornstein et al., 1992; Roberts & Blades, 1998; Waterman et al., 2001). For children who have experienced a repeated event, the task of sifting through multiple experiences, rather than just one, is cognitively taxing. Due to the difficulty of the task, these children may be more likely to rely less on cognitive operations and more on social cues to assist with responding, and thus be more susceptible to demand characteristics.

Thus, it has been argued that recognition questions may be more likely to result in acquiescence to suggestions, particularly in children who have weaker memory for the target event. However, the nature of the suggestibility analysis in recognition allows for a comparison between the rate of incorrect 'yes' responses to suggested versus control details and these were significantly more likely to occur in response to suggested than control details (i.e., a main effect of detail). Thus, if it was a simple matter of a greater likelihood of responding to recognition questions with a 'yes', there should have been no difference in the 'yes' responses reported to suggested and control details. It may be the case that recognition questions are a more sensitive measure of memory because, particularly for young children, generation of details in free and cued recall can be challenging. Recognition questions may provide a way for children to affirm memory for details that are familiar to them without requiring active production. Among repeated-

lesson children there was some indication of weaker memory for target instance details (e.g., fewer correct responses, more errors) compared to children who received only one lesson. Therefore, repeated-lesson children may have been more likely to affirmatively respond to questions that contained the suggested detail because many different details were considered plausibly experienced (from lessons other than the target and from the biasing book).

In sum, the findings in the present study regarding the influence of event frequency on children's recall are consistent with much previous research and theory that predicts better recall of an event by children who experience only one instance compared to children who experience multiple similar instances. The children in this study somewhat surprisingly evinced a significant suggestibility effect in response to recognition questions (but see Powell & Roberts, 2002), but not in free and cued recall. However, upon closer examination of some particular design issues that may have served to enhance the suggestibility of children in the single-event relative to repeat-event children and/or increase resistance to suggestions among repeat-event children relative to children in the single-lesson condition (including frequency with which suggestions were presented, differential delays from target event to presentation of biasing material and to final recall, and serial position of the target event) this finding was explicable.

### *Centrality*

There are two important issues raised by the observed pattern of reporting central and peripheral details. First, there was a common finding of superiority in recall of peripheral over central details, which is inconsistent with the generally observed superiority of central over peripheral details. Second, there was no interaction between



anxiety and centrality, which is inconsistent with a substantial body of research indicating that central details are substantially better recalled than peripheral details under conditions of high anxiety. These two findings, though related, are distinct issues and will be addressed individually.

Although there is some evidence to the contrary (e.g., Heuer & Reisberg, 1990), based on Christianson (1992) and many others (e.g., Howe et al., 1996; Peterson & Bell, 1996; Peterson & Whalen, 2001), we expected that recall of central details would be superior to recall of peripheral details (i.e., more correct and fewer suggested responses to central details). However, we found primarily the opposite pattern of results. Children reported more suggestions, and more external intrusion errors to central than peripheral details. These findings suggest that children's memory for peripheral details was stronger than their memory for central details. There is at least one methodological decision that may help to explain the superiority of peripheral over central details in recall. Two critical peripheral details (instructor bathing cap colour and insect badge) were visible throughout the entire 25-minute lesson and thus, the allotted exposure time was greater than for the remaining 14 details (approximately 3-4 minutes each). Increased exposure time and the resulting improved memory for particular types of information is a well-known phenomenon (e.g., Jacoby & Dallas, 1981; von Hippel & Hawkins, 1994). To examine this possibility, these two details were removed from the free and cued recall data and analyses and the means of the peripheral details were weighted (i.e., multiplied each mean by 1.33) to allow for comparison with the unadjusted central detail means. The results did not differ, indicating that mere exposure time does not explain our finding. These two details were not required for successful completion of the lesson or

any activity within the lesson. Children were always in close physical contact with their instructors, so there was no pressing need to continually attend to the instructor's appearance. Despite these arguments, in retrospect it would have been much more helpful had the exposure time to all details been more carefully controlled.

The most parsimonious explanation for the finding of superior recall of peripheral over central details is that our definition of central and peripheral details may not have reflected what children perceived to be central and peripheral in this study. As with any study purporting to measure centrality, consideration of our specific definition, rather than the labels of 'central' and 'peripheral' may be more appropriate. Recall that in the present study, central details were defined as ones that were essential to complete the activity, while peripheral details were ones in the child's environment that the child may interact with, but were not essential to the completion of the activity. It may have been the case that our peripheral details (e.g., instructor clothing, items present at the lesson) were more salient or important to the children than anticipated. Perhaps none of the critical details in our study were goal-oriented or essential to the basic story line (see Burke, Heuer, & Reisberg, 1992; Heuer & Reisberg, 1990 for a like definition of centrality) in that attending to them did not ensure survival during the lesson or accomplish the goal of learning to swim and thus, there may be no true centrality distinction. A measure of eye-gaze or attention would have been one way to explore this, but in the present study this was not done.

To address the second issue, based on Christianson's (1992) conclusions we anticipated that we would, but did not, find an interaction between centrality and anxiety. We expected that anxious children's recall of central details would be greater than their

recall of peripheral details, and that this difference would be less prominent in the non-anxious children. Of course, if the definition of centrality in the present study did not reflect children's conception of what was central to the lesson, as discussed above, the lack of interactions is not surprising. However, other explanations must also be considered. Although unexpected, this is not incompatible with some other scholars who have argued against the 'narrowing of attention' hypothesis, instead arguing that arousal improves memory for a larger (i.e., more than just central details) range of details (e.g., Heuer & Reisberg, 1990). Laney, Heuer, and Reisberg (2003) suggest that the narrowing of attention observed in recall of emotionally arousing experiences may instead be unique to particular sources of arousal. Laney and colleagues (2003; see also Reisberg & Heuer, 2004) describe two different methods of inducing emotional arousal: thematic and visual. When a person experiences emotional arousal from thematic inducement, it is through a vested interest with the stimuli. Conversely, visually-induced arousal is a result of viewing disturbing images. Although overlap between the two methods of arousal induction is likely to occur, the basic difference lies in the event's meaning: either emotional or visual (Laney et al., 2003). Laney et al. argue that these two methods of arousal-induction will result in different allocations of attention to stimuli. When, for instance, gory pictures are presented, they visually draw the viewer in to the most central elements of the stimuli (the gore). Results from such studies support the Easterbrook (1959) hypothesis that emotionally arousing stimuli narrow attention, but this effect may not be a result of arousal itself, but rather because of the "visual prominence" of the gory stimuli. Conversely, thematic arousal is a result of involvement with, or meaning of, the target event. Thematic arousal should then lead to attention that is distributed throughout

the event as a whole, rather than a primary focus on the central elements of the event. Laney et al. (2003) concluded that the majority of research conducted on memory for emotional arousal focuses unjustifiably on visual arousal-induction, which may not generalize as well to a forensic setting. Laney, Campbell, Heuer, and Reisberg (2004; Study 1) examined participant's recall of thematically-induced emotionally arousing slides (depicting implied sexual assault with no direct visual display) and non-emotionally arousing slides (depicting a neutral dating event). They found that participants in the emotional condition were not disadvantaged in their recall of peripheral details; their recall of peripheral details was better than non-emotional participants' recall of peripheral details. The authors concluded that narrowing of attention during thematically-induced emotional events was not present and that arousal improved memory generally, not just for central details.

The present research did not have a primarily visually arousing element (though it may be argued that the mere sight of a swimming pool may cause arousal in some children) and thus, the classic 'narrowing of attention' may not apply. This distinction may help to explain why we did not observe a central/peripheral difference between anxiety conditions, but does not explain why there was a consistent main effect favouring recall of peripheral details. As a result of these challenges in determining centrality, the relevant findings in the present study should, as with much of the extant research, be carefully considered.

### *Suggestibility*

The suggestibility manipulation in the present study led to two particularly clear findings. First, our suggestibility manipulation was effective. Second, most of the

children in the present study (all but two) reported at least one suggestion in the recall interview, a concerning level of suggestibility.

First, children in the present study consistently reported more suggestions to suggested than control details and this occurred in both frequency conditions in free and cued recall and at both levels of anxiety in cued recall and recognition. As discussed above, in response to recognition questions repeated-lesson children reported more suggestions to suggested than control peripheral details, while this was not the case for single-lesson children. Also, in free recall, non-anxious, but not anxious, children reported more suggestions to suggested than control details.

With regards to the second issue, a large number of children reported suggestions in the present study: 37% of children reported a suggested detail in free recall, 78% in cued recall, and 98% of children incorrectly responded with a 'yes' to a suggested detail in recognition. There were only two children who did not report a single suggested detail. This high level of suggestibility may be largely attributable to the biasing technique that was used and has proven to be extremely effective in increasing children's reports of suggested details – parent-presented material. Poole and Lindsay (1995), whose biasing presentation method we replicated, also found a high level of suggestibility; 41% of children reported at least one suggested detail in free recall and 94% provided at least one inaccurate 'yes' in recognition questions. Further, Poole and Lindsay (2001) found that 35% of children reported suggestions when interviewed shortly after the target event, and 3-4 months later 21% of children reported a suggested detail in free recall. However, recall that the parents in the present study (as in Poole & Lindsay) did not directly tell

their children that they had experienced the details that were read to them, they simply read the book aloud.

As evinced in this study and as argued by Poole and Lindsay (1995), free recall may not be the inoculation against suggestibility it is often touted to be. Free recall is often noted as being limited in its effectiveness in eliciting a large enough volume of information (also evinced in the present study), but is generally perceived as a way to elicit accurate information (e.g., Yuille, Hunter, Joffe, & Zaparkiuik, 1993). Yet, in the present study, fully 38% of children (similar to the Poole and Lindsay studies) reported suggested details in free recall. These findings suggest that the focus must shift to determining whether or not children have previously been subjected to suggestive questioning as well as to strategies that prevent children from reporting non-experienced information (Poole & Lamb, 1998; see Poole & Lindsay, 2001, 2002 for efforts to this end on source-monitoring training).

Why else may there have been such a high suggestibility rate in the present study? The particular design in the current study was also conducive to a high rate of suggestibility. For example, the frequency with which the suggestions were presented was relatively high (for comparison see Connolly & Price, 2006; Powell & Roberts, 2002, where suggestions were presented three or fewer times). Here suggestions were presented to children three times in each book, which itself was presented three times to each child. This means that each child heard each suggestion a total of nine times. More frequent presentations of suggestions have been found to lead to higher rates of reporting suggestions (e.g., Melnyk & Bruck, 2004). Also, as touched on briefly above, the delay between the target lesson and the biasing presentation was long (two and a half weeks)

which allowed for decay of the original memory, thereby leaving the memory more susceptible to suggestion (see Gobbo, 2000). Conversely, the delay between the final presentation of the biasing information and the final memory test was short (two days), which may have meant that the biasing information was relatively more available in memory (Gobbo, 2000).

### *Forensic Implications*

When memory experts are called to testify in court, a criticism that may be levelled against them is that the research they cite is based on lab experiments that do not involve stressful events, while the experiences they propose to generalize to, do. To assist with understanding the validity of this concern, one of the primary objectives of the present study was to examine whether or not children's memory for an emotionally-arousing event differed substantially from children's memory for a neutral event. We found no evidence that this was the case. If replicated, this is a particularly important finding for the criminal justice system because our basic understanding of memory processes, well-established over many years of research, may then be used to predict and interpret the recall of those who provide testimony to the court.

Children who participate in the legal system have frequently been abused repeatedly (Connolly & Read, in press; Sas, Hurley, Hatch, Malla, & Dick, 1993). These children are often required by the legal system to recall a particular instance of abuse in order to mount a defensible case. This research indicates that this may be a very challenging request which may not elicit the best and most accurate information for children (see also McNichol, Shute, & Tucker, 1999). Children who experienced four lessons in the present study often erred by reporting internal intrusions - a detail that was

experienced, but on a non-target day. It is important to acknowledge that though these responses are often labelled and conceived of as 'incorrect,' this does not represent the accuracy of children's overall recall of 'lessons.' That is, s/he may simply have confused the instance in which the particular detail was experienced. It is also possible that across multiple interviews a child may respond to the same question with a different answer (see Peterson, Moores, & White, 2001), though both may have been experienced at some point across the repeated experiences. This type of reporting error has important implications for evaluating a child's credibility. If a child is seen as inconsistent in his/her reports due to the selection of different experienced details to report during different interviews, s/he may be unfairly evaluated as a low credibility witness.

Of considerable concern in the legal system is the presence of suggestive interviewing. Despite substantial theoretical attention (see Ceci & Bruck, 1993, 1998), and the popularization in newspapers, magazines and television shows on the topic, suggestive interviewing still happens. The research regarding the relative suggestibility of repeated-event versus unique event children remains largely inconsistent, but we are making headway into understanding the origin of some of the differences in the literature. At this time, a clear statement as to when children are most suggestible is not recommended. However, in the present study, as in Poole and Lindsay (1995, 2001), it is apparent that suggestions presented by parents/caregivers are particularly likely to be incorporated into children's reports. This is an unfortunate finding for the criminal justice system because if a first disclosure of sexual abuse is made to a parent, there is no way to control, or determine, the potentially suggestive nature of that interview.



### *Limitations*

Of course, there are a number of limitations to the present study. First, the levels of attained anxiety may not be comparable to that of some children in a forensic setting. However, as argued above, we believe that these findings could generalize to many children in such settings (see Rind, Tromovitch, & Bauserman, 1998). Second, our measure of anxiety was imperfect. Ideally, physiological measures of anxiety would have been implemented, as well as a more accurate self-assessment of anxiety by the children themselves. As explained previously, most accessible physiological measures were not possible due to the physical nature of the activity and we are currently exploring options for a more effective self-assessment tool for children. Third, children who received four lessons were presented with the biasing information nearer to their lesson experience than children in the single-lesson condition. Unfortunately, it was not logistically possible to have the first lesson as the target lesson, have a consistent delay from the target lesson to the memory interview, AND have a consistent delay from the target lesson to the initial presentation of the misinformation. Finally, because our initial determinations of children's anxiety (based on parent descriptions during an initial interview) were not always accurate, it was very difficult to ensure equal numbers of participants in each condition. The result was equal numbers of participants for tests of main effects, but an unbalanced design for testing of interactions.

## Conclusion

In conclusion, the present findings indicate that research on memory for non-emotional events may generalize to children's recall of negatively arousing or stressful experiences. The findings related to anxiety are consistent with a sizeable body of research that has found few or no differences when comparing children's recall of a stressful and non-stressful event. This research also highlights the importance of considering frequency of experience when interpreting children's testimony and when researching children's recall performance. Multiple experiences are the norm in criminal investigations (e.g., child sexual abuse; Connolly & Read, in press; Sas et al., 1993) and research into children's recall abilities must reflect this prevalence. Finally, this research takes an important step into the experimental study of the impact of stress on children's memory. We have developed a paradigm that, though intensive, can be used in future research to compare children's recall of stressful and non-stressful events. Understanding the impact of stress on children's memory is essential for interpreting children's testimonial capabilities and we must be more creative in experimental explorations of this important issue.

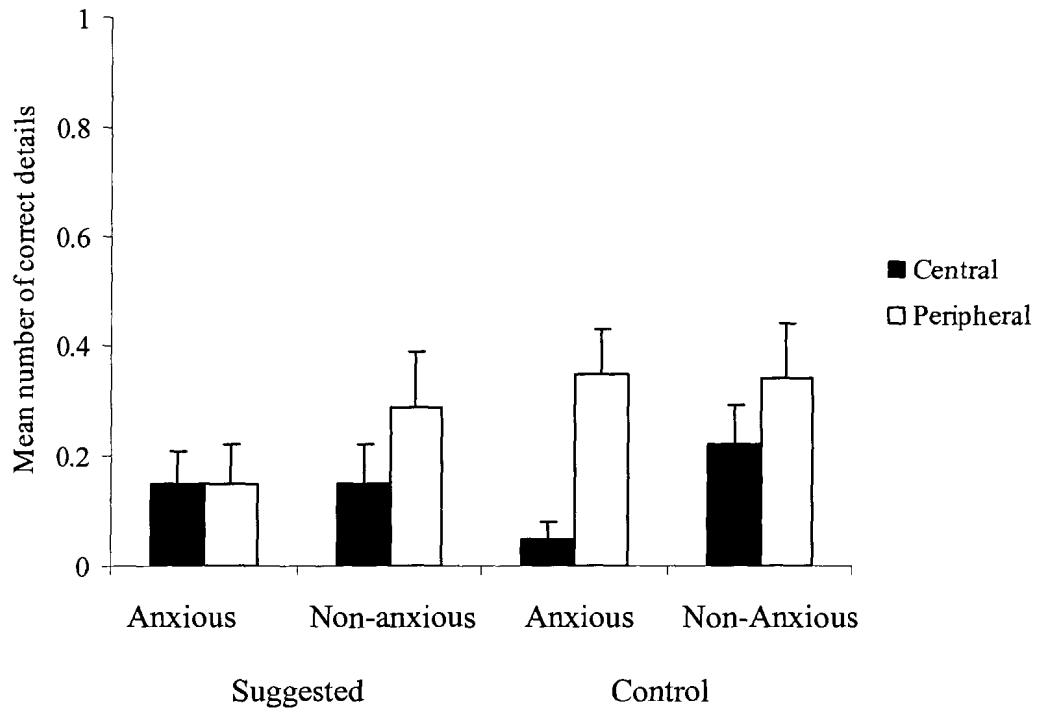


Figure 1.

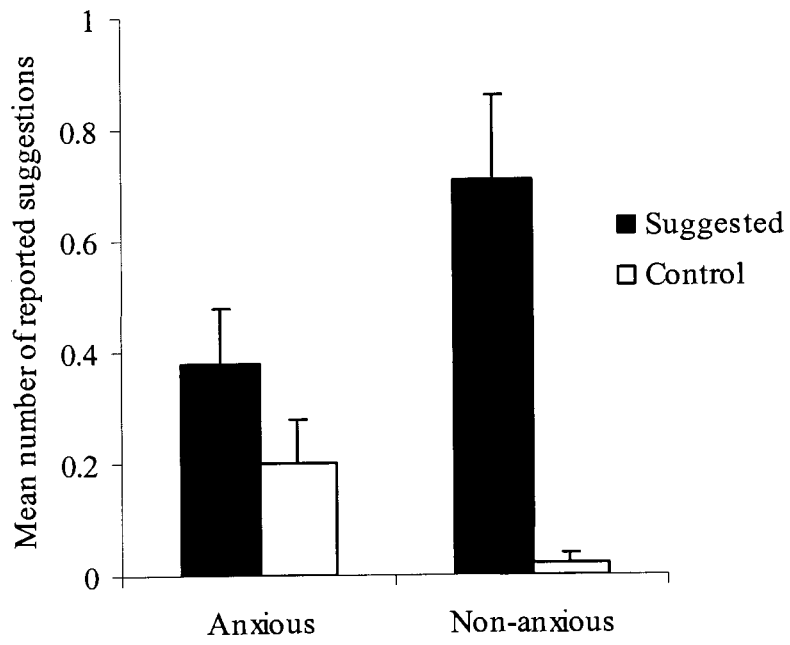


Figure 2.

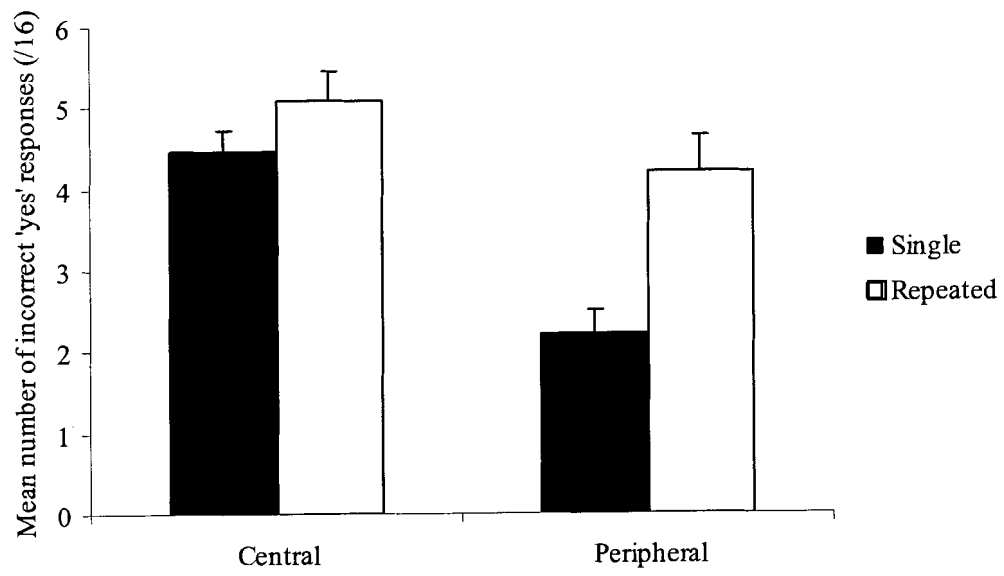


Figure 3.

Table 1.

## Sample set of experienced details

<i>Activity</i>	<i>Day 1</i>	<i>Day 2</i>	<i>Day 3</i>	<i>Day 4</i>	<i>Suggested</i>
<i>Safety</i>	Orientation	Call for help	PFD use	Safe entries	
<i>Bathing cap</i>	Red	White	Black	Blue	Green
<i>Picture</i>	Ant	Ladybug	Spider	Bee	
<i>Entry game</i>	Tree game	Crab walk	Alligator crawl	Simon says	Speckled frogs
<i>Float friend</i>	Shark	Whale	Ducky	Fishy	
<i>Paint body</i>	Face	Bum	Legs	Arms	Tummy
<i>Treasure</i>	Ring	Ball	Dice	Puck	
<i>Game</i>	Motorboat	Mr. Shark	Hokey pokey	Purple soup	
<i>Wrist band</i>	Bugs bunny	Tweety	Daffy duck	Scooby-doo	
<i>Get teacher wet</i>	Hands	Squirty frog	Sponge	Kicking	Bucket
<i>Lucky #</i>	2	8	7	3	5
<i>Music maker</i>	Guitar	Tambourine	Maraca	Cymbals	Drums
<i>Move in water</i>	Run	Float on back	Front float	Creep	
<i>Water trick</i>	Spin	Jump in water	Hand on bottom	Sit on bottom	Bubbles
<i>Foam mat</i>	Triangle	Octagon	Circle	Rectangle	Square
<i>Sticker</i>	Orange	Banana	Grapes	Pear	

Table 2.

Means (Standard Deviations) of children's scores on the CBQ (/7)

	Extraversion	Negative Affect	Effortful Control
Anxious	4.06 (0.92)	4.31 (1.02)	5.49 (0.73)
Non-Anxious	4.33 (0.93)	4.21 (0.84)	5.32 (0.72)
Repeat Event	4.14 (0.86)	4.31 (0.96)	5.23 (0.87)
Single Event	4.25 (0.99)	4.22 (0.92)	5.56 (0.56)
Overall	4.20 (0.93)	4.26 (0.93)	5.41 (0.73)

Table 3.

Means (Standard Deviations) of children's scores on the SDQ (/10)

	Hyperactivity	Emotional Problems	Conduct Problems	Peer Problems	Prosocial Behavior
Anxious	4.25 (1.32)	2.62 (1.91)	2.49 (1.14)	4.67 (1.06)	7.75 (1.93)
Non- Anxious	4.68 (1.40)	2.13 (2.00)	2.70 (1.40)	4.88 (1.24)	7.98 (1.59)
Repeat Event	4.38 (1.36)	2.89 (2.20)	2.46 (1.43)	4.78 (1.12)	7.65 (2.02)
Single Event	4.53 (1.39)	1.84 (1.59)	2.71 (1.13)	4.77 (1.19)	8.05 (1.51)
Overall	4.46 (1.37)	2.33 (1.95)	2.59 (1.28)	4.77 (1.15)	7.86 (1.76)



Table 4.

Means (Standard Deviations) of Correct Responses in Free and Cued Recall (/16)

			Free Recall	Cued Recall
Single Event	Suggested	Central	0.22 (0.43)	1.67 (1.04)
		Peripheral	0.28 (0.57)	1.72 (1.23)
Anxious	Control	Central	0.06 (0.24)	1.17 (1.15)
		Peripheral	0.56 (0.62)	2.33 (1.24)
Single Event	Suggested	Central	0.24 (0.60)	1.08 (0.91)
		Peripheral	0.44 (0.77)	2.04 (1.10)
Non-Anxious	Control	Central	0.28 (0.54)	1.08 (1.12)
		Peripheral	0.44 (0.71)	2.36 (1.70)
Repeat Event	Suggested	Central	0.09 (0.29)	0.55 (0.67)
		Peripheral	0.05 (0.21)	0.45 (0.67)
Anxious	Control	Central	0.05 (0.21)	0.41 (0.73)
		Peripheral	0.18 (0.39)	1.14 (1.08)
Repeat Event	Suggested	Central	0.00 (0.00)	0.69 (0.70)
		Peripheral	0.06 (0.25)	0.50 (0.82)
Non-Anxious	Control	Central	0.13 (0.34)	0.75 (1.13)
		Peripheral	0.19 (0.40)	1.44 (1.15)
Overall Means	Single Event		1.28 (1.47)	6.49 (2.45)
	Repeat Event		0.37 (0.49)	2.89 (2.26)
	Anxious		0.70 (0.97)	4.28 (2.97)
	Non-Anxious		1.00 (1.40)	5.32 (2.90)

Table 5.

Means (Standard Deviations) of Correct "Yes" Responses in Recognition (/16)

	Suggested	Central	2.78 (1.31)
Single Event		Peripheral	2.33 (1.14)
Anxious	Control	Central	2.67 (1.24)
		Peripheral	3.50 (0.62)
	Suggested	Central	2.88 (1.15)
Single Event		Peripheral	2.29 (1.00)
Non-Anxious	Control	Central	2.29 (0.91)
		Peripheral	3.00 (1.25)
	Suggested	Central	2.72 (1.39)
Repeat Event		Peripheral	1.91 (1.91)
Anxious	Control	Central	2.14 (1.39)
		Peripheral	3.05 (1.09)
	Suggested	Central	3.44 (1.50)
Repeat Event		Peripheral	2.44 (1.41)
Non-Anxious	Control	Central	2.44 (1.41)
		Peripheral	3.13 (1.50)
	Single Event		10.81 (2.51)
Overall Means	Repeat Event		10.50 (4.27)
	Anxious		10.48 (3.51)
	Non-Anxious		10.85 (3.40)

Table 6.

Means (Standard Deviations) of Suggested Responses in Free and Cued Recall (/8)

			Free Recall	Cued Recall
	Suggested	Central	0.33 (0.59)	1.33 (1.04)
Single Event		Peripheral	0.17 (0.38)	0.94 (1.11)
Anxious	Control	Central	0.11 (0.32)	0.17 (0.38)
		Peripheral	0.22 (0.43)	0.11 (0.32)
	Suggested	Central	0.52 (0.65)	1.12 (0.83)
Single Event		Peripheral	0.20 (0.41)	0.80 (1.04)
Non-Anxious	Control	Central	0.00 (0.00)	0.08 (0.28)
		Peripheral	0.00 (0.00)	0.12 (0.33)
	Suggested	Central	0.18 (0.39)	1.18 (1.34)
Repeat Event		Peripheral	0.09 (0.29)	1.09 (0.97)
Anxious	Control	Central	0.09 (0.29)	0.05 (0.21)
		Peripheral	0.00 (0.00)	0.36 (0.66)
	Suggested	Central	0.38 (0.62)	0.94 (1.24)
Repeat Event		Peripheral	0.20 (0.41)	0.88 (1.15)
Non-Anxious	Control	Central	0.00 (0.00)	0.13 (0.34)
		Peripheral	0.00 (0.00)	0.25 (0.58)
	Single Event		0.77 (0.87)	2.30 (1.70)
Overall Means	Repeat Event		0.53 (0.89)	2.47 (2.02)
	Anxious		0.58 (0.84)	2.63 (1.96)
	Non-anxious		0.73 (0.92)	2.15 (1.73)

Table 7.

Means (Standard Deviations) of Incorrect "Yes" Responses in Recognition (/8)

	Suggested	Central	3.28 (1.23)
Single Event		Peripheral	1.50 (1.29)
Anxious	Control	Central	1.78 (1.31)
		Peripheral	1.17 (1.20)
	Suggested	Central	2.76 (1.05)
Single Event		Peripheral	1.04 (1.02)
Non-Anxious	Control	Central	1.28 (0.85)
		Peripheral	0.84 (0.97)
	Suggested	Central	3.23 (1.31)
Repeat Event		Peripheral	2.18 (1.40)
Anxious	Control	Central	1.82 (1.18)
		Peripheral	1.95 (1.59)
	Suggested	Central	3.06 (1.48)
Repeat Event		Peripheral	2.19 (1.38)
Non-Anxious	Control	Central	2.06 (1.34)
		Peripheral	2.13 (1.86)
	Single Event		6.67 (3.18)
Overall Means	Repeat Event		9.29 (4.80)
	Anxious		8.53 (4.18)
	Non-Anxious		7.29 (4.19)

Table 8.

## Means (Standard Deviations) of External Intrusion Errors in Free and Cued Recall

			Free Recall	Cued Recall
Single Event	Suggested	Central	0.11 (0.32)	0.22 (0.43)
		Peripheral	0.61 (2.59)	0.22 (0.55)
Anxious	Control	Central	0.06 (0.24)	0.72 (0.83)
		Peripheral	0.17 (0.51)	0.39 (0.61)
Single Event	Suggested	Central	0.12 (0.33)	0.72 (0.74)
		Peripheral	0.00 (0.00)	0.32 (0.56)
Non-Anxious	Control	Central	0.04 (0.20)	0.84 (1.07)
		Peripheral	0.04 (0.20)	0.52 (0.92)
Repeat Event	Suggested	Central	0.00 (0.00)	0.50 (0.60)
		Peripheral	0.05 (0.21)	0.32 (0.48)
Anxious	Control	Central	0.05 (0.21)	1.00 (1.15)
		Peripheral	0.00 (0.00)	0.77 (1.07)
Repeat Event	Suggested	Central	0.00 (0.00)	0.88 (1.26)
		Peripheral	0.00 (0.00)	0.81 (0.75)
Non-Anxious	Control	Central	0.06 (0.25)	0.88 (0.81)
		Peripheral	0.00 (0.00)	1.00 (1.37)
Overall Means	Single Event		0.51 (1.74)	2.05 (2.22)
	Repeat Event		0.08 (0.27)	3.00 (2.93)
	Anxious		0.48 (1.80)	2.13 (2.09)
	Non-Anxious		0.15 (0.36)	2.85 (3.01)

Table 9.

## Means (Standard Deviations) of Internal Intrusion Errors in Free and Cued Recall

			Free Recall	Cued Recall
Single Event	Suggested	Central	0.22 (0.55)	0.06 (0.24)
		Peripheral	0.11 (0.47)	0.22 (0.55)
Anxious	Control	Central	0.11 (0.32)	0.17 (0.71)
		Peripheral	0.11 (0.32)	0.22 (0.55)
Single Event	Suggested	Central	0.12 (0.44)	0.00 (0.00)
		Peripheral	0.08 (0.28)	0.08 (0.28)
Non-Anxious	Control	Central	0.00 (0.00)	0.04 (0.20)
		Peripheral	0.04 (0.20)	0.16 (0.37)
Repeat Event	Suggested	Central	0.00 (0.00)	0.23 (0.43)
		Peripheral	0.05 (0.21)	0.82 (0.80)
Anxious	Control	Central	0.00 (0.00)	0.41 (0.50)
		Peripheral	0.14 (0.47)	1.23 (1.31)
Repeat Event	Suggested	Central	0.19 (0.40)	0.69 (0.95)
		Peripheral	0.06 (0.25)	0.94 (1.12)
Non-Anxious	Control	Central	0.19 (0.54)	0.56 (0.63)
		Peripheral	0.19 (0.54)	1.13 (0.89)
Overall Means	Single Event		0.37 (0.72)	0.44 (1.01)
	Repeat Event		0.37 (1.08)	2.95 (2.05)
	Anxious		0.35 (0.77)	1.78 (1.82)
	Non-Anxious		0.39 (1.02)	1.46 (2.20)

## Appendices

## Appendix A

### Water Experiences Questionnaire

1) Parent's Name: \_\_\_\_\_

2) Child's Name: \_\_\_\_\_

3) What is your child's age? \_\_\_\_\_

4) Is your child fluent in English? Yes  No

5) How would you describe the extent of your child's experience with bodies of water

(e.g., a

swimming pool, lake, etc.) using the following options?

A) No experience

B) Some Experience

C) Very Experienced

“Water” refers to larger bodies of water such as a swimming pool, lake, river, or ocean.

Activity in bathtubs should not be considered.

1) Has your child ever been in deep water (+1 metre)? Yes / No / DK

2) Can your child put his/her face in the water without undue fear? Yes / No / DK

3) Can your child blow bubbles in the water without undue fear? Yes / No / DK

4) Can your child walk through water without undue fear? Yes / No / DK

5) Does your child voluntarily splash when in the water? Yes / No / DK

6) On average, how often does your child spend time in the water?

\_\_\_\_ 3-5 times per week

\_\_\_\_ once per week

\_\_\_\_ once per month



\_\_\_ 5-10 times per year

\_\_\_ 1-5 times per year

\_\_\_ never

7) Has your child ever taken organized swimming lessons? Yes / No / DK

If YES, how many lessons? \_\_\_\_\_

If YES, when was your child's last completion of a lesson? \_\_\_\_\_

8) Is your child afraid of the water? Yes / No / DK

If YES, why do you think your child is afraid of the water?

9) Has your child ever gotten into difficulties in water and required help? Yes / No / DK

If YES, please describe the situation.

## Appendix B

### Strengths and Difficulties Questionnaire

For each item, please mark the box for Not True, Somewhat True, or Certainly True. It would help us if you answered all items as best you can even if you are not absolutely certain or the item seems odd. Please give your answers on the basis of the child's behaviour over the last 6 months.

	Not True	Somewhat True	Certainly True
1. Considerate of other people's feelings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Restless, overactive, cannot stay still for long	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Often complains of headaches, stomach-aches, or sickness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Shares readily with other children (treats, toys, pencils)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Often has temper tantrums or hot tempers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Rather solitary, tends to play alone	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Generally obedient, usually does what adults request	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Many worries, often seems worried	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Helpful if someone is hurt, upset or feeling ill	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Constantly fidgeting or squirming	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Has at least one good friend	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Often fights with other children or bullies them	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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13. Often unhappy, down-hearted or tearful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Generally liked by other children	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Easily distracted, concentration wanders	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Nervous or clingy in new situations, easily loses confidence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Kind to younger children	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Often lies or cheats	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. Picked on or bullied by other children	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. Often volunteers to help others (parents, teachers, other children)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. Thinks things out before acting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. Steals from home, school, or elsewhere	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23. Gets along better with adults than with other children	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. Many fears, easily scared	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. Sees tasks through to the end, good attention span	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

---

## Appendix C

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### Children's Behavior Questionnaire

Instructions: Please read carefully before starting:

On the next pages you will see a set of statements that describe children's reactions to a number of situations. We would like you to tell us what your child's reaction is likely to be in those situations. There are of course no "correct" ways of reacting; children differ widely in their reactions, and it is these differences we are trying to learn about. Please read each statement and decide whether it is a "true" or "untrue" description of your child's reaction within the past six months. Use the following scale to indicate how well a statement describes your child:

- | Circle # | If the statement is:                 |
|----------|--------------------------------------|
| 1        | extremely untrue of your child       |
| 2        | quite untrue of your child           |
| 3        | slightly untrue of your child        |
| 4        | neither true nor false of your child |
| 5        | slightly true of your child          |
| 6        | quite true of your child             |
| 7        | extremely true of your child         |

If you cannot answer one of the items because you have never seen the child in that situation, for example, if the statement is about the child's reaction to your singing and

you have never sung to your child, then circle NA (not applicable).

Please be sure to circle a number or NA for every item.

1. Seems always in a big hurry to get from one place to another.  
1      2      3      4      5      6      7      NA
2. Gets quite frustrated when prevented from doing something s/he wants to do.  
1      2      3      4      5      6      7      NA
3. When drawing or coloring in a book, shows strong concentration.  
1      2      3      4      5      6      7      NA
4. Likes going down high slides or other adventurous activities.  
1      2      3      4      5      6      7      NA
5. Is quite upset by a little cut or bruise.  
1      2      3      4      5      6      7      NA
6. Prepares for trips and outings by planning things s/he will need.  
1      2      3      4      5      6      7      NA
7. Often rushes into new situations.  
1      2      3      4      5      6      7      NA
8. Tends to become sad if the family's plans don't work out.  
1      2      3      4      5      6      7      NA
9. Likes being sung to.  
1      2      3      4      5      6      7      NA
10. Seems to be at ease with almost any person.  
1      2      3      4      5      6      7      NA
11. Is afraid of burglars or the "boogie man."

- |     |   |   |   |   |   |   |   |    |
|-----|---|---|---|---|---|---|---|----|
|     | 1   | 2 | 3 | 4 | 5 | 6 | 7 | NA |
| 12. | Notices it when parents are wearing new clothing.   |   |   |   |   |   |   |    |
|     | 1   | 2 | 3 | 4 | 5 | 6 | 7 | NA |
| 13. | Prefers quiet activities to active games.   |   |   |   |   |   |   |    |
|     | 1   | 2 | 3 | 4 | 5 | 6 | 7 | NA |
| 14. | When angry about something, s/he tends to stay upset for ten minutes or longer.                                       |   |   |   |   |   |   |    |
|     | 1   | 2 | 3 | 4 | 5 | 6 | 7 | NA |
| 15. | When building or putting something together, becomes very involved in what s/he is doing, and works for long periods. |   |   |   |   |   |   |    |
|     | 1   | 2 | 3 | 4 | 5 | 6 | 7 | NA |
| 16. | Likes to go high and fast when pushed on a swing.   |   |   |   |   |   |   |    |
|     | 1   | 2 | 3 | 4 | 5 | 6 | 7 | NA |
| 17. | Seems to feel depressed when unable to accomplish some task.  |   |   |   |   |   |   |    |
|     | 1   | 2 | 3 | 4 | 5 | 6 | 7 | NA |
| 18. | Is good at following instructions.  |   |   |   |   |   |   |    |
|     | 1   | 2 | 3 | 4 | 5 | 6 | 7 | NA |
| 19. | Takes a long time in approaching new situations.  |   |   |   |   |   |   |    |
|     | 1   | 2 | 3 | 4 | 5 | 6 | 7 | NA |
| 20. | Hardly ever complains when ill with a cold.   |   |   |   |   |   |   |    |
|     | 1   | 2 | 3 | 4 | 5 | 6 | 7 | NA |
| 21. | Likes the sound of words, such as nursery rhymes.   |   |   |   |   |   |   |    |
|     | 1   | 2 | 3 | 4 | 5 | 6 | 7 | NA |
| 22. | Is sometimes shy even around people s/he has known a long time.   |   |   |   |   |   |   |    |

- |     |   |   |   |   |   |   |   |    |
|-----|---|---|---|---|---|---|---|----|
|     | 1   | 2 | 3 | 4 | 5 | 6 | 7 | NA |
| 23. | Is very difficult to soothe when s/he has become upset.                       |   |   |   |   |   |   |    |
|     | 1   | 2 | 3 | 4 | 5 | 6 | 7 | NA |
| 24. | Is quickly aware of some new item in the living room.                         |   |   |   |   |   |   |    |
|     | 1   | 2 | 3 | 4 | 5 | 6 | 7 | NA |
| 25. | Is full of energy, even in the evening.                                       |   |   |   |   |   |   |    |
|     | 1   | 2 | 3 | 4 | 5 | 6 | 7 | NA |
| 26. | Is not afraid of the dark.  |   |   |   |   |   |   |    |
|     | 1   | 2 | 3 | 4 | 5 | 6 | 7 | NA |
| 27. | Sometimes becomes absorbed in a picture book and looks at it for a long time. |   |   |   |   |   |   |    |
|     | 1   | 2 | 3 | 4 | 5 | 6 | 7 | NA |
| 28. | Likes rough and rowdy games.  |   |   |   |   |   |   |    |
|     | 1   | 2 | 3 | 4 | 5 | 6 | 7 | NA |
| 29. | Is not very upset at minor cuts or bruises.                                   |   |   |   |   |   |   |    |
|     | 1   | 2 | 3 | 4 | 5 | 6 | 7 | NA |
| 30. | Approaches places s/he has been told are dangerous slowly and cautiously.     |   |   |   |   |   |   |    |
|     | 1   | 2 | 3 | 4 | 5 | 6 | 7 | NA |
| 31. | Is slow and unhurried in deciding what to do next.                            |   |   |   |   |   |   |    |
|     | 1   | 2 | 3 | 4 | 5 | 6 | 7 | NA |
| 32. | Gets angry when s/he can't find something s/he wants to play with.            |   |   |   |   |   |   |    |
|     | 1   | 2 | 3 | 4 | 5 | 6 | 7 | NA |
| 33. | Enjoys gentle rhythmic activities such as rocking or swaying.                 |   |   |   |   |   |   |    |
|     | 1   | 2 | 3 | 4 | 5 | 6 | 7 | NA |

34. Sometimes turns away shyly from new acquaintances.

1      2      3      4      5      6      7      NA

35. Becomes upset when loved relatives or friends are getting ready to leave following a visit.

1      2      3      4      5      6      7      NA

36. Comments when a parent has changed his/her appearance.

1      2      3      4      5      6      7      NA

Please check back to make sure you have completed all items by marking a number or "NA".



Appendix D

Excerpt from the Koala Fear Questionnaire (Muris et al., 2003)



## Appendix E

### Sample Biasing Book (suggestions in bold)

Today Allison is going to visit the swimming pool. The swimming pool is a bright place full of toys and games for children. Allison put on her coat when it was time to go. They got in the car and drove to a parking lot next to a building. The building had grass and some trees around it. Allison was a little scared at first, but it was a friendly place inside. Allison went into the changing room to get ready for her lesson. She put her bathing suit on and walked out onto the swimming pool deck. Allison waited beside the swimming pool until it was her turn to go swimming.

Allison's teacher, Nicole, met Allison by the swimming pool. First, they talked about swimming. Allison's teacher, Nicole, was wearing a **blue** bathing cap and a picture around her neck. The **blue** bathing cap with the picture looked really bright near the water. Nicole would be easy to find with her **blue** bathing cap on and her picture around her neck.

Allison's teacher, Nicole, took Allison to the side of the swimming pool. Allison and Nicole played **the speckled frog game to get into the water**. Nicole said to Allison, "**Squat down just like a speckled frog.**" Allison **squatted like a speckled frog beside the pool and Nicole helped her hop into the water**. To play the game, Allison and her teacher, Nicole, got all wet with water.

Next, Allison and Nicole painted themselves with water. **They painted neat designs on their tummies**. While they painted, Allison got to have a floating friend in the swimming pool with her. The floating friend floated around Allison while she and Nicole **painted their tummies**. **They had to wash the paint off of their tummies**

**before it dried.** Allison had fun painting and washing it off, with their floating friend watching.

Then, Nicole and Allison decided to throw a **ladybug** on the bottom of the pool. **Ladybugs** are not supposed to be in swimming pools, but Nicole thought it would be neat to be able to look down at the **ladybug** on the bottom of the pool. Nicole and Allison played a game. They held hands and played. When it was time to end the game, Nicole and Allison finished by getting all wet. It was a big splash.

Now it was time for Allison to get Nicole more wet. Allison put on a badge and got ready to get Nicole all wet by **splashing her with a bucket**. The badge helped Allison splash **with her bucket**. The badge made her a fierce splasher **with her bucket**.

Then, Nicole asked Allison, “Do you want to go on a treasure hunt?” Allison thought that sounded like it would be fun. Nicole threw something onto the bottom of the pool for Allison to get. Allison reached down as far as she could to get the thing from the bottom of the pool.

After that game, Nicole said it was time to have a race. First, they listened to the **drum** music that was playing to get ready for the moving through the water race. The **drum** music helped them get ready for the race. She wanted Allison to move through the water as fast as she could. They both moved very fast through the water while listening to the **drum** music.

The last thing that Allison and Nicole did in the water was some **blowing bubbles** water tricks. Allison and Nicole practiced **blowing bubbles** around in the water to show how far they could go. They were **blowing really big bubbles** and then it was time to get out of the water.

Allison got out of the pool and stood on a plastic mat that was shaped like a **square**. While Allison stood on the **square**, she got a sticker for doing such a good job in the lesson. She looked at the sticker and smiled. It was time to leave the plastic **square** mat, and, with her sticker, get ready to go home. Allison went back into the changing room and got dressed in her dry clothes.

## Appendix F

### Sample Final Interview

#### Free Recall

*Ask the child to tell you everything he/she can remember about the Flower Day. Non-contingent (i.e., not related to a particular detail reported) feedback is good here. Very non-specific prompts like “can you think of anything else that happened during the swimming lesson on Flower Day?” Write down all the details that the child reports.*

*When the child appears to have exhausted his/her memory based on the very open-ended prompts, list each of the details(one at a time) that the child mentioned in response to the first questions and ask for more information about each detail.*

#### Cued Recall

Now I have some specific questions for you. Remember, I want you to think about Flower Day when you went swimming at the pool. Think as hard as you can about that time and answer these questions based on what you remember about that time only. It is OK to say “I don’t know” if I ask you a question and you can’t remember what happened. I have to ask you all of these questions, I even have to ask you questions about things you might have told me about earlier. If I do that, it does not mean that your earlier answer was wrong. It is just that I have to ask all of these questions.

- 1) Before you started swimming on Flower Day, you and your teacher talked about some things. What did you talk about?
- 2) On Flower Day, what colour was your teacher’s bathing suit?
- 3) On Flower Day, your teacher wore a special picture around her neck. What was on the picture?

- 4) On Flower Day, you played a game to get into the water. What was the game?
- 5) On Flower Day you had a floating friend in the pool with you. Who was your floating friend?
- 6) You also painted a part of your body with water on Flower Day. What part of your body did you paint?
- 7) Before you played a game, you and your teacher threw something to the bottom of the pool. What did you throw to the bottom of the pool?
- 8) You played a game on Flower Day. What game did you play?
- 9) You wore a badge on Flower Day. What was the picture on the badge?
- 10) You got your teacher all wet by splashing her. What did you splash her with?
- 11) You did a treasure hunt on Flower Day. What did you hunt for?
- 12) There was music playing during your Flower Day. What was the instrument that was playing?
- 13) You moved through the water in a special way on Flower Day. How did you move through the water?
- 14) You did a neat trick in the water on Flower Day. What trick did you do?
- 15) When you got out of the swimming pool when your lesson was over, you stood on a foam mat. What shape was the mat?
- 16) You got a sticker at the end of the lesson. Where did your teacher put the sticker?

#### Recognition

- |    |  |   |   |    |
|----|--|---|---|----|
| 1. | Did your teacher wear a red bathing suit on Flower Day?  | Y | N | DK |
| 2. | Did your teacher wear a blue bathing suit on Flower Day? | Y | N | DK |

- |     |   |   |   |    |
|-----|---|---|---|----|
| 3.  | Did your teacher wear a picture of a starfish around her neck on Flower Day?                | Y | N | DK |
| 4.  | Did your teacher wear a picture of a guppy around her neck on Flower Day?                   | Y | N | DK |
| 5.  | Did you do a pool orientation with your teacher before you got into the pool on Flower Day? | Y | N | DK |
| 6.  | Did you talk about pool rules with your teacher before you got into the pool on Flower Day? | Y | N | DK |
| 7.  | Did you play the tree game to get into the water on Flower Day?                             | Y | N | DK |
| 8.  | Did you play the speckled frog game to get into the water on Flower Day?                    | Y | N | DK |
| 9.  | Did you have a floating Bugs Bunny in the pool with you on Flower Day?                      | Y | N | DK |
| 10. | Did you have a floating Tweety in the pool with you on Flower Day?                          | Y | N | DK |
| 11. | Did you paint your face with water on Flower Day?   | Y | N | DK |
| 12. | Did you paint your tummy with water on Flower Day?  | Y | N | DK |
| 13. | Did you and your teacher throw an ant on the bottom of the pool on Flower Day?              | Y | N | DK |
| 14. | Did you and your teacher throw a ladybug on the bottom of the pool on Flower Day?           | Y | N | DK |
| 15. | Did you play the game Motorboat on Flower Day?  | Y | N | DK |
| 16. | Did you play the game Fishy in the Middle on Flower Day?                                    | Y | N | DK |

- |     |  |   |   |    |
|-----|--|---|---|----|
| 17. | Did you wear a badge with a picture of a tiger on it on Flower Day?          | Y | N | DK |
| 18. | Did you wear a badge with a picture of a lion on it on Flower Day?           | Y | N | DK |
| 19. | Did you get your teacher wet by splashing her with your hands on Flower Day? | Y | N | DK |
| 20. | Did you get your teacher wet by splashing her with a bucket on Flower Day?   | Y | N | DK |
| 21. | Did you do a treasure hunt for a ring on Flower Day?                         | Y | N | DK |
| 22. | Did you do a treasure hunt for a car on Flower Day?                          | Y | N | DK |
| 23. | Did you listen to a guitar play music on Flower Day?                         | Y | N | DK |
| 24. | Did you listen to a drum play music on Flower Day?                           | Y | N | DK |
| 25. | Did you move through the water by walking on Flower Day?                     | Y | N | DK |
| 26. | Did you move through the water by hopping on Flower Day?                     | Y | N | DK |
| 27. | Did you do a water trick by spinning on Flower Day?                          | Y | N | DK |
| 28. | Did you do a water trick by blowing bubbles on Flower Day?                   | Y | N | DK |
| 29. | Did you stand on a plastic mat shaped like a triangle on Flower Day?         | Y | N | DK |
| 30. | Did you stand on a plastic mat shaped like a square on Flower Day?           | Y | N | DK |
| 31. | Did you get a sticker put on your leg at the end of the lesson?              | Y | N | DK |
| 32. | Did you get a sticker put on your arm at the end of the lesson?              | Y | N | DK |



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