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Children's recall of emotionally arousing, repeated events: A review and call for further investigation

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ABSTRACT

The influence, if any, of emotional arousal on memory is a controversial topic in the literature. Much of the research on memory for emotionally arousing events has focused on a few specific issues (e.g., differences in types of details recalled in emotionally arousing and neutral events; increasing ecological validity). Although gaining more recent attention, a neglected area in the literature has been memory for instances of repeated, emotionally arousing events. This issue has important implications for understanding children's ability to recall events in a forensic setting. We review existing findings on memory for emotionally arousing events in general and particularly in children, children's memory for events that occur repeatedly, and then discuss the scarce research on repeated emotionally arousing events and the need for further research in this area. We conclude that although it is clear that children are capable of accurately reporting arousing and repeated experiences, it is also apparent that circumstances both within and outside the control of investigative interviewers influence this ability.

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1. Introduction

The influence, if any, of emotional arousal on memory is a controversial issue in the psychological literature. Before discussing the extant research, it is important to clarify the terminology used in this article. Much of the recent research has used the term "emotional arousal," although many terms including stress, negative emotionality, emotional stress, trauma, anxiety, cognitive anxiety, and fear have often been used interchangeably. In this review, we use the term emotional arousal and review articles that use all terminology variously labelled relating to *negative* emotional arousal.

If memory for emotionally arousing 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 emotionally arousing events. Conversely, if the differences are quantitative (Pezdek & Taylor, 2002; Porter & Birt, 2001), existing theories may be useful for understanding memory for emotional events. This is important to study for both theoretical and practical reasons. Theoretically, it speaks to fundamental characteristics of memory for real-world events. Its practical importance is varied. For instance, when a question of memory arises in court, an expert witness may be called to testify. Currently, much of the work that forms the basis of knowledge about memory has been conducted on neutral events, whereas many events under discussion in court were emotionally arousing. This is a limitation that may be raised by opposing counsel. Although research on memory for emotionally arousing events is rapidly expanding (see Cordon, Pipe, Sayfan, Melinder, & Goodman, 2004; Deffenbacher, Bornstein, Penrod, & McGorty, 2004 for recent reviews), there are still many questions about the generalizability of much of the experimental research on memory for emotionally arousing events. One area of particular interest concerns child witnesses. Children often testify in court as victims, and the offences children describe are frequently of an emotionally arousing nature and may be

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personally threatening (e.g., Quas et al., 2005). Psychological research may be used to evaluate what children may be reasonably expected to report.

In this review, we are particularly interested in research concerning emotionally arousing events that threaten children's personal safety. We believe these types of events are ones that children are most likely to encounter in criminal offences (e.g., sexual or physical abuse, witnessing domestic violence). Understanding memory for emotionally arousing, personally threatening events is an important step towards protecting children's right to a legal remedy. For instance, such research may lead to the development of interviewing techniques that will improve the quality of children's memory reports and reduce the trauma associated with their involvement in the legal system. Indeed, many scholars have called for further scientific investigation into this issue (e.g., Christianson, 1992; Fivush, 2002; Goodman & Quas, 1997; Pezdek & Taylor, 2002).

Much of the research on memory for emotionally arousing events has focused on two specific issues; potential differences in memory for variably emotionally arousing events, and efforts to increase the ecological validity of stimuli and/or experimental paradigms. Although gaining attention, a neglected area of study is memory for instances of repeated emotionally arousing events. Does memory for repeated emotionally arousing events differ from that of single emotionally arousing events or from single and repeated neutral events? Much of what is experienced in life is repeated and, in particular, children who testify in court as victims of abuse often are victims of repeated abuse (e.g., Connolly & Read, 2006; Sas & Cunningham, 1995). In Canadian criminal law and many other international justice systems, a criminal charge must be specific enough for the accused to raise a defence (R. v. B. (G.), 1990). This may require a complainant who has witnessed or experienced a repeated offence to provide details of a specific instance or instances of that offence. It is reasonable to anticipate that abusive incidents are emotionally arousing for a victim (see Rind, Tromovitch, & Bauserman, 1998 for a discussion of retrospective accounts of abuse) and thus, memory for repeated emotional events is of obvious forensic relevance. In this article, we review the existing findings on memory for emotionally arousing events in general and particularly in children, we discuss children's memory for events that occur repeatedly, and then we review the scarce research on repeated emotionally arousing events and the need for further research in this area.

2. Emotional arousal and memory in adults

2.1. Theoretical background

Although some research on the impact of emotional arousal on memory supports the contention that arousal enhances memory (e.g., Cahill & McGaugh, 1995; Goodman, Hirschman, Hepps, & Rudy, 1991; Porter & Birt, 2001; Yuille & Cutshall, 1986; Yuille, Davies, Gibling, Marxsen, & Porter, 1994), other studies report a negative impact of emotional arousal on memory (e.g., Bugental, Blue, Cortez, Fleck, & Rodriguez, 1992; Byrne, Hyman, & Scott, 2001; Dutton & Carroll, 2001) or even a "catastrophic drop in memory performance at high levels of cognitive anxiety and physiological activation" (Deffenbacher et al., 2004, p. 689). Indeed, the authors of two of the most comprehensive reviews of research on memory for emotionally arousing events (Christianson, 1992; Deffenbacher et al., 2004) appear to disagree about both the direction of and explanation for differences in memory for emotionally arousing and neutral events. Christianson (1992) concluded that certain elements of emotionally arousing events are better remembered and less susceptible to forgetting than neutral events. Specifically, for recall of emotionally arousing events, details central to the event are particularly well-remembered when compared to details more peripheral to the event. This effect may be the result of a narrowing of attention, what has been referred to as 'tunnel memory' (e.g., Safer, Christianson, Autry, & Österlund, 1998). This is consistent with Easterbrook's (1959) cue-utilization hypothesis that physiological arousal narrows attentional resources to central details of stimuli at the expense of attention to peripheral details.

In a 2004 meta-analysis, Deffenbacher et al. concluded that high levels of emotional arousal impair recall in many domains including facial identification, responses to directive questioning, and overall recall (although this latter effect was only found in adults, not children). The authors surmised that arousal can have a positive influence on memory, but only until it reaches a certain peak point, after which the impact of stress on memory is disastrous. Deffenbacher et al. critiqued the conclusions drawn in Christianson's (1992) review paper by arguing that Christianson's review was based largely on studies that elicited only a moderate level of arousal.

In some very unique field work, there are indications that recall of emotionally arousing events may not remain consistent over time. Southwick and colleagues (Southwick, Morgan, Nicolaou, & Charney, 1997) examined combat veterans' memories of Operation Desert Storm one month and again two years after their return. At the second interview, the vast majority (88%) of veterans changed at least one response from the first interview. Further, Roemer and colleagues (Roemer, Litz, Orsillo, Ehlich, & Friedman, 1998) interviewed Somalia peace-keeping soldiers about their exposure to war-zone stressors within one year of the experiences and again one to three years after their return. Over time, the soldiers' reports of the frequency of exposure to stressors increased. These studies indicate that, although emotionally arousing events may be recalled accurately, they may also be malleable.

2.2. Paradigmatic issues

Some research on memory for emotional arousing events in adults involves experimental manipulations, such as when participants view a video or a set of slides or pictures which contain disturbing images and then are asked to recall the experience (e.g., Burke, Heuer, & Reisberg, 1992; Heuer & Reisberg, 1990). Other research has explored memory for naturally occurring non-experimental traumatic events, such as witnessing a real crime (e.g., Christianson & Hübinette, 1993; Wagenaar & Groeneweg,

1990; Yuille & Cutshall, 1986; Yuille & Tollestrup, 1992). These two types of research often result in discrepant findings. Generally, real-world and naturalistic studies find that emotionally arousing events are well-remembered, while laboratory studies tend to find a more complex relationship between emotional arousal and memory. Of course, there are limitations to both types of studies.

A significant problem with laboratory-based studies is that they do not engage the high level of emotional arousal that can be observed in field studies. Recall Deffenbacher et al.'s (2004) argument that Christianson's conclusion of emotional arousal's enhancing effect on memory was a result of relatively low arousal across the reviewed research. Deffenbacher et al. claimed that this effect is only found when arousal is below a particularly high point. In experimental studies, the very high levels of emotional arousal required to achieve what Deffenbacher et al. (2004) referred to as a "catastrophic drop" in memory performance have not been induced (for obvious ethical reasons) and this may explain the discrepant conclusions between field and laboratory research. It is notable that, to date, field studies have often found that high levels of arousal result in reasonably accurate and complete recall of a target event.

There are, of course, problems with field studies as well. A major challenge for field studies is that it is not possible to investigate causal relations. That is, there is no true comparison group, no experimental control over the experience, no manipulation of variables of interest, no random assignment to groups, and often no knowledge of base truth. One limited exception to this is a unique study by Morgan et al. (2004) who compared eyewitness identifications of military personnel who endured extremely stressful interrogations as part of training in a mock prisoner of war camp. Morgan et al. found that highly stressed (compared to lower stress) military personnel were remarkably inaccurate in their identifications of their interrogators with whom they had had close contact for over 30 min. However, given that only eyewitness identifications were examined, the applicability to the present review of research on memory for event details is limited. Person identification accuracy may indeed differ significantly from accuracy of recall of event details depending upon, for example, the relative attention paid to the person and event. It is important to note that even within particular types of event details (e.g., central or peripheral to the event), and with different modes of questioning, such differences in recall are to be expected.[1]

2.2.1. Summary

A number of research paradigms have been used to study memory for emotionally arousing events. There are substantial advantages and limitations to each paradigm, which has left us with an incomplete answer to the question of the differences, if any, between recall of emotionally arousing and neutral events.

3. Emotional arousal and memory in children

Ecologically valid research on children's memory for emotionally arousing events is even more difficult to conduct than comparable research with adults. That is, ethically exposing children to events that are stressful, yet considered to be "within the range of normal experience" is more challenging than it is with adults. Thus, research on children's memory has largely been based on recall of neutral or positive experiences (e.g., Hudson, 1990). Although valuable and necessary in many ways, such events lack some important real-life qualities of emotionally arousing events such as personal threat and physical discomfort (Fivush, 2002; Yuille & Tollestrup, 1992). There are, however, some recent and important exceptions.

3.1. Memory for medical procedures

An important advance in research on children's recall of emotionally arousing events was the move towards studying children's memory for medical experiences (e.g., Goodman et al., 1991). As naturally occurring events that contain such characteristics as personal touch and/or physical discomfort, medical procedures can be an ideal way to examine children's memory for emotionally arousing events that may generalize to a forensic context. Researchers have explored children's recall of routine physical examinations (Baker-Ward, Gordon, Ornstein, Larus, & Clubb, 1993) including examinations involving genital touch (Saywitz, Goodman, Nicholas, & Moan, 1991), inoculations (Goodman et al., 1991), visits to the emergency room (Peterson & Bell, 1996), and the dentist (Vandermass, Hess, & Baker-Ward, 1993), and invasive, painful, and frightening medical procedures such as the voiding cystourethrogram (VCUG; Brown et al., 1999; Goodman & Quas, 1997; Merritt, Ornstein, & Spicker, 1994; Quas et al., 1999; Salmon, Price, & Pereira, 2002). In this latter procedure, children's bladders are filled with a liquid and they are required to void on a table while an X-ray is taken. Using medical paradigms, it is often possible to determine precisely what occurred during the experience and children's recall can be compared with an objective record.

Unfortunately, beyond a finding that children's memory can be generally quite accurate for emotionally arousing events, even after long delays (Peterson & Whalen, 2001; Pezdek & Taylor, 2002), no other clear pattern of findings has materialized from the medical procedures research (see Fivush, 2002). For example, with the VCUG studies, positive influences of emotional arousal on recall have been reported (e.g., Brown et al., 1999), as have negative influences (e.g., Brown et al., 1999; Merritt et al., 1994; Salmon et al., 2002), with more inconsistent than consistent effects of emotional arousal observed. In one example of a medical experiences study, Quas et al. (1999) found that in response to open-ended questions children aged 3–13 years who had experienced more fear during and after a VCUG reported less information than children who experienced less fear. Conversely, in response to more direct questions, children who were more upset during and after the VCUG recalled more correct information, reported fewer "don't

[1] A thorough discussion of the influences of types of event details and types of particular questions on recall are beyond the scope of the present review. However, interested readers are referred to Christianson (1992) and Waterman, Blades, and Spencer (2001).

know" responses, and were less suggestible than children who were less upset. The authors proposed that the source of the difference was motivational rather than memorial. That is, children who were more emotionally aroused by the procedure may have been less willing to discuss their experience spontaneously but were willing to report information in response to direct questions. The finding that children are generally quite accurate in their recall of such events is critically important, but further work that describes the complexity of memory for emotionally arousing events is crucial; for instance, exploring conditions that influence reporting errors, and that more clearly delineate the influence of different measures of arousal (e.g., physiological versus behavioural; see Quas & Lench, 2007, for recent efforts to this end).

3.2. Memory for disaster

Another useful way to study children's recall of extremely emotionally arousing events is to explore memory for natural disasters. In one highly cited study of 3- to 4-year old children's recall of an arousing event, Bahrick, Parker, Fivush, and Levitt (1998) examined children's recall of Hurricane Andrew (a major hurricane that caused extensive property damage). Children were divided into three stress-level conditions: low, moderate, and high based on exposure to the storm as measured by degree of damage to their home. Consistent with the Yerkes–Dodson theory, a subsequent interview revealed that children who were moderately stressed remembered the most information, while those who experienced high and low levels of stress recalled significantly less. Overall, most children were able to report a surprisingly large number of details soon after the event (Bahrick et al., 1998) and after a very long delay of 6 years (Fivush, Sales, Goldberg, Bahrick, & Parker, 2004).

3.3. Forensic case studies

In most cases of sexual abuse, base truth is unavailable for comparison with a child's testimony, and so assessing the accuracy and completeness of a child's report is difficult. However, there are a few unique and informative case studies in which researchers have been able to obtain at least partial base truth of what occurred during a child's traumatic experience. Jones and Krugman (1986) examined the testimony of a three year-old girl who was 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 the perpetrator, his vehicle, and the activities engaged in. She maintained her story through multiple interviews and identifications of the suspect, including rejecting line-ups in which the suspect 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. About half (50.8%) of the details reported by the young girl were corroborated on audiotape and only 7% of the details that the authors determined could have been verified from the audiotape were not. Similarly, Bidrose and Goodman (2000) studied the detailed testimonies of four young girls (aged 8, 13, 14, and 15 years) and corroborating photographic (623 photographs) and audiotape (77 tapes) evidence of their involvement as victims of a 'sex ring' of adult males. The authors found audio or photographic support for 85% of sexual allegations made by the girls, and found that the majority of errors were omissions rather than commissions.

Despite this body of research that shows impressive memory for traumatic events, we cannot draw conclusions about the similarity or dissimilarity of memory for emotionally arousing and neutral events. First, in many extant studies, children did not report details of a comparable neutral event. Even in those studies where a direct comparison is made, there are methodological limitations. Most notably, in such studies the neutral and emotional events are different and so a direct comparison between the two is not possible. For example, Lindberg, Jones, McComas Collard, and Thomas (2001) compared 5-year old children's recall of receiving an inoculation with children's memory for watching a video of a child receiving an inoculation. Of course, the degree of participation in the event varied which may impact the memorability (e.g., Rudy & Goodman, 1991; Tobey & Goodman, 1992; but see Pipe & Wilson, 1994 for the contrary conclusion that participation does not influence memory). To directly compare memory for emotionally arousing and neutral events we must test memory for the same event that is experienced as neutral to some children and emotionally arousing to others. Such a direct comparison is essential for determining the effect of emotional arousal on memory (Christianson, 1992; Fivush, 2002; Pezdek & Taylor, 2002). Until such a body of research exists, conclusions about memory for emotionally arousing events based on non-arousing experimental research should be, as they have been, carefully qualified.

3.4. Experimental research

An approach often taken in the adult memory literature has been to expose participants to emotionally laden material and compare the resulting memory to that for emotionally neutral material. This research is more difficult to conduct with children because the ethical leeway is far narrower. For instance, showing young children photographs of violent and disturbing images is likely to cause them more emotional distress than showing adults the same images. Moreover, the fact that children are a dependent and particularly vulnerable population precludes these procedures. However, there are ways in which children's memory for emotional material has been examined experimentally. For example, Davidson, Luo, and Burden (2001) presented children aged 6–11 years with stories containing high-emotional (e.g., a child drops a carton of eggs and her mother is mad; resulting in more emotion) and low-emotional information (e.g., a child drops an apple and her mother is mad; resulting in less emotion) and found that high-emotion stories were recalled more accurately than low-emotion stories. In another study, Ridley, Clifford, and Keogh (2002) showed children aged 9–10 years a video of a minor car accident and found that children who became

more emotionally aroused while viewing the video were less likely to accept false information about the video than children less emotionally aroused. In a third study, Quas and Lench (2007) showed 5- to 6-year old children a frightening video clip of three boys narrowly escaping being hit by a train (from the movie *Stand By Me*) and found that increased physiological arousal at encoding was related to children's correct recall in response to direct questions. All of these studies found that arousal was related to stronger memory. However, once again it is important to note that the level of emotion depicted in the stories and videos was not high. Because the relationship between emotion and memory may be non-linear, the relevance to recall of more intensely arousing events is unknown.

The only experimental manipulation we were able to locate of emotionally arousing versus non-emotionally arousing events in which children actively participated was conducted by Peters (1991, 1997). Children aged 6–9 years were told that they were participating in tests of "physical characteristics and skills" during a visit to the university. During the testing, either an unexpected fire alarm or a loud radio sounded (Peters, 1997; Study 1). The arousal level (as measured by blood pressure, pulse, and performance on a card-sorting task) was significantly higher in the fire alarm than the radio condition. In response to recognition questions, children in the fire alarm group performed more poorly than children in the no-fire alarm group, although both groups performed moderately well (73% and 83% of the questions were answered correctly, respectively). Group differences were substantial when responses to suggestive questions were examined: The least accurate group was the fire alarm group who had been questioned suggestively. Thus, in contrast to much of the above-reviewed research, arousal had a negative impact on children's recognition and suggestibility.

Peters (1997) replicated these findings with a similar study (Peters, 1997, Study 2; see also Peters, 1991), but added a delay condition, wherein half of participants were interviewed immediately and half were interviewed at a 6-week delay. The delay resulted in a general increase in suggestibility to false information and decrease in overall performance, but did not interact with children's level of arousal. This finding contrasts with some research that has suggested that children's memory for arousing events improves over time (e.g., Goodman et al., 1991). Importantly, although Peters' work on children's memory for surprising fire alarms is unique and exercises clean experimental control over the experience, it still lacks many elements that are present in some types of events that bring children to the justice system (e.g., betrayal, personal touch, extremely high levels of stress; Fivush, 2002; Yuille & Tollestrup, 1992).

3.5. Suggestibility

Across both field and experimental studies, children's suggestibility has been of substantial interest, particularly given the forensic implications. However, the findings regarding the influence of emotional arousal on children's suggestibility has been just as inconsistent as other memory measures. For instance, Bruck and Melnyk (2004) recently reported that across 15 studies examining the influence of emotional arousal on children's suggestibility, only half exhibited a significant relationship. Of those studies in which a directional effect was identifiable, half evinced a negative relationship between arousal and suggestibility and half evinced a positive relationship.

3.5.1. Summary

Creative research conducted on children's memory for medical experiences, natural disasters, and forensic case studies all indicate that children's recall can be quite accurate, although under which specific conditions is not yet clear. There has also been some effort at experimental research on children's memory for emotionally arousing events. However, the few experimental studies have resulted in mixed conclusions about children's capabilities.

4. Event repetition and memory

A neglected topic in the empirical study of the impact of arousal on memory has been repeated events. Because much of what brings children to court is repeated emotionally arousing events (e.g., physical or sexual abuse, witnessing domestic violence), and most research into children's eyewitness memory is based on reports of a single neutral event, there is a clear need for more work on memory for repeated trauma. This would not be an issue if children recalled unique and repeated events similarly. However, there is substantial evidence that children recollect and report repeated events differently than they do single events (e.g., Connolly & Lindsay, 2001; Connolly & Price, 2006; Fivush & Hudson, 1990; Hudson, 1990; Nelson, 1986; Powell, Roberts, Ceci, & Hembrooke, 1999; Price & Connolly, 2004).

4.1. Theoretical background

Several theories can be used to explain how children's memory for single, compared to repeated events might differ. One class of theories, trace theories, rests on the assumption that each event receives its own memory trace (e.g., Hintzman, 1984), regardless of event frequency. When recalling an experience, similar traces are simultaneously activated based on their connection to the retrieval cue. Accordingly, when accessing an instance of a repeated event, all similar instances are activated leading to interference and confusion. Conversely when memory for a singly-occurring event is accessed, there should be fewer traces activated and consequently less interference and confusion.

Another theory that can be used to understand memory for repeated events is fuzzy trace theory (Brainerd & Reyna, 1996, 2002; Reyna, Holliday, & Marche, 2002). When an event is experienced, two independent memory traces are simultaneously formed:

a verbatim trace and a gist trace. The verbatim trace contains the precise details of the event, while the gist trace contains the general meaning of the event. When an event is experienced repeatedly, distinct verbatim traces are formed while the same gist trace is activated each time. Accordingly, whereas verbatim traces for unique events and instances of repeated events may be similar in strength, at least at immediate recall, the gist trace associated with repeated events should be stronger than the gist trace associated with unique events. Research on memory reports of unique events has found that verbatim traces decay faster than gist traces and so recall relies relatively more on gist memory than verbatim memory.[2] For reports of a unique event, this may mean a slight decline in particular details of the target event. However, for reports of an instance of a repeated event, it may mean that general details common to all instances of the repeated event are reported at the expense of unique aspects of the target instance.

One theory that has been heavily relied upon in the study of children's memory for repeated events is script theory. In the 1980's Katherine Nelson and colleagues began focusing on children's event memory, and specifically on children's formation of event representations after repeated experience of several similar events (e.g., Fivush, 1984a; Hudson, 1990; Nelson, 1986). These researchers demonstrated that similar events that occur repeatedly are remembered differently from events that occur only one time. Specifically, repeatedly experienced events are said to form an abstract cognitive representation, or script, of what typically occurs (Fivush & Hudson, 1990; Nelson, 1986). This script leads to expectations of what will transpire when the routine is encountered in the future (Nelson, 1986; see Alba & Hasher, 1983). Although particular instances are difficult to access, with sufficiently supportive cues children are able to report details about particular instances (Fivush, 1984b, 2002; Powell, Thomson, & Ceci, 2003). Accordingly, compared to recalling unique events, children who recall instances of repeated events rely more on a general schema of what they "know" occurs during the event.

4.2. Paradigmatic issues

When children are asked to recall a specific instance of a repeated event, they often respond by providing both general event information and particular instance details. Although both types of information may prove useful, the legal requirement of specificity of a criminal charge may make recall of particular details more helpful. The extent to which this balance weighs in favour of either type of information is influenced by at least two factors: retrieval cues and the nature of the experienced event. The following discussion relies heavily upon predictions made by script theorists, largely because it is the most well-developed theory regarding memory for instances of complex, repeated autobiographical events (i.e., has received the most empirical attention).

4.2.1. Retrieval cues

Particular questioning techniques may access different types of memory and will therefore influence the content of children's responses to questions about repeated events. Specifically, when children are asked to recall what "takes" place during a repeated event, general event memory is more likely to be accessed, while when children are asked to recall what "took" place during a particular instance, instance memory is more likely to be accessed (although details of the instance of the repeated event may still be impoverished relative to details of a comparable unique event). Hudson and Nelson (1986) explored the influence of question type on children's recollections of a specific instance of a repeated event. When children who had repeatedly experienced an event were asked "what happens?" during a particular routine their responses were longer and more organized than their responses to the question "what happened one time?". When the same children were questioned about a unique event, they were able to provide a long and detailed response, but these reports were not more detailed than their general reports of repeated events. Thus, when questioning a child witness suspected of having been abused repeatedly, phrasing a question more generally may result in more information, but may not provide a forensic investigator with information that is sufficiently specific to support a charge.

4.2.2. Nature of the event

Related to the above point, when inquiring specifically about one particular instance from a series of many similar instances, the characteristics of the particular instance and of the general event can have a substantial influence on recall. There are two types of details present in a repeated event: fixed and variable. Fixed details remain constant across a series of similar experiences (e.g., that a main course is ordered before dessert in a restaurant) while variable details vary across each instance of a repeated event (e.g., the particular item that is ordered when a person visits a restaurant). Across repeated experience, fixed details are represented in the script as particular details and so memory for them is very good. However, the influence of repetition on variable details is not as clear. According to script theory, variable details are represented as list-like sets of experienced options that are not tightly associated with any one instance, and that provide expectations about the characteristics of future options (Fivush, 1984a; Hudson, Fivush, & Kuebli, 1992). Thus, when recalling which variable details occurred during a specific instance, children will often confuse details across instances. Such inconsistencies are to be expected and should not be taken as indicative of overall inaccuracy.

Because fixed details are represented as particular details and because repetition of the same information strengthens memory (e.g., Hudson, 1990), recall of fixed details in a repeated event is akin to recall of general event details. Thus, when eliciting recall of a particular instance containing fixed details, it does not matter which type of question ("happens" or "happened") is asked, because each will access the same content. However, in forensic events, as with many repeated events generally, it is unlikely that all particular details will remain constant throughout multiple experiences (although it is certainly possible that many elements will be consistent). Thus, variable details of a repeated event, the ones that are likely to be confused, may be more forensically relevant.

[2] Similar research has not be done on memory for instances of repeated events. It may be that verbatim memory for instances of repeated events decays faster than verbatim memory for unique events.

4.3. Consequences of repetition on memory reports

There are several consequences for memory and memory reports of having multiple similar experiences with an event. We discuss those that have the most important forensic implications. First children appear to have great difficulty describing the variable details that occurred on a particular episode of an event they repeatedly experienced (e.g., a trip to McDonald's, a school day; Fivush, 1984a; Hudson & Nelson, 1983). Across many of the studies comparing children's memory for repeated and unique events, most of the errors committed by children who experience a repeated event were reports of details that have been experienced, but were not experienced in the particular instance the child is asked to recall (Connolly & Lindsay, 2001; Connolly & Price, 2006; Powell et al., 1999; Price & Connolly, 2004). Across multiple interviews, these differences may appear as contradictions of previously reported information. Importantly, inconsistencies can seriously undermine the perceived credibility of a witness (Berman, Narby, & Cutler, 1995; Brewer, Potter, Fisher, Bond, & Lusczcz, 1999; Connolly, Price, Lavoie, & Gordon, 2008; Leippe & Romanczyk, 1989).

Second, because memory for repeated events tends to become more general over time (e.g., Hudson & Nelson, 1983), extraction of particular instances from memory becomes more challenging (see Connolly & Read, 2003). Most children delay reporting sexual abuse for a substantial period of time (for a review see London, Bruck, Ceci, & Shuman, 2005) and it often takes a very long time for a case to be heard in court. Thus, the legal expectation that children retrieve one instance from a series of many to provide the accused with a defensible accusation (R. v. B. G., 1990) may be especially difficult for many child witnesses.

The third point concerns how children speak about repeated events. Compared to children who report a unique event, children who report a repeated event tend to use impersonal pronouns and present tense (i.e., "you *play* with toys" versus "I *played* with toys") more often and they tend to report the event in a more temporally organized manner (Fivush, 1984b; Hudson & Nelson, 1986; Nelson, 1986). This language can be interpreted as an indication that children are accessing general memory for the event, rather than any specific instance in the series of events. This is important for forensic investigators who may not be aware of this tendency and who may interpret this language as a sign of, for instance, fabrication.

Fourth, children who have experienced repeated events may be more suggestible than children who have experienced only one event. A suggestibility effect is found when, in response to questions about their memory for an event, children respond by reporting a detail that was not experienced, but was only suggested to them (Bruck & Ceci, 1999). It is consistently found in the extant research that children are more suggestible for details that vary across instances (variable details) when compared to details that remain the same across instances (fixed details; e.g., Connolly & Lindsay, 2001; Powell & Thomson, 1996). Further, when compared to details of a unique event, fixed details are more resistant to suggestion (Connolly & Lindsay, 2001; Pezdek & Roe, 1995; Powell et al., 1999). However, as discussed in more detail below, there is less consensus regarding the relative suggestibility of variable details of a repeated event and details of a single-event.

Using a recognition test, Connolly and Lindsay (2001) reported that children aged 4–8 years who repeatedly experienced an event were more suggestible for variable details of a target instance than children who experienced only the target event. In contrast, with a cued recall test Powell et al. (1999) found that children aged 3–8 years who experienced a repeated event were not more suggestible than children who experienced a single-event (Experiment 2), and in some circumstances, they were less suggestible (Experiment 1). Powell and Roberts (2002) compared suggestibility with recognition questions and cued recall. Children aged 5–6 years who experienced a repeated event were more suggestible (after 3 days and more so after 21 days) than those who experienced a unique event when questioned with recognition questions. A cued recall test resulted in no differences in suggestibility between children in the single- and repeated event conditions. Some recent research has explored this discrepancy by isolating factors thought to contribute to the different results. Price and Connolly (2004) explored responses to cued recall questions and used special instructions designed to minimize demand characteristics (i.e., opposition instructions — see Lindsay, Gonzales, & Eso, 1995) and Connolly and Price (2006) studied the influence of similarity (level of association) between experienced details. Both studies again found that repeated event children were consistently more suggestible than single-event children about variable details of the event (see also Price, Connolly, & Gordon, 2006). Thus, we are approaching an understanding of the circumstances under which children's suggestibility for an instance of a repeated event varies.

4.3.1. Summary

Understanding children's ability to recall an instance of a repeated event is legally and theoretically important. Children's reports of instances of repeated events differ from reports of unique events in several forensically important ways related to both content (i.e., ability to access instances of the event and confusion across instances) and syntax (i.e., use of the impersonal pronoun, present tense, and prevalence of temporal markers). Children's memory and suggestibility for an instance of a repeated event may be influenced by such factors as questioning techniques (general versus specific), temporal spacing of instances, type of details experienced (fixed or variable; categorical relatedness), and type of test used to retrieve the memories (recognition or cued recall). Importantly, although children have difficulty recalling a particular instance, they tend to be quite accurate at recalling their experiences generally. The theories described above can help to explain these phenomena and to develop additional hypotheses for children's recall, but much more research needs to be done.

5. Event frequency and emotional arousal

Despite the presence of many naturally existing repeated emotionally arousing events that children endure, little research has systematically focused on the influence of repetition on memory for such arousing events. Although not an experimental

manipulation of repeated trauma, one exception is Goodman and Quas's (1997; see also Goodman, Quas, Batterman-Faunce, Riddlesberger, & Kuhn, 1994) study on children's memory for VCUG's. Of the 46 (aged 3–10 years) children who participated in the study, 29 children had not previously experienced a VCUG (single-event), and 17 had experienced the VCUG before (repeated event: from two to six times). Interestingly, the authors found no differences in accuracy as a result of repetition of experience, nor were there any event frequency differences as a function of age or arousal (see Salmon et al., 2002, who also found that repetition of experience did not influence recall). However, it remains an empirical question whether a "once" versus "more than once" definition of repetition is an informative way to measure frequency, or whether a specific number of experiences is required to observe memory variations attributable to event repetition.

Quas et al. (1999) conducted another study of children's (aged 3–13 years) memory for VCUG's, and found a positive correlation between the number of VCUG's a child had experienced and the amount of correct information the child provided in free recall. This finding is interpretable from our current knowledge of recall of repeated events. When VCUG's are repeated, we expect children to develop a script of what ordinarily takes place. The details that remain consistent (fixed) across each VCUG experience will become stronger in memory, when compared to details that vary across instances (variable details; Connolly & Lindsay, 2001; Powell & Thomson, 1996). Given that this medical procedure is likely to be highly structured, perhaps even administered in exactly the same way each time, it will contain many fixed details. Thus, as described above, one expects recall to improve with experience.

The research reviewed thus far suggests that children's memory for variable details of repeated events may be more malleable than their memory for a unique event under particular circumstances. However, the relationship between arousal and recall for such events in children remains to be discussed. There are theoretical reasons to predict that repeated emotionally arousing events will be recalled differently than repeated neutral events, at least after relatively few experiences. For instance, arousal may lead to an increased focus on central details of an event leading children to identify the relations between instances more quickly, thus resulting in expedited script formation (i.e., after fewer repetitions).

To draw conclusions about the influence of the presence of arousal on memory, we require ethical comparisons between *the same* event that is experienced as negatively emotionally arousing to some children and completely non-arousing, or positively arousing, to others. In such a study, Price and Connolly (2007) compared children's recall of a single or an instance of four similar swimming lessons in which children were or were not afraid of the water. The lessons were structured exactly the same for children who were and were not afraid of the water. Although there was some evidence that anxious children were less suggestible, the results from this experimental comparison evinced few differences between the arousing and non-arousing events. This supports that notion that much of the existing literature on memory for repeated neutral events may generalize to repeated emotionally arousing events. Future work is required that continues to make such experimental comparisons. Further, because we know that children recall repeated events differently than unique events, specific questioning techniques should be developed that address repeated event children's needs specifically (i.e., extraction of one instance from the series). Work to this end has been started by Powell and Thomson (2003) in experimental settings, but much more is required.

There are also recommendations that can be made regarding the treatment of child witnesses. It is clear that children are capable of accurately reporting their experiences, even if repeated and/or traumatic. Although many memorial factors will influence the precise content of children's reports, investigators only have control over the investigative process. It is important that children are questioned in an appropriate manner, with open-ended non-leading questions. Children who have experienced a repeated event appear to be particularly susceptible to suggestion when asked very specific questions (i.e., recognition questions; Connolly & Lindsay, 2001; Powell & Roberts, 2002), and this tendency may (or may not) be especially salient at particular levels of emotional arousal. Practically speaking, this leads to the reiteration of recommendations made by interviewing experts that interviews of child witnesses must be recorded (e.g., Bala, 1999; Poole & Lamb, 1998). Recordings of child witness interviews (and first disclosures in particular) are the best representation of what the child said and may be a record of contamination of the child's report.

6. Conclusion

Arguably, most children who are forensic witnesses have been exposed to repeated abuse (physical or sexual abuse, domestic violence). Notwithstanding this, there is a substantial shortage of research on memory for repeated events that are emotionally arousing. Accordingly, the children who are most in need of help, those who have been and may continue to be repeatedly abused, are those whose testimony courts are least prepared to hear (Roberts, 2002). As reviewed here, many forensically relevant differences have been reported between children's recall of repeated and unique events that are neutral or positive. This raises the very real possibility that similar differences will be observed in comparisons between repeated events and unique events that are emotionally arousing. The challenge for researchers is to develop creative paradigms to study repeated stressful events. The full importance of obtaining levels of arousal more comparable to those experienced in forensic events is not yet understood, but there are good indications that it may be instrumental in determining the impact of emotional arousal on memory (see Deffenbacher et al., 2004).

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