

## ABSTRACT

EATON, KIMBERLY LINHART. Memory and Emotion: The Influence of Valence on Children's Memory for a Salient Event. (Under the direction of Lynne Baker-Ward.)

Remembering is a constructive process. Children's memories for events have been shown to conform increasingly over time to script-based expectations, stereotypes and suggestions. Effects of personal, socio-emotional factors on children's recall, however, are less well understood and often juxtapose highly arousing negative events (e.g., stressful medical procedures) with benign positive events (e.g., family gatherings). This research is unique because both the positive and negative groups experienced the same event, thus controlling for differences in event structure and salience.

Children were observed during the final game of an end-of-season soccer tournament. The event was scored for the presence or absence of central and peripheral components of the game, identified in previous research in consultation with peer experts. Recall was assessed immediately after the game and 6 weeks later, through interviews conducted at the field and in participants' homes. Extending previous work within this paradigm, the interview began with a free-recall component followed by elicited recall items. The protocol included misleading questions about plausible central and peripheral components. Participants' free-recall narratives about the event were coded for the proportion of central, peripheral, evaluative and mentalistic propositions in the narrative, and narrative cohesiveness.

Emotional valence of the event was defined initially as event outcome (won/lost). Although event outcome has been shown to correlate with post-game emotion, previous work suggests children's post-event descriptions of pre-game emotions are independent of outcome and related to correct rejection of misleading questions. Ratings of event

salience, perceived individual and team performance, and the point at which the participant was confident of the outcome were obtained.

Narratives from participants in the positive condition included a greater proportion of cohesive devices than participants in the negative condition, and narratives contained a greater proportion of evaluative statements at the first interview but a greater proportion of mentalistic statements at the second interview. The proportion of statements about central and peripheral aspects of the event did not differ by time or outcome group. There was an outcome group by time interaction on elicited recall of present and absent features, where participants in the positive group did better on present feature questions and participants in the negative outcome group did better on correct denials of peripheral absent features, both at the first interview. Groups did not differ at the second interview. Participants who knew the outcome early in the event were less likely to correctly recall central event details than participants who did not know the outcome until the end, and there were few differences between the positive and negative outcome group when comparing participants who did not know the outcome until the end.

This research provides further evidence that emotion at the time of encoding is related to recall and change over time in children's memories, and highlights the importance of controlling event structure when comparing recall for positive and negative stimuli.

**Memory and Emotion: The Influence of Valence  
on Children's Memory for a Salient Event**

by

**Kimberly L. Eaton**

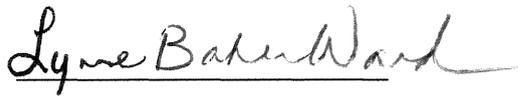
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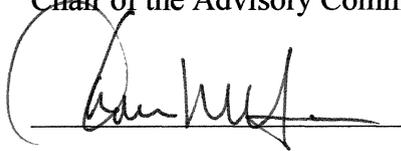
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## Introduction

Emotion plays a powerful role in memory. By definition, emotional events are personally salient, thus it is not surprising that they are recalled with more clarity and are characterized by more stability in recall over time than less personally – or emotionally – important events (Brown & Kulik, 1977; Christianson, 1989; Keenan, MacWhinney, & Mayhew, 1977; Linton, 1975). Much of the research on the relationship between emotion and memory focuses on the intensity and valence of emotion or comparing memory for highly arousing negative events to memory for neutral events (e.g., Fivush, Hazzard, et al., 2003). One area that has received little attention, however, is recall for emotionally arousing positive events and how such recall might differ from memory reports of negative events (see, for example, Hastorf & Cantril, 1954). Examination of recall for an event that is both arousing and positive for some participants and arousing and negative for others offers an opportunity to explore the relative contributions of valence and intensity to event memory.

Reviewing research in this area has particular methodological challenges, including researchers' varying definitions of emotion (in the person vs. in the event), the tasks researchers use to elicit emotion (field vs. lab studies), and the nature of the to-be-remembered material (e.g., autobiographical vs. striking “flashbulb” events vs. photographs that evoke affective responses). Thus, meaningful ways of comparing findings across studies that examine the relationship between emotion and memory are not always evident

The following review will begin by addressing definitional issues surrounding emotion and memory, as well as some of the physiological measures involved in

examining links between the two. Next, research on children's memory will be discussed, with a focus on autobiographical memory and how factors such as narrative structure can shed light on the processes involved in remembering emotional material. Third, the results of two pilot studies examining the relationship between emotion and memory, and the contribution and limitations of those studies, are presented. Finally, the rationale for the proposed research and hypotheses are offered at the conclusion of this chapter.

*Emotion and Memory*

...it is a notorious fact that what interests us most vividly at the time is ...what we remember best. An experience may be so exciting, emotionally as to almost leave a scar on the cerebral tissues. (James, 1890)

Why should emotion affect memory, and how? Understanding this relationship is important for predicting the ways in which memories and recall might differ for more positive versus negative events. The intensity of emotion is related to stability of recall over a delay in some studies (Bohannon, 1988; Pillemer, 1984) and emotional memories generally are quite stable (Yuille & Cutshall, 1986; but see Neisser & Harsch, 1992). Similarly, emotional events are forgotten more slowly than neutral events and some studies find that emotion enhances memory for an event (Brown & Kulik, 1977; Heuer & Reisberg, 1990; Reisberg, Heuer, McLean, & O'Shaughnessy, 1988; Yuille & Cutshall, 1986, 1989), but others find that negative emotions impede recall (Clifford & Hollin, 1981; Clifford & Scott, 1978; Loftus & Burns, 1982). What are the various mechanisms contributing to the impact of emotion in memory? Do they offer a possible explanation for the inconsistent effects of emotion on memory as reported in the literature?

*Approaches to understanding emotion and memory.* From an evolutionary perspective, emotion is implicated in identifying the important events that need to be remembered and differentiating them from more commonplace events. Thus, an emotional reaction may be an adaptive response to threat and a survival mechanism (Brown & Kulik, 1977; Gold, 1986; Livingston, 1967; Zajonc, 1980). If we remember the circumstances surrounding exposure to danger, we enhance our ability to craft an adaptive or avoidance strategy in the future (Clore, Gasper, & Garvin, 2001; Gohm & Clore, 2002; Ridley, Clifford, & Keogh, 2002). Recall of a positive experience may be related to pleasure seeking behavior, but it is not as critical to survival as recall for an event involving mortal danger. Similarly, recall for low-intensity events that are mildly negative or mildly positive would be expected to have little impact on survival and, thus, such experiences should be less salient in memory. From this it appears that the intensity of emotion, as well as the valence, is likely to be involved in the process of encoding and retrieving information from memory.

Psychologists ascribing to a discrete theory of emotions are interested in distinguishing one emotion from another (Frijda, 1986; Izard, 1977; Plutchik, 1962; Tomkins, 1962), and it is this perspective that has generated the most attention outside of psychology with respect to physiological measures of emotion (e.g., Calder, Lawrence, & Young, 2001; Canli, Sivers, Whitfield, Gotlib, & Gabrieli, 2002; Ekman, Levenson, & Friesen, 1983). This view often assumes that emotions are biologically based reactions that have evolved to organize individuals' responses to important events. These reactions unfold over a relatively brief time course (differentiating them from mood, for example), are subject to frequent quantitative and qualitative change, and are best characterized by

considering their expressive, experiential, and cognitive components in concert, rather than limiting consideration of the response to just one of these domains.

Others have advocated for a dimensional approach to studying emotions (e.g., Davidson, 2000; Larsen & Diener, 1992; Watson & Tellegen, 1985). This view focuses on examining emotions within the general, orthogonal domains of valence and intensity of affect, and dates as early as Wundt (1924/1912). For example, Schneirla (1959) argued that approach, elicited by pleasant emotional events, and withdrawal, elicited by negative emotional events, were the only universal patterns of motivated behavior, and that the intensity of the physical response was the key element of approach or withdrawal behaviors. Likewise, Hebb (1949) concluded that the direction of the behavior (toward or away) was a central factor in interpreting human behavior. Whether valence or intensity of emotion is primary in the experience of emotion has been the subject of considerable debate (Schachter & Singer, 1962).

Several theorists propose that the appetitive and defensive systems are an evolutionary adaptation to insure survival of the species (e.g., Darwin, 1872/1998; Rolls, 2000). Thus, threatening situations activate the defense system that in turn leads individuals to rely on behavioral repertoires including withdrawal, escape, and attack (Bradley, Codispoti, Cuthbert, & Lang, 2001). The appetitive system, activated in contexts promoting survival, involves sustenance, procreation, and nurturance (Bradley et al., 2001). Neural circuits in the brain activate both systems, with presumptively common responses to mediating physiological systems, and structures critical in attention and action (Lang, Bradley, & Cuthbert, 1990, 1992). A common assumption is that the appetitive and aversive systems in emotions are reciprocally inhibited. That is, as activity

in one system increases, activity in the other decreases (Konorski, 1967). Dimensional measures of affective valence reflect this assumption by stating a stimulus can be rated as either positive or negative, but not both. Cacioppo and Berntson (1994) present a more flexible theory of affective valence, allowing all possible modes of activation. In this model, appetitive and defensive activation might vary from being mutually reciprocal to simultaneously active to separately active.

*Emotion, arousal and memory.* Despite these differences in the conceptualization of emotion, researchers in the area remain largely focused on the same issue surrounding emotion. That is, the relationship of arousal to emotion has long been a primary area of research and theorizing (e.g., Cannon, 1927; Schachter & Singer, 1962; Lang, 1994). Measures of emotional arousal have included observational data, self-reported intensity ratings, and speed of processing, all in an effort to measure the underlying construct of strength or speed of the individuals' response (Bradley & Lang, 2000; Lang et al., 1990).

In terms of physiological measures, activation theorists (e.g., Duffy, 1957) posited linear increases in arousal across systems, such that cardiovascular, electrodermal, and somatic systems would all respond with equivalent strength to emotion-eliciting stimuli. This theory has been challenged by evidence that the relationships are neither linear nor do they proceed in tandem. Somatic activation varies according to the context-specific response of the individual. Thus, threat is associated with differing levels of muscular activation, depending on whether the individual flees or fights the threat. Although both fighting and fleeing will have an association with autonomic system activation, the degree to which the systems (e.g., cardiovascular) are activated will differ (Levenson, Ekman, & Friesen, 1990).

Another difficulty with physiological measures of arousal is the difference in onset and offset times of the response. For example, EEG activation occurs within milliseconds of a stimulus onset, skin conductance changes after several seconds, self-reports of activity and energy reflect arousal sampled over a longer period than either EEG or SCL, and body temperature seems to indicate average activity over a period of minutes to hours (Revelle & Loftus, 1992).

Self-report measures of arousal seem to reflect the general factor of the physiological measures of arousal (e.g., heart rate, skin conductance, EEG; Thayer, 1986, 1989). Arousal is an intraindividual construct, thus self-report is a useful indicator of arousal changes. However as an inter-individual variable, arousal levels may mean different things to different people, making comparisons difficult. Additionally, skin conductance as a measure of emotional intensity can reflect inter-individual differences in skin composition as well as arousal, and intraindividual changes are not necessarily related to inter-individual variation. Some individuals will be more labile, while others are relatively unresponsive. Regardless of the particular physiological measure or self-report of it, few studies have examined the link between arousal and memory in children (but see Eisen, Qin, Goodman, & Davis, 2002).

Why might emotional intensity be related to recall? While it is functionally efficient to vary metabolic functioning in concert with periods of task demand, rather than keeping the rate universally high at all times, a complementary system is needed to respond to events occurring out of the normal cycle. Memory is one such system in that it can provide the benefit of previous experience for potentially threatening events and be continuously available without draining physiological resources. Arousal may contribute

to the strength of the memory by deploying physiological resources to maximize encoding of at least the central features of the event (Manning, Hall & Gold, 1990; Christianson & Loftus, 1991). Likewise, arousal may dictate a shift from encoding of semantic to episodic information (Hockey, 1978). Emotion-laden memories are likely to be more distinctive than their neutral counterparts; however, distinctiveness alone is not as powerful as emotion effects (Christianson & Loftus, 1991). Emotional events have the capacity to influence self-concept in a way that neutral events do not. We would expect a protective effect for those who remember the central details of highly positive events more so than highly negative ones. Likewise, persons who experience relatively higher levels of arousal in response to negative emotion events are likely to have less positive senses of self—at least in negative emotion eliciting situations. We would expect this premise holds true for children, as well as adults, but the lack of research in the area makes this a difficult assumption to support.

*Arousal and “flashbulb” memories.* Emotion has alternately been associated with better and poorer memory. The “flashbulb” hypothesis suggests that events occurring during intense emotional arousal are encoded with exceptional clarity and accuracy (Brown & Kulik, 1977; Christianson, 1989). Alternatively, others propose that anxiety associated with emotion serves to suppress memory (Freud, 1915; Grunberg & Ney, 1997; Peters, 1991; Rapaport, 1942). Support for a model of an inverted-U relationship between arousal and performance, with exceptionally high and low levels of arousal being associated with poor performance compared with memory for events encoded under moderate arousal conditions (Yerkes-Dodson, 1908), comes predominately from studies of induced emotion.

Researchers have repeatedly found a strong, positive relationship between emotion and extent (but not necessarily veracity) of recall (e.g., Christianson & Loftus, 1990, Pillemer, 1984). Vividness of recall is not always related to accuracy, especially for emotional events (Christianson, 1989; McCloskey, Wible, & Cohen, 1988; Neisser, 1982; Wagenaar & Groeneweg, 1990).

Some theorists posit that emotion intensity is positively related to vigilance, thereby increasing the detection and retention of event details, but that this benefit comes at the cost of decreased memory for the event in the short term due to the disruptive effect of arousal (Revelle & Loftus, 1990, 1992). Arousal and emotion (valence), however, are difficult to disentangle.

Autobiographical memory for highly arousing negative events such as trauma (e.g., Peterson & Bell, 1996), stressful medical procedures (e.g., Baker-Ward, Gordon, Ornstein, et al., 1993; Ornstein, Baker-Ward, Gordon, & Merritt, 1997; Ornstein, Shapiro, Clubb, et al., 1997) or witnessing a crime (e.g., Yuille & Cutshall, 1986) have been extensively studied, as have “flashbulb” memories for autobiographical details about the circumstances surrounding the encoding of significant negative information (e.g., space shuttle disaster, Bohannon, 1988; assassination attempt on President Reagan, Pillemer, 1984; MS Estonia ferry disaster, Christianson & Engelberg, 1999).

Studies of recall for traumatic events and “flashbulb” memories find remarkable stability over time in the content of the memories, although the veracity of the accounts often cannot be verified (e.g., Brown & Kulik, 1977, Yuille & Cutshall). In fact, recent reexaminations of flashbulb memories suggest that these memories are subject to the same distortions and maintenance through rehearsal as other types of memory (for a

review see Winograd & Neisser, 1993). Hence, they do not appear to represent a different kind of memory -- the neuropsychological "now print" mechanism that has previously been proposed (Livingston, 1967).

In addition to these concerns, researchers working with adults have been able to identify constructs that are both highly arousing and pleasurable (e.g., Ito, Cacioppo, & Lang, 1998). However, studies involving children typically only include low arousal events in the positive condition (e.g., visits to a theme park, Hamond & Fivush, 1991; details about a family gathering, Fivush, et al., 2003). In short, there is ample research on the relationship between memory and arousing, negative events, but relatively little research on arousing positively valenced events.

#### *Autobiographical Memory in Children*

What role might emotion play in children's autobiographical memories? A study of young children's conversations with their mothers found that children's memories primarily concerned negative events, in particular events of physical harm (Miller & Sperry, 1988). Fully 91% of the child-initiated conversations, and 53% of conversations initiated by others included negative events. Memories of physical harm, likely an intensely negative situation for small children, were described by the children in 70% and 30% of the child- and other-initiated conversations. Although methodological issues may have contributed to the large effects found in this study (small, at-risk sample), it highlights the salience of negative events in children's memories and the research focus on highly arousing negative events (e.g., falling, various forms of physical assault).

Not surprisingly, several factors may influence retention over a delay: the physiological arousal experienced as the event unfolded, the distinctiveness of the to-be-

remembered event, and the frequency with which rehearsal takes place between encoding and the delayed recall test. How might children's conversations about an event influence their subsequent recall of central and peripheral details about the event? Researchers have consistently found that recall is better when participants rehearse or are exposed to reminders about the target event in the intervening period between encoding and the time of the recall test (e.g., Fivush & Hamond, 1989; Howe, Courage, & Bryant-Brown, 1993; Rovee-Collier & Hayne, 1987; Sheffield & Hudson, 1994; Principe, Ornstein, Baker-Ward & Gordon, 2000). But Hudson (1990) found that intervening experiences that are similar to the target event are negatively related to recall accuracy, possibly because of the change in event schema that take place with each subsequent event experience. Studies of children's suggestibility have also found that intervening experiences can interfere with accuracy of recall (e.g., Ceci & Bruck, 1993; Loftus, 1979). Thus, intervening experiences can have differing effects on recall depending on whether they involve rehearsal of the target event or include new schema-relevant information that commingles with information about the target event.

In a study examining these conflicting findings, Principe et al. (2000) compared the recall performance of 3- and 5-year-old children after varying the intervening experience conditions. Children were interviewed after a visit to the doctor, and were assigned to one of four conditions: a return visit to the office during the delay, an intervening interview about the visit, a presentation of a video about a visit to a doctor, or no intervention (control). Recall performance was enhanced in the experimental conditions compared with the controls for both age groups. Children in the return-visit and control condition experienced more forgetting over the delay than did those who had

an intervening interview or watched the video. Suggestibility did not differ among the groups for the younger participants (all performed at chance). For the older children, however, an effect of condition was present. The older children who watched the video, in comparison to those in all other conditions, exhibited a performance decrement over time in their ability to correctly reject suggestions about event details that did not occur and they generated more intrusions (volunteering additional absent features).

The findings of Principe et al. (2000) highlight how the underlying event representation may change with intervening experiences (Baker-Ward, Ornstein, & Principe, 1997). Rehearsal can have a facilitating effect, but encoding of new event-relevant information can also increase suggestibility. The target event was relatively neutral in this instance, thus how emotion might influence these relationships is not yet known.

*Stress and memory.* Knowledge about the relationship between affect and memory comes largely from studies of adults. Findings from research with children have been mixed, with some studies finding a facilitative effect of stress on recall (e.g., Goodman, Hirschman, Hepps, & Rudy, 1991) and others finding that stress impeded recall (e.g., Bruck et al, 1995; Merritt et al, 1994) or that stress was not related to recall (Eisen et al, 1998; Peterson & Bell, 1996; Vandermaas, Hess, & Baker-Ward, 1993). In a study of children's recall for naturally occurring stressful events, children who underwent a stressful medical procedure (injections) were better able to recall central and peripheral details and were less suggestible, than children in a control condition (Goodman, Rudy, Bottoms & Aman, 1990, study 3). After a one-year delay, these same participants were again asked to recall the event. Not surprisingly, the amount of correct information

recalled, and accuracy on questions about central components of the event declined over time, and suggestibility for events that did not occur increased. Despite this, there were few intrusions (incorrect information recalled).

Similarly, Peterson and colleagues have conducted a series of studies on children's recall for stressful medical emergencies, and find that children's recall for such events is quite good with respect to the central aspects of the event (Peterson & Bell, 1996; Peterson, 1999; Peterson & Whalen, 2001). In a 5-year follow-up study, children exhibited very little forgetting of central and peripheral details of the injury and subsequent hospital treatment (Peterson & Whalen, 2001). Recall for central features and the injury was better than recall for peripheral features and the hospital treatment, and older children performed better than younger ones. Thus, even children who were two years old at the time of the event were able to recall the gist of the event, and recall was better for the highly stressful injury than for the hospital treatment, when explanation and scaffolding was provided by the parents. Further, recall for central details about the hospital treatment was positively related to stress during such treatment.

Not all studies have found this positive relationship between recall and stress. In one of the few studies examining multiple age levels, 6- and 7-year-old children exhibited less forgetting over a delay after a potentially stressful event (doctor's office visit) than three-year olds (Ornstein, Gordon & Larus, 1992; Baker-Ward, Gordon, Ornstein, Larus & Clubb, 1993) but levels of rated stress were unrelated to memory performance. Similarly, Vandermaas et al. (1993) found that children's stress (anxiety) was not related to recall.

In sum, evidence from these studies seems to provide some support for the relationship between arousal and recall posited by the Yerkes-Dodson law (1908), in that children are able to recall events encoded under moderate to highly negative conditions. However, the effect of stress and the negativity of the event are confounded, making it difficult to generalize about the independent effect of stress.

*Central and peripheral event components.* Physiological arousal, conceptualized as an orienting response, may induce the organism to attend to the central features of an event and exclude encoding of supplementary or peripheral details (Bruner, Matter, & Papanek, 1955; Easterbrook, 1959; Eysenck, 1982; Mandler, 1975). Heuer and Reisberg (1992) define peripheral details as those that can be altered without changing the event's identity at the basic level (e.g., clothing worn at an event, or the angle at which an event was viewed).

Peripheral information is important, because it is the peripheral details that allow us to discriminate between accurate recall and plausible reconstruction. From an individual importance perspective, memories that are rich with detail are more likely to be referenced as true by the individuals themselves than those that are somewhat sparse and include only the gist of the event. Perhaps it is the peripheral details that we associate with our memories that personalize them, differentiate them from what another observer remembers from the same event, makes them "our own" account of the event (Heuer & Reisberg, 1992).

Central details of an event are remembered better if the event is emotional than if it is neutral (Christianson, 1984; Christianson & Loftus, 1987, 1990, 1991; Christianson, Loftus, Hoffman, & Loftus, 1991). Even negative emotional events

seem to be recalled well, particularly the central components of the event.

Peripheral information is less well recalled, and suggestibility for peripheral elements of an event may be greater than for central details. Implications of this are that credibility of the memory for central details may be threatened if the individual commits errors on the peripheral detail questions about the same event, or event memory generally for memories of neutral events. Type of event (more or less emotional), type of detail (central or peripheral), and time of test (immediate or delayed) interact in predicting recall. By contrast, peripheral aspects of an event are remembered better if the event is neutral versus if it is emotional and this information is more susceptible to suggestibility. How might peripheral details be impacted by emotion and arousal in children's recall for positive events?

When studies distinguish between recall of central and peripheral aspects of an event, researchers find interactions between emotion and type of information recalled (central vs. peripheral; e.g., Burke, Heuer, & Reisberg, 1992; Christianson & Loftus, 1987, 1991; Christianson, Loftus, Hoffman, & Loftus, 1991), between emotion and recall type (recall vs. recognition; e.g., Davis 1987; Wagenaar, 1986), and between emotion and time of testing of recall (immediate vs. delayed; e.g., Burke et al, 1992, Christianson, 1984).

Christianson (1984) found that when participants viewed emotional and neutral versions of a slide sequence (a boy hit by a car vs. a boy walking by a car), there were no differences in recognition of peripheral details, but participants in the emotional conditions were better at recalling central features. Subsequent work by Christianson and

Loftus (1987) found that participants could recall central features better from emotional compared with neutral slides and could recall peripheral features better in the neutral than the emotional condition, but were less adept at recognizing the emotional compared with neutral slides they had seen. Similarly, Kebeck and Lohaus (1986) found that central details were recalled equivalently in an emotional and neutral condition, but peripheral details were better recalled by participants in the neutral condition than by those in the emotional condition. Christianson & Loftus (1991) found that subjects in an emotional condition retained central details better, but peripheral information was recalled better by the participants in the neutral condition.

Children's memory is better for central information than for peripheral information (e.g., Fivush, Gray, & Fromhoff, 1987; Goodman, et al., 1990). With regard to time of testing effects, Burke et al. (1992) found that children's recall for central details about an event increased between the immediate and delayed interviews, but recall for peripheral details declined.

Finally, memory tests under free-recall conditions find that (negative) emotion is related to poorer memory for an event, but testing the same participants using a recognition paradigm finds no such effect (Christianson & Nilsson, 1984, with adults; but see Perlmutter & Lange, 1978, with children).

*Additional influences on memory.* Certainly, a host of variables influence memory and recall for emotionally relevant events. Among others, these include event structure, expert status, and memorial reinstatement. With regard to event structure, investigations attempting to examine the relationship between emotional valence and emotional intensity often compare events with components embedded in the structure that

likely contribute to performance differences. Hence, the events compared may differ with regard to their structure as well as with respect to the alternative emotions they evoke among the individuals who experience them. For example, recall for events comprised of temporally connected details, especially those that could only occur in an invariant order (“enabling” elements), tends to be more accurate and detailed than recall for details about an event that are more arbitrarily organized (Bauer, 1992; Bauer, Hertzgaard, Dropik & Daly, 1998; Bauer & Thal, 1990). Thus, recall for details about baking a cake would be superior and more resistant to suggestibility compared with recall for details about a trip to the park. When baking a cake, one assembles the ingredients, mixes the ingredients, bakes the cake, and then decorates it. Each of these features of the event is enabled by the previous step, and in turn enables the subsequent step. Recall for any element of the event would be expected to activate connections in both temporal directions and facilitate recall for the entire sequence. A trip to the park might include temporally connected items such as riding a carousel and playing on the swings, but the order of these events is somewhat arbitrary. Recall may still be facilitated in that, although the order was arbitrary, they did occur in some order and thus may be connected in memory, albeit more weakly than the case involving enabling elements.

The benefit associated with enabling relations exists even when event knowledge might be expected to compensate for the arbitrary nature of the elements in a particular event (Bauer & Travis, 1993). An underlying mechanism that may account for this better recall is the chunking of separate elements into an organizational unit, such that aspects of events connected by enabling relations would be resistant to separation by other elements (Bauer, 1992). In these ways, enabling relations in events may enhance recall

by facilitating the connections between to-be-remembered components, increasing the amount of information that can be recalled (Bauer, 1992).

Likewise, recall for events about which a participant is more knowledgeable is better than recall for events where the participant is a novice (Ornstein, Merritt, Baker-Ward et al, 1998). For example, in a study of 5-year-olds, children's knowledge about physical exams and their memory for a particular exam were significantly correlated, and the strength of the correlation increased as a function of length of the delay interval (Clubb, Nida, Merritt, & Ornstein, 1993). Expert status may be predictive of a more richly defined script for the event, facilitating activation of the memory as a network of components.

Further, the frequency of opportunities for reinstatement may be implicated in recall. Talking about an event may strengthen the associations between elements of the event, through the construction of a coherent narrative and better subsequent understanding of the event (Klein, 2002; Klein & Boals, 2001; Pennebaker & Francis, 1996; Pennebaker, 1997). Studies on the effect of emotional disclosure through expressive writing on working memory capacity find greater increases in working memory when participants write about thoughts and feelings compared to when they write about a trivial topic, and what they write about negative compared with positive experiences (Klein & Boals, 2001). Writing that included more causal and evaluative content showed a similar pattern. Klein and Boals (2001) suggest that expressive writing reduces intrusive and avoidant thinking about a stressful experience, thus freeing cognitive (working memory) resources.

*Summary of Emotion and Memory*

Studies examining the “why” of emotion and memory provide insight into the important role negative emotions play in encoding, memory and recall. Moreover, research indicates that memory is impacted in different ways based on the level of arousal. Examples of this are provided in flashbulb memories where memories are quite vivid but not necessarily accurate, as well as in event components where central details are recalled more accurately than peripheral ones. Event structure, expert status and reinstatement play beneficial roles in memory, as well.

Less information is available on the impact of emotion on autobiographical memory. Likewise, the findings on stress and memory are highly variable indicating the complex stress-recall relationship. How might children recall personally relevant, emotionally positive, moderately stressful events?

*Pilot Work on the Effect of Valence on Memory for a Salient Event*

In order to explore the contribution of emotion valence to the relationship between emotion and memory, two pilot studies were conducted using a naturally occurring stressful event that had positive and negative implications for two groups of participants. Thus the nature of the event was the same and the arousal was the same, but the outcome differed between two groups.

*Study 1.* Eaton and Baker-Ward (2003) recruited 10- and 11-year-old girls who were playing in their last game in an end-of-season soccer tournament. During a game, children are exposed to a variety of event components that can be classified as central or peripheral to the outcome of the event. For example, scoring a goal is central, but what you wear in your hair is peripheral. However, games vary widely depending on the skill

level of the teams involved. In practice therefore, each game represents a unique subset of all possible event features, but observation of the game by researchers enables the specification of the details of the game. Thus, the accuracy of the children's reports can subsequently be verified.

Eaton and Baker-Ward (2003) established two groups of participants, all of whom were interviewed immediately after the game, and then again after a delay of five weeks. In this way it was possible to get an estimate of the children's encoding of the game and to carry out within-participant analyses of forgetting over time.

A structured interview protocol was used to assess memory for the component features of the game. Questioning began with open-ended prompts (e.g., "Tell me about your game"), continued with more specific questions (e.g., "How many drop balls were there?"), and then moved to ratings of individual and team performance. A manipulation check for event salience was included, in which the child provided a rating of "how much you wanted to win this game." Children were also asked potentially misleading "absent feature" questions about plausible event components that were not present in their game (e.g., "How many times did a player score from midfield?").

Basic recall data are shown in Table 1. In Table 1, narrative content is indicated at each delay interval for each condition, in terms of the percentage of propositions relating to central or peripheral components of the game, evaluative comments (e.g., "They were better than we were."), and mentalistic comments (e.g., "I was thinking", "I remember"). The teams did not differ with regard to the total number of propositions reported at either time of measurement, although performance was quite variable. There was a trend for recall of central information, such that all participants recalled more

Table 1

*Recall by Time and Outcome in Eaton and Baker-Ward (2003) Study 1*

	Time 1				Time 2			
	Negative ( <i>n</i> = 12)		Positive ( <i>n</i> = 6)		Negative ( <i>n</i> =12)		Positive ( <i>n</i> =6)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
<b>Spontaneous Recall</b>								
Narrative Length <sup>1</sup>	16.33	15.53	10.33	3.72	9.33	9.54	8.33	7.97
Central Propositions <sup>2</sup>	0.57	0.23	0.70	0.14	0.42	0.27	0.51	0.37
Peripheral Propositions <sup>2</sup>	0.02	0.05	0.14	0.13	0.23	0.33	0.19	0.15
Mentalistic Propositions <sup>2</sup>	0.08	0.09	0.02	0.04	0.16	0.14	0.03	0.07
Evaluative Propositions <sup>2</sup>	0.33	0.19	0.14	0.15	0.19	0.20	0.10	0.16
Cohesive Devices <sup>3</sup>	0.10	0.04	0.14	0.02	0.09	0.05	0.12	0.02
<b>Elicited Recall</b>								
Central – Present <sup>4</sup>	0.73	0.13	0.71	0.14	0.61	0.13	0.57	0.10
Peripheral – Present <sup>4</sup>	0.94	0.11	1.00	0.00	0.80	0.14	0.65	0.13
Central – Absent <sup>4</sup>	0.85	0.17	0.86	0.16	0.79	0.23	0.71	0.40
Peripheral – Absent <sup>4</sup>	1.00	0.00	1.00	0.00	0.29	0.33	0.50	0.32

<sup>1</sup> Number of propositions in narrative.<sup>2</sup> Ratio to total number of propositions in narrative.<sup>3</sup> Ratio to total words in narrative.<sup>4</sup> Percent correct.

central details at the first interview, however, recall of peripheral detail did not differ by group or at either interview.

Participants in the negative condition produced a higher proportion of evaluative comments than did the participants in the positive condition, and participants used a greater proportion of evaluative statements in the first interview than in the second interview. Moreover, participants in the negative condition generated a significantly higher proportion of mentalistic comments than did those in the positive condition. In summary, although the groups did not differ in terms of the extent of the narratives, the children experiencing the negative outcome reported significantly more evaluative and mental information.

Recall performance at each delay interval for each group in terms of the percentage of correct responses to the specific questions is shown in Table 1. Recall of central information the groups did not differ. Participants in both groups recalled more central information at the first interview than at the second interview. For recall of peripheral information, although the groups did not differ at the initial interview, those experiencing the negative outcome responded correctly to more elicited questions at the delayed interview than did those in the positive condition.

Children's rates of correct denials to questions about plausible event components that did not occur were greater at the first interview than the second. The absent feature questions were worded in such a way as to require participants to provide details about the event –yes/no questions were not used in either pilot study. Thus, performance on these questions is unlikely to reflect the response bias often associated with such methods in research with children (Baker-Ward, Ornstein, Gordon, Follmer, & Clubb, 1995).

Participants performed at the ceiling level at the first interview, correctly rejecting items that did not occur in the event. At the delayed interview, however, participants were significantly more likely to provide details about these absent features.

These findings indicated that children experiencing the same event under conditions that differed in valence recalled the event differently and their recall changed over time in different ways. However, the small sample size limited generalizability of the results. Thus a second pilot study was conducted in order to increase the sample size, statistical power and practical interpretability.

*Study 2.* In a second pilot study, Eaton and Baker-Ward (2003) recruited 10- and 11-year-old soccer players in an end-of-season soccer tournament. The measures and procedures were nearly identical to those of Study 1, with the following exceptions. Participants included both boys and girls, and the target event was defined as the final tournament game for any child, instead of limiting participation to children on the opposing sides in a single game. Thus, the sample included children on 16 teams playing in 15 separate games. A manipulation check for event valence was included, in which the child provided a narrative description of his or her pre-game and post-game thoughts and feelings. Interviews were conducted in the children's homes within several days following the game.

Basic recall data are shown in Table 2. In Table 2, narrative content is indicated at each delay interval for each condition, in terms of the percentage of propositions relating to central or peripheral components of the game, evaluative comments, and mentalistic comments.

Table 2

*Recall by Time and Outcome in Eaton and Baker-Ward (2003) Study 2*

	Time 1				Time 2			
	Negative ( <i>n</i> = 18)		Positive ( <i>n</i> = 12)		Negative ( <i>n</i> =18)		Positive ( <i>n</i> =12)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Spontaneous Recall								
Narrative Length <sup>1</sup>	28.44	25.38	25.73	15.94	22.28	21.40	19.20	14.85
Central Propositions <sup>2</sup>	0.30	0.16	0.59	0.24	0.37	0.22	0.47	0.30
Peripheral Propositions <sup>2</sup>	0.23	0.16	0.18	0.10	0.24	0.19	0.21	0.18
Mentalistic Propositions <sup>2</sup>	0.09	0.12	0.06	0.07	0.11	0.08	0.10	0.09
Evaluative Propositions <sup>2</sup>	0.38	0.21	0.18	0.17	0.29	0.18	0.20	0.15
Cohesive Devices <sup>3</sup>	0.09	0.02	0.11	0.03	0.08	0.03	0.09	0.04
Elicited Recall								
Central – Present <sup>4</sup>	0.62	0.12	0.65	0.09	0.66	0.15	0.60	0.19
Peripheral – Present <sup>4</sup>	0.82	0.14	0.83	0.11	0.81	0.14	0.79	0.13
Central – Absent <sup>4</sup>	0.66	0.28	0.70	0.17	0.65	0.27	0.69	0.23
Peripheral – Absent <sup>4</sup>	0.92	0.13	0.84	0.25	0.86	0.16	0.67	0.26

<sup>1</sup> Number of propositions in narrative.<sup>2</sup> Ratio to total number of propositions in narrative.<sup>3</sup> Ratio to total words in narrative.<sup>4</sup> Percent correct.

Participants in the positive condition recalled a greater proportion of central details at both interviews compared with participants in the negative condition. At the second interview, participants in the negative condition included a larger proportion of central items than they had at the first interview, while the participants in the positive condition showed a decline in the proportion of central items recalled. Participants in the negative condition used a greater proportion of evaluative propositions than participants in the positive condition, but the groups did not differ in the proportion of peripheral and mentalistic propositions in the narratives. Participants in the positive condition used a higher proportion of cohesive devices at both interviews.

Recall performance at each delay interval for each group in terms of the percentage of correct responses to the specific questions is shown in Table 2. Participants in both groups correctly recalled about the same proportion of central and peripheral items at each interview. Children's responses to the questions about plausible event components that did not occur did not differ by group or at either interview for questions about plausible central details. Participants in both groups correctly rejected a greater proportion of the peripheral absent features at the first interview, and there was a trend for the decline to be steeper in the positive outcome group. These findings suggest that children in the negative outcome group are processing event information differently than children in the positive outcome group. Their spontaneous accounts of the event are less cohesive, suggesting that the event representation is less well organized. Participants in the negative group also exhibited less forgetting, as indicated by their superiority over children in the positive outcome group at correctly rejecting absent feature questions at the second interview. It may be that the children in the negative outcome group are

ruminating more about the event (instead of talking about it), while children in the positive outcome group are discussing the event and then assimilating it into their existing event schema.

*Summary and Rationale for the Current Study*

Although there is much research examining the link between emotion and memory, very little of it has focused on children's memories for emotional events and especially emotionally positive ones. Rather, research has focused on the "whys" of emotional memory (e.g., why do we remember more intense and negatively valenced emotions), the physiological indicators of emotion, the role of particular aspects in emotion memories (e.g., arousal, event structure, autobiographical memory), and emotions role in recalling central versus peripheral events. Most often, researchers have explored these aspects of emotion by comparing memory for highly arousing negative events to memory for neutral events – rarely including comparisons to memory for positive events. Moreover, with few exceptions (e.g., Fivush, et al., 2003; Hamond & Fivush, 1991), these studies have examined adults' memories rather than the developmental aspects of emotion and memory in children. Although extensive research has examined children's memory for pleasant experiences such as family outings (e. g., Fivush et al., 2003; Fivush & Hudson, 1990; Hamond & Fivush, 1991), the extent to which these autobiographical reports are influenced by emotion has not been a question of empirical interest

Generally, to the extent that emotion is associated with arousal, differences in recall (and by inference, encoding) are expected based on the valence and emotional intensity of the experience. This suggests a shift in attentional focus to central aspects of

the event when the event is both positive and expected, compared with more vivid recall for events that are negative and surprising (e.g., Christianson & Lindholm, 1998). When the event is negative, increased vigilance should lead to better encoding of peripheral aspects of the event, compared with encoding of positive events, where encoding of the gist of the event would be sufficient (e.g., Ornstein, 1995; Peterson & Bell, 1996).

Mentalistic and evaluative statements, indicative of increased processing and reflection in a quest for understanding, tend to be greater when events are negative than when they are positive and are associated with better mental and physical health in adults (e.g., Pennebaker, 1997). Applying these findings to children, the rate at which mentalistic and evaluative statements are included in children's spontaneous accounts of an event should be positively related to the need for understanding associated with the event, and consequently constitute a greater proportion of the narratives of children in the negative condition as compared with narratives of children in the positive condition.

In addition, the two pilot studies provide preliminary evidence suggesting that the valence associated with a salient event makes a unique contribution to both children's immediate and delayed recall, as evidenced by the differences in their spontaneous event narratives and responses to elicited recall questions. In both studies, participants rated the event as highly salient. Thus, this paradigm provides an opportunity to compare responses to negative stimuli with responses to positive stimuli while holding arousal (operationalized as salience) constant and high. High arousal, positively valenced stimuli are difficult to identify, elusive to study and virtually absent from the child literature.

The proposed research interweaves many of the aspects of emotion traditionally studied and summarized above, but contributes to the developmental understanding

emotion and memory by examining young children's recall of a positive emotion event. Thus, the proposed research involves recall for an event that is (a) emotional at the time it occurs, (b) can be distinguished from other events by the participant, (c) can be tested after a delay, and (d) can represent either the positive or negative condition, depending on how the participant experiences the event. Further, independent observers can verify the accuracy of the report.

*Hypotheses.*

In summary, the hypothesized effects for the current study are the following:

- 1) *Central propositions in spontaneous recall.* An interaction between outcome and time of measurement for central details in the participants' spontaneous narratives is expected. Participants in the positive condition are expected to include a greater proportion of central details in their narrative at both interviews compared with participants in the negative condition, and this proportion is not expected to change over time. Participants in the negative condition are expected to exhibit an increase over time in the proportion of central items included in their narratives, such that at the second interview they are more similar to (but still lower than) the proportions used by children in the positive condition. Because the focus is on the qualitative content of the narrative and not the extent or veracity of the report, and because length is quite variable among participants, only proportions will be compared. In terms of the raw amount of central details in the narratives, participants in the positive

group are expected to exhibit a decline over time, as a result of the consolidation of the memory to its gist.

- 2) *Peripheral propositions in spontaneous recall.* Pilot work has not yielded any significant effects of time or outcome on the proportion of peripheral propositions in the narratives. Trends in the data, however, suggest that there may be an effect of time and outcome on such proportions. Thus, participants in the negative condition are expected include a greater proportion of peripheral details at both interviews than participants in the positive condition. At the second interview, participants in the negative condition are expected include a greater proportion of peripheral details than they had at the first interview, while the participants in the positive condition are expected to decline in the proportion of peripheral details included in their narrative.
- 3) *Mentalistic and evaluative propositions in spontaneous recall.* Further, a significant effect of condition is predicted on proportion of evaluative and mentalistic propositions in the narratives, with participants in the negative condition producing a higher proportion of such comments than participants in the positive condition at both times of measurement.
- 4) *Cohesive devices in spontaneous recall.* Children in the negative condition are expected to use fewer cohesive devices than children in the positive group at the first interview, when they will still be forming their account of the event. At the second interview however, the proportion of cohesive

devices to narrative length should increase for children in the negative group, and not differ from children in the positive group

- 5) *Elicited recall of present features.* Children's elicited recall about the event will also exhibit valence-related differences. Children are not expected to differ significantly in their accuracy for questions about central and peripheral aspects of the event at the first interview. However, their forgetting over time, as indicated by the change in accuracy from the first to the second interview, is expected to differ by valence condition. Children in the positive condition should show more forgetting of both central and peripheral information than the children in the negative condition. Children in the negative condition are expected to show little forgetting of central information, and no forgetting or an increase in accuracy for peripheral details, due to the facilitative impact of rumination about the event. Thus, an interaction of time and condition is predicted for elicited recall.
- 6) *Correct denial of absent features.* For questions about "absent features" of the event, children in both groups are not expected to differ at the first interview. At the second interview, however, children in the negative condition should outperform children in the positive condition.

## Method

### *Design and Overview*

Children were interviewed immediately after their participation in a soccer game. Children who participated on winning teams constituted the positive outcome study group, whereas those participating on losing teams constituted the negative outcome group. After 6 weeks, when some memory for the event was expected to have faded, children were interviewed again to assess the role of positive and negative emotions on event memory.

### *Participants*

Participants were 69 children (42 boys and 27 girls) who were recruited through advertisements in a local soccer publication and contacts with coaches and tournament staff. The participants' mean age was 116.43 months ( $SD = 6.98$ ), with a range of 97 to 130 months of age. The children were drawn from the pool of players in the Under-9 and Under-10 age categories that were used by local soccer organizations to group players by their age the preceding August. Potentially participating families received a letter summarizing the research procedures and requesting permission to include their child in the study. (See Appendix A for a copy of this letter.) Approximately 54% of families contacted elected to participate in the study. Participants were compensated with a \$5 gift card to a local business at each interview, and a matching contribution was made to the soccer organizations.

Participants formed two groups on the basis of event outcome (positive vs. negative). The positive outcome group included 42 participants (17 girls, 25 boys) and the negative outcome group included 27 participants (10 girls, 17 boys). Eight children

did not complete the second interview (2 girls and 3 boys from the positive group, 1 girl and 2 boys from the negative group). Each family was contacted at least five times by two researchers without success before a participant was dropped from the study. These 8 participants did not differ from the 61 participants who were tested at both times in mean age, length of spontaneous narrative, or any recall measures. Thus, data for the 8 children who dropped out of the study are included for all analyses except those involving repeated measures.

### *Event*

The soccer tournament was held at the soccer fields where the participants played their regular season games. Games consisted of two 30-minute halves and a 10-minute half-time break. The target event that was the focus of this research was the final game in the tournament for any participant's team. Because the soccer season had ended, children were not expected to have intervening soccer games between the first and second interview occasions.

Spectators, who were primarily family members of players, sat on bleachers or in chairs near the sidelines. Researchers observed the game and scored it by taking notes on a clipboard and audio recording comments about the game as they occurred. At half-time, researchers reviewed the list of elicited recall questions, and recorded information about peripheral aspects of the game (e.g., weather, uniform colors). At the conclusion of the game, researchers again reviewed all the questions to insure that all target information about the event had been recorded. At least two researchers scored each game.

After the game, players spoke briefly with their coach, and then came to a research table set up between the field and the parking lot to be interviewed. Interviews

were conducted on an adjacent soccer field. The interview area was furnished with 12 beach umbrellas, with two folding chairs under each umbrella. The distance between interview sites was large enough for there to be little sound carryover from one interview site to a bordering one. When each game ended, a group of researchers were lined up behind the research table with interview materials and clipboards, so that interviews could start promptly. Parents filled out consent forms and usually waited near the research table (approximately 100 yards from the interview sites).

At the conclusion of the interview, researchers walked children back to the research table to be reunited with their parent(s). At this time children were thanked and compensated for the interview, and parents were informed that they would be contacted in approximately four weeks to make an appointment for a second interview.

#### *Interviewers*

Researchers were 13 undergraduate students and the principal investigator. Eleven of the undergraduate researchers and the principal investigator were students at North Carolina State University, and two of the undergraduate researchers were students at the University of North Carolina at Chapel Hill. Five of the researchers were male, nine were female, and all were European American. Two researchers and the principal researcher were over 30 years old, and eleven researchers were in their early 20s. A large group of researchers was needed in order to conduct post-game interviews at the soccer venue in a timely manner.

As an introduction to this research, researchers were asked to read summaries of two pilot studies, as well as literature regarding children's memory and techniques for eliciting information from children through interviews. Following this, interviewers were

provided with a copy of the interview protocol, and trained in a group setting on the skills needed for interviewing young children. Researchers interviewed each other and interviewed or observed interviews with children at the training sessions. Interviews conducted at the training sessions were not included in this research. Each researcher observed at least one interview with a child prior to conducting an interview. The principal investigator and two researchers who participated in the pilot studies observed the initial interviews and monitored interviewers to ensure their conformity to protocol instructions. All interview tapes were transcribed by experienced interviewers, and it was determined that interviewers were compliant with protocol instructions.

The principal investigator completed a total of 23 of the 130 interviews. Two undergraduate co-investigator researchers completed 21 and 30 interviews, respectively. Eleven undergraduate researchers, each of whom conducted fewer than 10 interviews, conducted the remaining interviews. There was no effect of interviewer, and no time by interviewer interaction, on the length of narratives elicited by the interviewers or in the proportion of correct responses to elicited recall questions about central or peripheral aspects of the game.

#### *Interview Protocol*

The interview protocol consisted of four sections. The first section focused on building rapport between the interviewer and the participant, and included questions about the child's age, number of years playing on a recreational soccer team and the number of days per week the child played soccer. The second section focused on spontaneous recall of the event, the third section focused on elicited recall about the

event, and the final section contained the event salience and emotion valence rating questions.

*Spontaneous recall.* The children's narrative accounts of the game were first elicited as spontaneous recall (see Appendix B for a copy of the interview protocol). Spontaneous recall was defined as the information the child provides in response to only very general prompts by the interviewer (e.g., Ornstein et al., 1992). Spontaneous recall was elicited through open-ended questions, including the following: "Tell me about this last game," "Tell me more about that," "Tell me what else happened." The spontaneous recall portion of the interview ended after the child had provided all the spontaneous information that she could and responded in the negative to the question, "Can you tell me anything else about what happened during the tournament game?"

*Elicited recall.* In the elicited recall portion of the interview, participants responded to standard closed questions regarding central and peripheral components of the game. These components were initially defined on the basis of Peterson and Bell's (1996) classification. In this study, central components affected the play or outcome of the game or referred to an invariant aspect of the game. Peripheral components, in contrast, were outside the game or did not affect play directly, including descriptive and visual information, play not related to scoring, and pre-game or post-game activities. For example, "What was the final score?" is a central component, whereas "What color uniform did the other team wear?" is classified as a peripheral component. These classifications were developed through pilot work (Eaton & Baker-Ward, 2003). Researchers first agreed on the category to which questions were to be assigned (central vs. peripheral). Young soccer players then categorized these questions. This was

important because previous research suggests that the central and peripheral nature of event components may be ascribed differently by researchers and children (Peterson & Bell, 1996). All items were categorized by four 10-year-old children who were participants in a soccer league in the same geographical area from which participants for this study were recruited, but were not members of the teams involved in this study. When there were discrepancies in categorizations, the soccer players' categorizations were used. So, for example, a question in the first pilot study that asked about instructions from the coach elicited comments from the players that all comments and directions to the players by coaches and parents during the game were peripheral. Although no questions about coach and parent talk were used in the elicited recall portion of the interview for this study, this information was used when coding such information when it occurred in the spontaneous recall narratives.

The interview questions referenced both actions that did and did not transpire, in order to include suggestibility items (see Appendix C for the distribution of interview questions among the four categories). For example, "What was the score?" referred to a central present feature, and "How many times did a player score from midfield?" referred to a central absent feature. Similarly, "What color uniforms did the other team wear?" referred to a peripheral present feature and "What kind of drills did you do at half-time?" referred to a peripheral absent feature. For each game, the assignment of questions to present and absent feature categories was adjusted based on what actually transpired. Question order within the elicited recall segment was counterbalanced across participants; however, the spontaneous recall segment always constituted the first half of the interview.

### *Event Salience Ratings*

Event salience was measured with three items regarding game importance and individual and team performance (see Appendix D for a copy of the complete rating scales). Participants rated how much they wanted to win the game on a 7-point Likert scale ranging from “I wanted to win as much as I've ever wanted anything in my life” to “I didn't care if we won or lost.” Individual and team performance evaluations were obtained by participants' ratings on a 7-point Likert scale ranging from “It was [my][our] best game ever” to “It was [my][our] worst game ever”.

### *Emotion Valence Ratings*

After the game, participants were asked to describe all the things they were thinking and feeling when they were on the field immediately prior to the start of the game and all the things they were thinking and feeling before they left the field when the game ended (see Appendix E for the complete instructions to the participants). In pilot work with these items, when children described both their pre-game and post-game feelings, self-reported pre-game emotion differed from post-game emotion (which was indistinguishable from event outcome) (Eaton & Baker-Ward, 2003). So, for example, a child on a team that lost their game described her feelings before the game as

Well I think we were all really excited because we've been a team for a really long time and we've never made it to the championship. And we were pumped, and we didn't think we were going to win, but we didn't really care because just making it to the championships was an honor.

and after the game as

I'm feeling disappointed, because I wanted to win even though it didn't really matter. And I was feeling just a little angry, because some of the players on the other team had been scoffing, and we were like "they stink."

Participants also were asked when in the game they knew who would win the game, to determine how early in the event the emotion associated with the outcome may have been present, and thus may have affected encoding of the event. A child who did not know their team would lose until the end may have encoded information about the game more similarly to participants who won the game (and also did not know until the end), compared with participants on teams that lost the game and knew early in the game that they were going to lose.

### *Procedure*

Participants were on different teams playing in 13 separate games in two local tournaments. The events were observed and scored by the researchers, enabling verification of the children's subsequent reports. Researchers noted the absence, or presence and number of occurrences, of each item in the interview protocol for each game. Participants were interviewed for the first time immediately after the game, and were assigned to one of two groups on the basis of the naturally occurring outcome of the games: a positive event group (won the game), and a negative event group (lost the game). Interviews were audio recorded and transcribed verbatim for data entry and narrative coding.

After a delay of 6 weeks, children in both the positive and negative event groups were interviewed using the same interview protocol that was used in the first interview. This interval was chosen because, presumably, some memory for the event would have faded. The final interview was conducted in the child's home, by an interviewer who had not previously interacted with the child. The interval between the first and second interview times was approximately 6 weeks ( $M = 41$  days,  $SD = 7$  days), and did not differ for the two outcome groups.

### *Coding*

*Propositions.* Each child's narrative was coded for the number of propositions. Propositions were defined as independent clauses including a subject and a verb. As in previous studies (e.g., Hudson & Shapiro, 1991; Peterson & McCabe, 1994), propositions were coded when subjects or verbs were implied. For example, if a child responded to the general spontaneous recall prompt "Tell me what happened" with "First, they kicked it out of bounds. We threw it in and we got our first goal and then came back", then "they kicked it out of bounds" would be coded as the first proposition, "we threw it in" would be coded as the second proposition, "we got our first goal" would be coded as the third proposition and "came back" would be coded as a fourth proposition with the subject implied "we".

Propositions such as "I don't know", "I forget", and "I don't remember" were omitted. For example, if the interviewer prompted, "Can you tell me anything else?" and the child responded with "That's all" or shrugged, then the child's response was not coded.

*Spontaneous recall.* Spontaneous recall was scored as the proportion of propositions containing central, peripheral, evaluative or mental propositions to the total number of propositions for each child. Central and peripheral information was defined in manner consistent with the determination of central and peripheral components of the event in the design of the interview protocol (see description above). Evaluative information referred to any utterance that contained an assessment or conclusion about something that occurred in the game (e.g., “They were better than us”, “I played well”). Mental information referred to the participant’s description of a cognitive activity (e.g., “I remember”).

Reliability for coding of propositions, calculated on 50% of the transcripts, was excellent (Cohen’s  $\kappa > .81$  overall; central items  $\kappa > .82$ , peripheral items  $\kappa > .71$ , mentalistic items  $\kappa > .90$ , and evaluative items  $\kappa > .80$ ). Two researchers independently coded 100% of the transcripts from both the first and second interviews, and differences were resolved by discussion between the coders.

*Narrative cohesion.* The method for coding narrative cohesion was an adaptation of a method employed by John-Steiner and Panofsky (1987; cited in Hudson & Shapiro, 1991). Cohesive devices were operationalized as the proportion of devices used divided by the total number of propositions in each child's narrative. Four types of devices were counted to measure the cohesion of children's narratives: simple connectives (e.g., “and”), temporal connectives (e.g., “then”, “first”, “next”, “before”), adversative connectives (e.g., “but”, “except”, “sometimes”, “usually”, “though”), and causal connectives (e.g., “because”, “if”, “so”). Scores for the four device types for each child were summed and divided by the total number of words in the narrative, to arrive at a

coherence score for each narrative at each time of measurement. Reliability between two coders for 50% of the narratives was excellent (Cohen's  $\kappa > .80$ ).

*Elicited recall.* Within the elicited recall section of the interview, the division of interview questions between the present feature and absent feature categories was not uniform across participants. Depending on the circumstances of each participant's target event, items were allocated to the present-feature and absent-feature categories in keeping with what actually transpired. Because of this variation in how many items applied to a participant's situation, children had different numbers of scorable items in each category (but, because the categories encompassed present and absent features, all items were scorable into one of the categories for all children). For example, the response to "How many times did the other team score on a penalty kick?" was a central-present feature for some participants, and a central-absent item for others. Thus, elicited recall scores were calculated as the proportion of correct times to the total items for each child in each category using only the scorable items for that category.

Children's correct recall of elicited event-related information was represented by the proportion of correct responses to elicited recall questions divided by the total number of questions posed. Two coders independently coded the raw narrative responses as correct or incorrect by comparing them to the researchers observations of the events. Reliability between two coders for 25% of the interviews was excellent (Cohen's  $\kappa > .80$ ).

Proportions were calculated within the categories of central and peripheral aspects of the event for items relating to both central and peripheral "present feature" and "absent feature" questions. Correct denials were calculated for each child as the proportion of

accurate rejections of questions about actions that did not actually take place. Thus, each child had 4 elicited recall scores: proportion correct central – present features, proportion correct peripheral– present features, proportion correct denials central-absent features, and proportion correct denials peripheral-absent features.

*Emotion valence.* Children’s emotional reactions prior to and following the event were independently coded by two researchers. Global ratings of positive, negative-dominant or negative-submissive were assigned to participants responses based on the emotional content of the narrative. Positive ratings included descriptions of happiness and excitement. Negative-dominant ratings were assigned to descriptions of anger or hostility. Negative–submissive ratings were assigned when children described sadness or disappointment. When a child’s narrative included mixed descriptions, the valence of the first emotion word to occur in the narrative was used to assign the global rating. Previous work with this paradigm has suggested that all three emotion categories may be present in the children’s reports, however in this sample only one child expressed a negative-dominant emotion (“I was kind of sad and angry because I had thought we were going to win when we were first two to nothing.”), and it was not the first-occurring emotion statement. Thus, a single emotion category of “negative” was assigned to all negative comments.

## Results

The results section begins with a description of the analytic methods used. Descriptive statistics are presented next, to summarize the characteristics of the sample and provide evidence that the event was both salient and emotional for participants. Next, analyses associated with participants spontaneous recall narratives are described. Participants' responses to elicited recall items is described next, followed by analyses of the event ratings, salience and emotion ratings. Finally, the relationships between the event ratings, salience and emotion ratings and outcome are explored, and the repeated measures analyses of variance on spontaneous and elicited recall are reproduced using these alternative conceptualizations of "event outcome".

### *Analytic Strategy*

The main hypotheses tested in this study were examined in a series of 2 X 2 (Time X Outcome) repeated measures mixed analyses of variance (ANOVA). These models with time as a within-participant factor, and outcome as a between-participants variable, were used to test the effect of time, outcome and interaction between time and outcome on spontaneous and elicited recall. Analyses were conducted using the Mixed procedure in SAS® because the mixed model approach provides a larger class of covariance structures and a better mechanism for handling missing values than the GLM procedure (Jennrich & Schluchter, 1986; Wolfinger & Chang, 1995). The Mixed procedure allows specification of a particular covariance matrix structure, rather than imposing an assumption of compound symmetry, which has constant variance and constant covariance. In these analyses, a completely general (unstructured) covariance matrix, parameterized directly in terms of variances and covariances, was compared with a compound symmetry

covariance matrix structure. Other covariance structures can be tested, such as an autoregressive model that assumes measurements taken closer in time are more highly correlated than those farther apart in time, but these do not add any information when there are just two times of measurement. Goodness of fit of the model was examined using alternate covariance structures of unstructured (no assumption about the relationship in the correlations between times of measurement) and compound symmetry (assumes that repeated measurements are correlated). Table 3 summarizes the model fit criteria values obtained using both compound symmetric and unstructured variance structures, computed using Akaike's Information Criterion (AIC; Akaike, 1974; Harvey, 1981) and Schwarz' Bayesian Criterion (BIC; Schwarz, 1978). Both criteria are log-likelihood values penalized for the number of parameters estimated, and BIC imposes a heavier penalty than AIC. The AIC is computed as  $-2 \ln(L) + 2k$ , where  $L$  is the likelihood function and  $k$  is the number of free parameters. The BIC is computed as  $-2 \ln(L) + \ln(n)k$ , where  $n$  is the number of residuals that can be computed for the data. The model with the smaller information criteria is said to fit the data better. The best fit using at least one of these criteria was obtained using a compound symmetry covariance structure in 9 of the 10 dependent variable cases, thus compound symmetry structure was specified in the final model.

### *Descriptive Statistics*

*Background characteristics of participants.* The groups did not differ in age  $t(66) = -0.16$ , ns, and age was not significantly correlated with any of the spontaneous or elicited recall measures (all  $r_s < .12$ , all  $p_s > .15$ ). There were no differences in the mean number of boys and girls in each group,  $\chi^2(1, N = 69) = 0.0816$ , ns. There were no

Table 3

*Goodness of Fit Statistics for Dependent Variables Under Compound Symmetry and Unstructured Covariance Structure Assumptions*

Recall Type	Variable	Goodness of Fit Statistic	Compound Symmetry	Unstructured	
Spontaneous	Central propositions	AIC	133.5	135.5	
		BIC	138.0	142.2	
	Peripheral propositions <sup>1</sup>	AIC	38.7	31.2	
		BIC	43.2	37.9	
	Mentalistic propositions	AIC	-9.1	-11.3	
		BIC	-4.7	-4.6	
	Evaluative propositions	AIC	99.9	101.8	
		BIC	104.4	108.5	
	Cohesive Devices	AIC	-165.3	-164.6	
		BIC	-160.8	-157.9	
	Total Propositions	AIC	922.6	925.1	
		BIC	929.3	929.6	
	Elicited	Central correct recall	AIC	-49.6	-47.7
			BIC	-45.1	-41.0
Central correct denials		AIC	55.5	55.1	
		BIC	60.0	61.8	
Peripheral correct recall		AIC	-58.1	-60.1	
		BIC	-53.6	-53.4	
Peripheral correct denials		AIC	27.3	29.1	
		BIC	31.7	35.8	

differences between boys and girls in reports of pre-game emotion at the first interview  $\chi^2$  (1,  $N = 66$ ) = 1.36, ns, or in mean recall of central or peripheral aspects of the event for both absent and present features at either time of measurement,  $t(67) = .03, -1.48$ ,

<sup>1</sup> The unstructured covariance structure was associated with a better fit for the proportion of peripheral propositions in the narratives, indicating that the variances are unequal.

-.87, -.44 for central-present, central-absent, peripheral-present, and peripheral absent, respectively, all  $ps > .10$ . Thus, age and sex are not included in any subsequent analyses. As expected, at the first interview, the groups did not differ with regard to the number of years they reported playing on a recreational soccer team, or their self-reports of their personal investment in the outcome of the game (“How much did you want to win the game?”). Means and standard deviations on these measures for each group are presented in Table 4.

There was a significant group difference in the number of days per week children reported practicing soccer, with children in the negative outcome group recalling that they practiced more often than children in the positive outcome group,  $t(62) = 2.25, p < .05$ . Since this variable was included solely for the purpose of describing the sample, and is not linked to any of the dependent measures of interest, it is not discussed further and is not included in any further analyses.

*Length of narratives.* The length of children’s narratives at both times of measurement, measured by the number of propositions in the free recall narrative, was quite variable and did not differ by outcome group or time of measurement (see Table 5). Because of this variation in narrative length, the spontaneous recall scores are presented as the participant’s ratio of relevant propositions (e.g., central, peripheral, mentalistic, evaluative) to the participant’s total number of propositions.

*Association between game outcome and emotion.* As expected, children’s post-event feelings at the first interview were significantly related to the event outcome,  $\chi^2(2, N = 66) = 17.58, p = .0002$ . Participants in the negative outcome group reported negative

Table 4

*Means (and Standard Deviations) for Descriptive Variables by Outcome Group*

	Negative ( <i>n</i> =27)		Positive ( <i>n</i> =42)		<i>t</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Age (Months)	116.26	6.84	116.54	7.16	-0.16	<i>ns</i>
Wanted to Win	5.37	2.00	5.52	1.66	2.25	<i>ns</i>
Soccer Practice (Days per Week)	3.96	2.57	2.53	2.47	2.25	0.0282
Soccer Experience (Years)	4.37	1.72	4.13	1.71	0.56	<i>ns</i>
Days Between Interviews	40.63	6.72	42.00	7.20	-0.76	<i>ns</i>

Table 5

*Means (and Standard Deviations) of Spontaneous and Elicited Recall Variables by Time and Outcome Group*

	Time 1				Time 2			
	Negative ( <i>n</i> = 27)		Positive ( <i>n</i> = 42)		Negative ( <i>n</i> = 24)		Positive ( <i>n</i> = 37)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
<b>Spontaneous Recall</b>								
Narrative Length <sup>1</sup>	13.00	11.08	14.33	12.01	11.29	10.05	11.56	9.04
Central Propositions <sup>2</sup>	0.50	0.28	0.53	0.30	0.54	0.29	0.51	0.29
Peripheral Propositions <sup>2</sup>	0.09	0.12	0.06	0.09	0.08	0.15	0.13	0.21
Mentalistic Propositions <sup>2</sup>	0.07	0.09	0.04	0.08	0.12	0.13	0.10	0.14
Evaluative Propositions <sup>2</sup>	0.34	0.23	0.32	0.27	0.26	0.25	0.23	0.24
Cohesive Devices <sup>3</sup>	0.07	0.04	0.10	0.09	0.08	0.04	0.08	0.07
<b>Elicited Recall</b>								
Central – Present <sup>4</sup>	0.66	0.11	0.69	0.17	0.47	0.19	0.49	0.17
Peripheral – Present <sup>4</sup>	0.82	0.14	0.89	0.10	0.74	0.14	0.76	0.13
Central – Absent <sup>4</sup>	0.77	0.22	0.73	0.21	0.59	0.20	0.58	0.19
Peripheral – Absent <sup>4</sup>	0.90	0.13	0.81	0.17	0.77	0.18	0.78	0.15

<sup>1</sup> Number of propositions in narrative.

<sup>2</sup> Ratio to total number of propositions in narrative.

<sup>3</sup> Ratio to total words in narrative.

<sup>4</sup> Proportion correct.

post-game feelings more often than participants in the positive outcome group.

Participants' reports of their feelings at the start of the event, however, were independent of the outcome of the game,  $\chi^2 (2, N = 66) = 1.37$ , ns.

### *Spontaneous Recall*

As reported above, the outcome groups did not differ with regard to the total number of propositions reported at either time of measurement. Hence, categories of information were analyzed in terms of the proportion of central, peripheral, evaluative and mentalistic propositions to the total propositions in the narratives. Because proportion scores are known to violate assumptions regarding the normal distribution, with variances being largest at .5 and nearly 0 as the proportion approaches 0 or 1, proportions were transformed to the arcsine of the square root of the proportion for all tests (Steele, Torrie, & Dickey, 1997)<sup>1</sup>. Hypothesis tests were conducted on the transformed data. However, to facilitate interpretation of the results, descriptive statistics (means and standard deviations) are reported in the original (untransformed) unit of measure. Correlations among the spontaneous and elicited recall variables are presented in Table 6.

The groups did not differ in the proportion of propositions in their narratives that related to central aspects of the event, and there was no significant change over time in this proportion. Central propositions accounted for the majority of the narrative for both groups at both times of measurement. The means and standard deviations for each group at each time are presented in Table 5.

<sup>1</sup> Another approach appropriate for analysis of proportions is to transform the scores to the log of the score, increased by a constant to address any proportions equal to zero. Analyses were conducted on the spontaneous recall scores using the logs, and the pattern of obtained results did not differ. Thus, analyses using the arcsine transformed scores are reported here.

Table 6

*Correlations Among Spontaneous and Elicited Recall Measures (Time 1 below diagonal)*

Variables	1	2	3	4	5	6	7	8
1 Central Propositions <sup>1</sup>		-0.46***	-0.22+	-0.59***	-0.01	-0.17	-0.04	-0.14
2 Peripheral Propositions <sup>1</sup>	-0.22 <sup>+</sup>		-0.03	-0.16	-0.07	0.08	0.04	0.10
3 Mentalistic Propositions <sup>1</sup>	-0.29*	-0.03		-0.22 <sup>+</sup>	-0.30*	0.12	-0.14	0.19
4 Elicited Propositions <sup>1</sup>	-0.75***	-0.06	0.10		0.20	0.06	0.05	-0.03
5 Central – Present <sup>2</sup>	-0.15	-0.05	0.04	0.13		0.13	0.39**	0.09
6 Central – Absent <sup>2</sup>	0.13	-0.04	-0.04	-0.19	0.01		0.09	0.21
7 Peripheral – Present <sup>2</sup>	-0.26*	-0.20 <sup>+</sup>	0.14	0.25*	0.53***	-0.002		0.06
8 Peripheral – Absent <sup>2</sup>	-0.04	0.02	0.07	0.03	0.24*	0.20 <sup>+</sup>	0.06	

<sup>1</sup> Ratio to total number of propositions in narrative.

<sup>2</sup> Proportion correct.

+ $p < .10$ . \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

The proportion of propositions about details peripheral to the event also did not differ between groups or across times of measurement. There was a trend for an outcome by time interaction in the proportion of peripheral propositions in the narratives,  $F(1,66.1) = 3.47, p = .0669$ . Participants in the negative group exhibited little change over time in the proportion of peripheral propositions included in their narratives, whereas participants in the positive condition included a greater proportion of peripheral propositions at the second interview than they had at the first interview.

Mentalistic statements (e.g., “I think”, “I remember”) occurred infrequently compared with statements about central and evaluative aspects of the event, and constituted a larger proportion of the propositions at the second interview than the first interview for both groups,  $F(1, 65.1) = 7.34, p = .0086$ . Evaluative statements exhibited the reverse pattern, with propositions of this type being more likely to occur in narratives at the first interview than the second,  $F(1, 59.8) = 8.37, p = .0053$ .

#### *Elicited Recall*

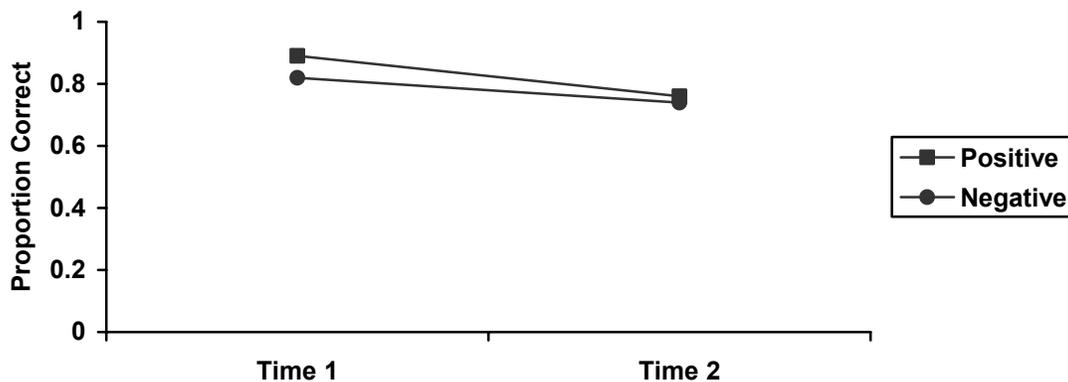
*Central present and absent features.* When children were asked questions about central features of the event, they provided a greater proportion of correct responses at the first interview as compared to the second interview, for both present features,  $F(1, 65) = 58.22, p < .0001$ , and absent features (correct denials),  $F(1,62.6) = 22.58, p < .0001$ . There were no between group differences in the proportion of correct recall for present or absent central features of the event. Means and standard deviations for central present and absent features are presented in Table 5.

*Peripheral present and absent features.* There was a group by time interaction in the proportion of correct responses to questions about peripheral, present aspects of the

event,  $F(1, 62.7) = 5.06, p < .05$  (see figure 1). For questions about peripheral aspects of the event that did occur, children in the positive outcome group correctly recalled a greater proportion of the peripheral present features at the first interview compared with children in the negative outcome group at the first interview. Both groups declined over time in their ability to correctly recall peripheral details, but the positive outcome group declined more steeply, such that by the time of the second interview the two groups performed approximately equally on these questions. Means and standard deviations for peripheral present and absent features are presented in Table 5.

Figure 1

*Interaction Between Time and Outcome on Proportion of Correct Recall of Peripheral Event Features.*

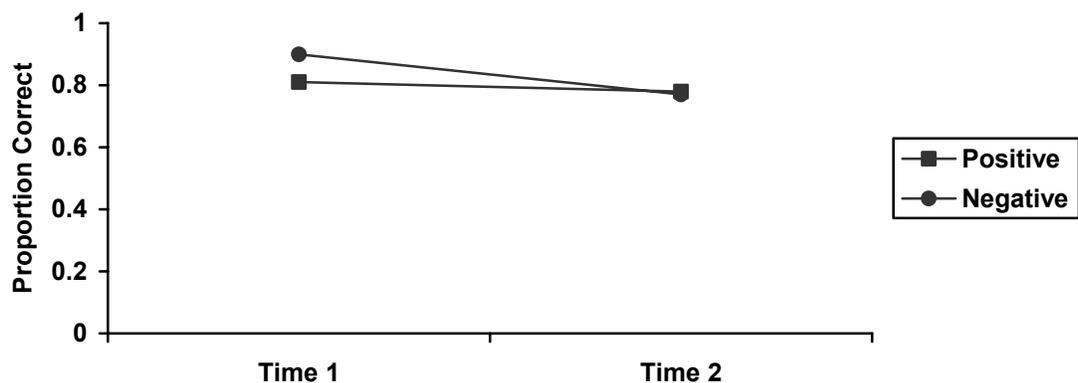


There was a main effect of time on the proportion of correct responses to questions about peripheral present features of the event,  $F(1, 62.7) = 43.43, p < .0001$ . This result indicated that children responded correctly to a greater proportion of the questions at the first interview compared with the second interview.

Additionally, there was a group by time interaction in the proportion of correct denials to questions about peripheral, absent aspects of the event,  $F(1, 61.2) = 5.79$ ,  $p < .05$  (see figure 2). For questions about peripheral aspects of the event that did not occur, children in the negative outcome group correctly denied a greater proportion of the peripheral absent features at the first interview compared with children in the positive outcome group at the first interview. Both groups declined over time in their ability to correctly deny questions about peripheral details that did not occur, but the negative outcome group declined more steeply. Thus, like the group comparisons for correct recall of peripheral present features, by the time of the second interview the two groups performed approximately equally on these questions.

Figure 2

*Interaction Between Time and Outcome on Proportion of Correct Denials of Peripheral Absent Feature Questions.*



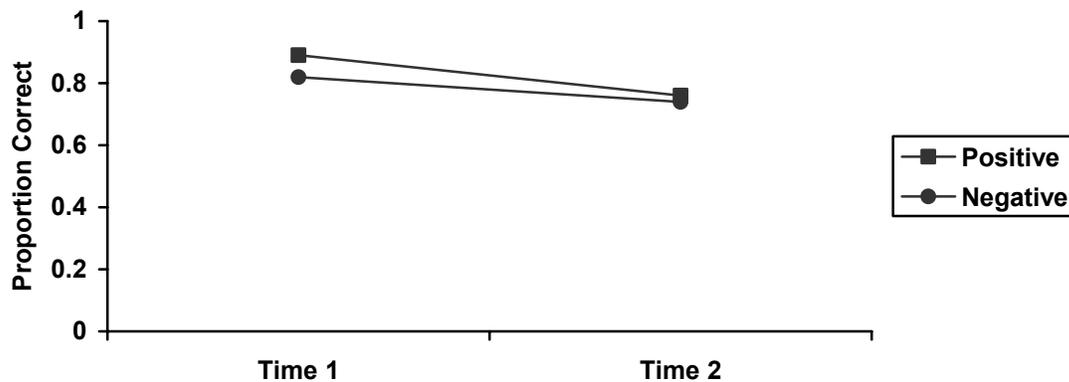
There was a main effect of time on the proportion of correct denials to questions about peripheral absent features of the event,  $F(1, 61.2) = 15.50, p < .001$ . Children correctly denied a greater proportion of the questions at the first interview compared with the second interview.

#### *Narrative Coherence*

There was a significant time by outcome interaction in participants' use of cohesive devices in their spontaneous narratives as a proportion of total words in the narrative,  $F(1, 62.1) = 4.18, p < .05$ . At the first interview, children in the positive outcome group used a greater proportion of cohesive devices in their narratives compared with children in the negative outcome group (see Table 5 for the means and standard deviations). At the second interview, however, the children in the negative outcome group used more cohesive devices than they had at the first interview and the children in the positive outcome group used fewer than they had at the first interview. There was a trend for a main effect of time in use of cohesive devices,  $F(1, 62.1) = 2.85, p < .10$ . Participants tended to use more of these narrative devices at the first interview than they had at the second interview ( $M = .09$  and  $.08, SD = .07$  and  $.06$ , for the first and second interviews, respectively).

Figure 3

*Interaction Between Time and Outcome on Proportion of Cohesive Devices to Words in Spontaneous Recall Narratives*



#### *Event Salience*

Participants' ratings of event salience were first examined for the extent to which they were independent of game outcome. The four items in this category were questions regarding how much the participant wanted to win the game at the outset, how well they thought the game turned out for themselves, how well they thought the game turned out for their team, and when in the game they were confident about which team would win the game.

*How much they wanted to win the game.* Participants' ratings of the strength of their desire to win the game were collapsed from 7 levels to 4 for analysis. At the first interview, 8 children gave this item a rating of 1 ("I didn't care if we won or lost."), there were no ratings of 2 ("I wanted to win but just a little") or 3 ("I wanted to win a medium amount"), and only 2 children rated it a 4 (I wanted to win quite a bit). Thus, ratings 2

and 3 were dropped, and rating 4 was combined with rating of 5 (“I wanted to win a lot”), resulting in the 4 levels listed in Table 7.:

Table 7

*Event Salience Ratings Collapsed to Four Levels*

Rating	Description	<i>n</i>
1	I didn't care if we won or lost.	8
2	I wanted to win quite a bit or a lot	13
3	I wanted to win a whole, whole lot	30
4	I wanted to win as much as I've ever wanted anything in my life	18

Analysis of the relationship between event outcome and participant’s desire to win the game indicated that self-reported desire to win was independent of game outcome,  $\chi^2(3, N = 69) = 3.51$ , ns.

*Team and individual performance.* Participants also rated team and individual performance in the event on a scale ranging from our/my best game ever to our/my worst game ever, by responding to the question “How do you feel about how your last game turned out for you/your team?” These two performance ratings were significantly correlated at both times of measurement,  $r(67) = .59$  and  $.64$  at Time 1 and Time 2, respectively,  $ps < .0001$ . Performance ratings were not related to participants’ reports of

their desire to win the game for either individual or team performance at either time of measurement,  $r_s = .07$  to  $-.15$ , ns.

Participants rarely used rating levels 1 through 4 with regard to team performance. Only one child (on a winning team) rated performance as a 1 (“It was our worst game ever”), rating level 2 was not used and two children (on losing teams) indicated rated it a 3 (“It wasn't awful but it wasn't good”). These two levels were combined with level 4 (“It was an OK game for us”) to create a neutral to negative category, resulting in the four levels listed in Table 8.

Table 8

*Team Performance Ratings Collapsed to Four Levels*

Rating	Description	<i>n</i>
1	An OK game for us / our worst game ever.	11
2	A pretty good game for us.	10
3	A really good game for us.	29
4	Our best game ever.	19

Analysis of the relationship between team performance ratings and outcome indicated that these variables may be independent,  $\chi^2(3, N = 69) = 6.17, p = .1038$ . This finding should be interpreted with caution because 25% of the cells have expected counts less than 5, thus Chi-Square may not be a valid test. When team performance is treated

as a continuous variable, there is a significant group difference in the mean rating,  $t(65) = -2.01, p < .05$ . Children in the positive outcome group rated their team performance higher than children in the negative outcome group ( $M = 6.02$  and  $5.44, SD = 1.14$  and  $1.19$  for the positive outcome group and the negative outcome group, respectively). This finding should also be interpreted with caution, because the ratings were not equally spaced and thus are not continuous data. The trend toward a group difference in the chi square analysis and the group difference finding in a comparison of the means suggests that there may be a real group difference and that team performance ratings may not be independent of the outcome of the event.

In contrast to ratings of team performance, participants' ratings of their individual performance was significantly related to event outcome, suggesting that these variables may not be independent,  $\chi^2(4, N = 69) = 12.55, p = .0137$ . This finding should be interpreted with caution because 40% of the cells have expected counts less than 5, thus Chi-Square may not be a valid test. When individual performance was treated as a continuous variable, there was a significant group difference in the mean rating,  $t(67) = -3.70, p < .001$ . Children in the positive outcome group rated their team performance higher than children in the negative outcome group ( $M = 5.98$  and  $4.92, SD = 1.00$  and  $1.36$ , for positive outcome group and negative outcome group, respectively). As noted above, this finding should likewise be interpreted with caution, because the ratings were not equally spaced and thus are not continuous data. The group differences illustrated in the chi square analysis and the comparison of means suggests that there may be a real group difference and that personal performance ratings may not be independent of the outcome of the event.

*When they knew who would win.* Participants responses regarding when in the game they knew the outcome were significantly related to game outcome at the first interview,  $\chi^2(2) = 14.33, p = 0.0008$ . Participants in the negative outcome group were approximately evenly divided between categories of children who reported knowing the outcome in the first half of the game, children who reported knowing in the second half of the game, and children who said they did not know the outcome until the final minutes of the game (35%, 35% and 30%, respectively). For children in the positive outcome group, only one child reported being confident of the outcome in the first half, one-third of the group reported knowing the outcome in the second half, and the majority of children reported not knowing the outcome until the final minutes of the game or when the game ended (2.5%, 32.5% and 65%, respectively).

To enable an examination of the hypotheses that emotion affects encoding of information, analyses were conducted to examine how the onset of the emotion associated with the outcome (operationalized as when the participant knew the outcome) might have affected encoding of details about the event. As shown in Table 9, children in the positive outcome group reported that they were not confident about the outcome of the game until the second half or the final minutes of the game. Thus, encoding differences based on when during the course of the event they were confident of the outcome would be less likely to have an effect on the positive outcome group, since this group was likely to have remained vigilant until close to the end of the game.

Table 9

*Distribution of Participants among Time of Knowing and Outcome Groups*

	Negative <i>n</i>	Positive <i>n</i>
First Half	9	1
Second Half	9	13
Final Minutes or End	8	26

Participants in the negative outcome group, however, were evenly distributed between knowing the outcome early in the game, during the second half and at the end. Repeated measures analysis of variance was conducted using only the participants from the negative outcome group, to explore the relationship between emotion and encoding at various time periods during the event.

There was no effect of time of knowing the outcome on narrative length, narrative coherence, or any of the measures of spontaneous recall content for participants in the negative outcome group. Additionally, there was no effect of time of measurement, or any interactions with time of measurement, for any time of knowing analyses. There was a significant effect of time of knowing on the proportion correct recall of central present feature items,  $F(2, 23.9) = 3.71, p = .0395$ . Linear contrasts were conducted to examine this effect (see Table 10).

Table 10

*Linear contrasts of Change Over Time in Mean Proportion Correct Central Recall**Between Time of Knowing Groups*

Time of knowing	<i>df</i>	<i>F</i>	<i>p</i>
First half vs. end of game	1, 23	4.54*	0.0439
First half vs. second half	1, 24.2	6.21*	0.0200
Second half vs. end of game	1, 24.7	0.21	0.6487

The contrasts suggest that there was a significant difference in the proportion correct central recall between participants who reported knowing the outcome early in the game, and those that reported knowing either in the second half or at the end. There was no difference in central recall between participants who reported knowing in the second half those who did not know until the end. The mean proportions of correct central recall within time of knowing groups is presented in Table 11. There was no relationship between time of knowing and correct denials of central absent feature questions. There was a trend for an effect of time of knowing on the proportion correct peripheral present feature items,  $F(2, 23.4) = 3.14, p = .0621$ , and for an effect of time of knowing on the proportion correct peripheral absent feature items,  $F(2, 21.8) = 3.10, p = .0651$ . Table 11 presents the means and standard deviations on the recall variables by time of knowing.

Table 11

*Negative Outcome Group Mean (and Standard Deviation) Proportion of Correct Responses to Central Feature Items by Time of Knowing*

	Time of Knowing					
	First Half ( <i>n</i> = 9)		Second Half ( <i>n</i> = 9)		End of Game ( <i>n</i> = 8)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Time 1						
Central – Present	0.58	0.13	0.69	0.10	0.72	0.05
Central – Absent	0.80	0.27	0.76	0.20	0.75	0.20
Peripheral – Present	0.71	0.17	0.89	0.08	0.86	0.08
Peripheral – Absent	0.81	0.15	0.93	0.12	0.95	0.10
Time 2						
Central – Present	0.39	0.17	0.51	0.19	0.54	0.21
Central – Absent	0.54	0.18	0.55	0.15	0.65	0.28
Peripheral – Present	0.70	0.17	0.77	0.12	0.79	0.15
Peripheral – Absent	0.66	0.19	0.79	0.16	0.86	0.13

An alternative way of exploring the effect of time of knowing on encoding is to compare recall performance of participants in the negative outcome group who reported not knowing the outcome until the end of the game (*n* = 8) with recall performance of participants in the positive outcome group who also reported not knowing the outcome until the end. As expected, the groups were nearly identical on all measures of recall.

There were no group differences for extent of narrative, narrative coherence or any measure of spontaneous recall. For elicited recall, there were no group differences on the proportion of correct central or peripheral present feature items. Likewise, groups did not differ in their proportion of correct denials to questions about peripheral present features. They did, however, differ in their proportion of correct responses to peripheral absent feature questions,  $F(1, 32.2) = 7.82, p = .0086$ . Participants in the negative outcome group correctly denied a greater proportion of such questions than did participants in the positive outcome group ( $M_s = .91$  and  $.77, SD_s = .12$  and  $.16$ , for negative and positive groups, respectively).

#### *Performance Ratings as Affect*

Participants' ratings of how the event turned out for their team and for themselves is an alternative way of measuring the presumptive affective state associated with the event. That is, if a child feels that it was their team's best game ever, then the child may have experienced the event as a positive event, regardless of the actual outcome of the event. Similarly, if the child feels that it is his own worst game ever, then the child may have experienced the event as a negative event, even if his team won the game. As discussed above, participants ratings of their individual and team performance were significantly correlated ( $r = .59$  and  $.64$  at Time 1 and Time 2, respectively,  $p_s < .0001$ ).

A repeated measures analysis of variance was conducted on the spontaneous and elicited recall measures using time and the participants' ratings of team performance as class variables. There were no significant differences in the length of narratives, although they tended to be longer at the first interview compared with the second,  $F(1,$

64)= 2.67,  $p = 0.1072$  ( $M=13.79$  and  $11.45$ ,  $SD=11.58$  and  $9.38$ , at the first and second interviews, respectively).

There was a group by time interaction in the proportion of central propositions in the spontaneous recall narratives,  $F(3, 83.4)= 4.18$ ,  $p = 0.0083$ . Figure 3 presents a graph of the interaction, and Table 12 presents the means and standard deviations. Participants who rated their team performance as “our best game ever” used a greater proportion of central propositions at the second interview than they had at the first interview, and participants who rated their team performance as less positive exhibited a less striking shift.

Figure 4

*Time by Team Performance Rating Interaction in Proportion of Central Propositions in the Spontaneous Recall Narratives.*

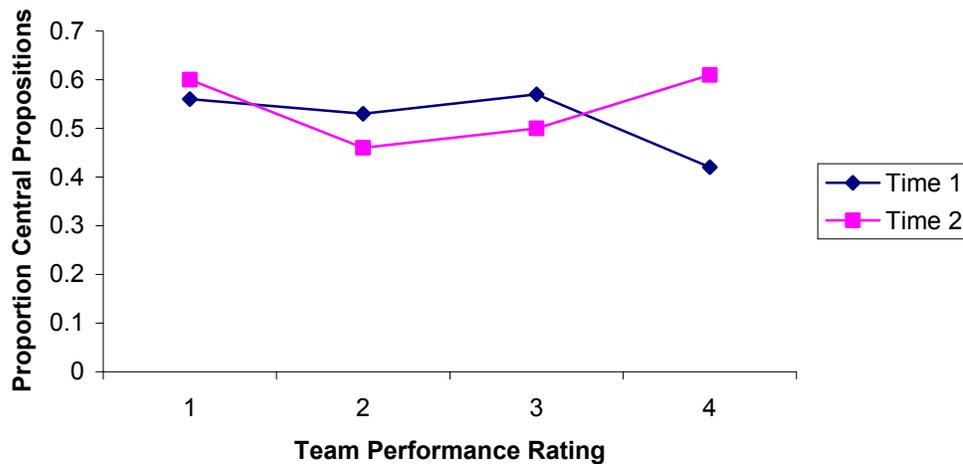


Table 12

*Proportion of central propositions in spontaneous recall narratives by time and team performance rating*

Team Performance Rating	Description	Proportion Central Propositions			
		Time 1		Time 2	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
1	An OK game for us / our worst game ever	0.56	0.24	0.60	0.28
2	A pretty good game for us	0.53	0.25	0.46	0.27
3	A really good game for us	0.57	0.32	0.50	0.32
4	Our best game ever	0.42	0.29	0.61	0.27

There were no differences between groups in the proportion of peripheral, evaluative or mentalistic propositions in the spontaneous recall narratives, or in the proportion of cohesive devices in the narratives.

Elicited recall was related to ratings of team performance in several ways. The proportion of correct recall of central present features was significantly better at the first interview than at the second,  $F(1, 66) = 45.88, p < .0001$  ( $M = .68$  and  $.48, SD = .15$  and  $.17$ , for the first and second interviews, respectively). Higher ratings of team performance tended to be related to better performance on questions about central present features of the event,  $F(3, 115) = 2.58, p = .0570$  (see Table 13).

Correct denial of central absent features was also significantly better at the first interview than at the second,  $F(1, 66.2) = 19.37, p < .0001$  ( $M = .75$  and  $.58, SD = .21$  and  $.19$ , for the first and second interviews, respectively). Higher ratings of team performance tended to be related to better performance on correct denials of questions about central absent features of the event,  $F(3, 115) = 2.57, p = .0577$  (see Table 13). The proportion of correct recall of peripheral present features was significantly better at the first interview than at the second,  $F(1, 65.8) = 31.01, p < .0001$  ( $M = .86$  and  $.75, SD = .12$  and  $.13$ , for the first and second interviews, respectively). Ratings of team performance were not related to better performance on questions about peripheral present features of the event.

Correct denial of peripheral absent features was also significantly better at the first interview than at the second,  $F(1, 66.4) = 8.21, p < .01$  ( $M = .84$  and  $.78, SD = .16$  and  $.16$ , for the first and second interviews, respectively). Ratings of team performance

Table 13

*Elicited recall by team performance rating level.*

		Central – present		Peripheral - present		Central - absent		Peripheral – absent	
Team Performance									
Rating	<i>n</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Time 1									
1	11	0.64	0.15	0.82	0.18	0.65	0.19	0.93	0.10
2	10	0.62	0.09	0.81	0.09	0.68	0.24	0.75	0.17
3	29	0.65	0.17	0.88	0.11	0.80	0.22	0.84	0.17
4	19	0.76	0.14	0.89	0.11	0.76	0.19	0.84	0.15
Time 2									
1	14	0.53	0.20	0.75	0.10	0.46	0.13	0.74	0.18
2	21	0.43	0.17	0.74	0.13	0.56	0.18	0.75	0.16
3	18	0.51	0.14	0.75	0.15	0.62	0.17	0.84	0.11
4	16	0.48	0.21	0.78	0.13	0.60	0.24	0.76	0.21

tended to be related to the proportion of correct denials of questions about peripheral absent features of the event,  $F(3, 114) = 2.56, p = .0587$  (see Table 13). Additionally, there was a trend for a group by time interaction in the proportion of correct denials to peripheral absent feature questions,  $F(3, 89.9) = 2.14, p < .1008$ . Participants who rated performance in the highest and lowest categories declined over time in their ability to correctly deny peripheral absent feature questions, while participants who used the two middle rating categories exhibited little change over the same time period.

## Discussion

This research was conducted to clarify the processes influencing children's encoding, as well as the processes contributing to change over time in children's recall of a personal experience that involved emotion. Much of the research on the relationship between emotion and memory focuses on the intensity and valence of emotion, comparing memory for highly arousing negative events to memory for neutral events (e.g., Fivush et al., 2003). One area that has received little attention, however, is recall for emotionally arousing positive events and how such recall might differ from memory reports of negative events (see, for example, Hastorf & Cantril, 1954). Examination of recall for an event that is both arousing and positive for some participants and arousing and negative for others offers an opportunity to explore the relative contributions of valence and intensity to event memory. By examining recall among children who experienced the same event but had different emotional reactions to it, it was also possible to examine the effects of emotion on recall without introducing the potential confounds of event structure (e. g., causal links between event components) and participants' background, knowledge.

The present study examined the effects of affective valence on young children's encoding and subsequent recall of both central and peripheral aspects of a salient event. This study also explored the relationship between valence associated with an event and children's suggestibility regarding plausible, but absent, features of the event. Finally, this research considered alternative approaches to measuring affective valence and intensity associated with an event, in an effort to more completely describe individual differences in experienced valence.

The following discussion begins with a summary of the study's preliminary and major findings, as well as their implications. After this review, limitations of the study are addressed. Future considerations for predictions about encoding, investigative interviewing, understanding children's coping with negative events, and conceptualizing salience and valence conclude the discussion.

### *Findings and Implications*

*Preliminary findings.* As noted in the results, event outcome and time of measurement did not have significant main effects on the extent of children's spontaneous recall, or on the proportion of central information provided in such narratives. However, as expected, children reported post-game feelings that were consistent with event outcome. Children's reports of pre-game emotion were independent of outcome, even though they knew the outcome at the time of the first interview. This finding suggests that children are accurately distinguishing between their pre- and post-game feelings and that children's reports of post-game feelings are linked to the event.

Participants' ratings of event salience confirmed that the event was personally salient to the participants, and salience was unrelated to outcome, suggesting that such ratings were robust to the effects of subsequent knowledge. Thus, the basic premise that participants experienced an emotional event in which the outcome had personal significance is supported. This is a strength in the study since past research examining the impact of emotional valence has often compared reports of events that differed in salience (e.g., memories of a family gathering versus memories of an injury; Fivush et al., 2003), or studied memory for items that are not personally

salient (e.g., viewing slides; Christianson & Loftus, 1987). Likewise, the finding indicating that narrative length did not differ at either interview occasion for the positive and negative groups supports the assumption that the documented group differences were not simply an artifact of narrative length.

Not surprisingly, participants provided higher ratings of individual and team performance when they won than when they lost, and these two types of ratings were highly correlated. Soccer is a team activity that offers few occasions for individual players to distinguish themselves in a game. Thus opportunities for a player to have a personal best game ever in the context of the team losing the game are infrequent.

*Spontaneous recall.* Occurrence of central propositions in the narratives did not differ by time or outcome group. Production of peripheral information in the narrative tended ( $p < .06$ ) to be influenced by an interaction between time and outcome valence. Contrary to predictions, children in the positive outcome condition included a higher proportion of peripheral information at the second interview than they had at the first, whereas the children in the negative outcome condition remained stable over time. Mentalistic and evaluative statements did not differ by group, but were related to the time of measurement. As expected, mentalistic statements were significantly more frequent in the second interview than they had been in the first, and evaluative statements were significantly more frequent in the first compared with the second interview. At the second interview participants were more likely to use phrases beginning with “I remember...” or “I think...”, reflecting the distance between the event and the interview occasion.

These results differ from previous work using this paradigm (Baker-Ward & Eaton, 2003, Study 2) chiefly by the equivalent use of central propositions by both groups, and the paucity of peripheral propositions in the present investigation. The differences in the interval between the target event and the first interview, as well as the location for the first interview, may have contributed to this difference. In the earlier study the initial interview was conducted in children's homes during the week that followed the event, and no interviews were conducted at the soccer venue on the day of the game. In the present study, all initial interviews were conducted at the soccer fields, within minutes of the end of the game. Thus, opportunities for reflection and consolidation of the event were fewer in this study and may have resulted in fewer differences between outcome groups at the initial interview. The proportion of peripheral propositions in the narratives, and the length of the narratives, appear to be more similar to Study 1 (when initial interviews were also conducted at the soccer venue immediately after the event) than Study 2.

*Elicited recall.* When children were asked about central features of the event, both groups performed equivalently, and were more accurate at the first interview compared with the second interview. However, when children were asked about peripheral features of the event, there was an interaction between group and time. At the first interview children in the positive group outperformed children in the negative group on these questions, but by the time of the second interview there was little difference between the groups. Thus, children in the negative outcome group may have been attending less to the central aspects of the event as it unfolded, leading to poor performance at the first interview compared with the children in the positive

outcome group. The negative outcome group did not lose this information at the same rate as participants in the positive outcome group, however, leading to similar performance across groups over time. While there was no overall main effect of group, both groups performed significantly better at the first interview than they did at the second interview. This is not particularly surprising as many studies have documented memory loss over time.

It is important to remember that central and peripheral items in the elicited recall portion of the interview differ in important ways from central and peripheral items in the spontaneous recall section. Although questions and statements are defined as central or peripheral to the event in the same way, in elicited recall a participant's score is the proportion of items answered correctly and in the spontaneous recall section it is the proportion of that participant's statements that fall into the category. Thus one refers to how often the child was correct, and the other refers to how often the child mentioned a central feature of the event relative to other features.

Analyzing children's narratives in these ways provides opportunities for examining what children are attending to in the event (spontaneous recall) and what children are able to remember about events (elicited recall). This is important because past studies comparing children's memories of emotionally arousing events typically have not examined what children do and do not remember about the event. Rather, they examine either children's spontaneous reports (e.g., Fivush et al., 2003) or elicited recall (e.g., Peterson & Bell, 1996), but not both in the same study. Neglecting to explore children's memories for events beyond those that they offer

through spontaneous recall does not provide a full portrait of the effects of emotional valence on children's event memories. This study begins to provide such an understanding.

*Correct denials.* Participants were also asked about plausible, but absent, features of the event in order to assess differences in suggestibility between groups and across time. Not surprisingly, responses to questions about absent central features were more accurate at the first compared with the second interview across groups.

Analysis of correct denials to questions about absent peripheral features revealed the presence of an interaction between time and group. Consistent with previous work (Baker-Ward & Eaton, 2003), children in the negative condition were more accurate in their responses than children in the positive group at the first interview. By the time of the second interview, both groups had declined and their performance was equivalent. As discussed previously, since encoding is influenced by patterns of deployment of attention, this suggests that children in the positive outcome group were less attentive to peripheral aspects of the event than the children in the negative outcome group. As the event unfolded in a negative way for children on a losing team, they may have diverted their attention toward peripheral aspects of the game as a protective mechanism, to dilute the central (and, in this case, negative) information. Alternatively, children in the positive condition simply may have been more likely to report that absent events did occur because they won the game and, thus were less likely to correctly deny absent features in their elicited recall. This

finding suggests the necessity for further research concerning the emotional valence of events and children's suggestibility based on that valence.

*Narrative coherence.* Cohesiveness of a narrative is thought to enhance recall by facilitating efficient retrieval of a coherent story, rather than expending cognitive resources to recall somewhat scattered, disparate event details. In this study, narrative coherence was influenced by an interaction between time and group such that at the first interview, children in the positive outcome group used a greater proportion of cohesive devices in their narratives compared with children in the negative outcome group. By the time of the second interview, however, the children in the positive outcome group declined in their use of cohesive devices, and were quite similar to children in the negative outcome group (who exhibited a slight increase in such usage). The time one results are consistent with the idea that a negative event requires more time to consolidate into a coherent narrative than a positive experience. Further, the convergence of the two groups over time as hypothesized suggests that this was an easily understandable event that had few lasting consequences for children.

*Time of knowing the outcome.* Perhaps the most interesting findings in the study concern those focusing on when children predicted that they would win or lose their game and the implications they suggest regarding the influence of emotion on encoding. As a reminder, participants in the negative outcome group were evenly distributed across time of knowing categories. One-third of the participants reported that they knew the outcome in the first half of the game, one-third reported they knew in the second half of the game, and one-third reported they knew at end of the game.

By contrast, one-third of the children on winning teams reported being confident of the game outcome in the second half of the game, and two-thirds of children in this group reported being confident of the outcome only at the end of the game.

Examination of differences in recall among the negative outcome group suggests that time of knowing the outcome may indeed have had an effect on children's encoding of the event. Participants who reported knowing the outcome in the first-half of the game were significantly worse at correctly responding to questions about central aspects of the event compared with participants who reported knowing the outcome in the second half or at the end of the game. This effect was present at both times of measurement. Correct denials to questions about absent central features were not related to time of knowing. However, correct recall of peripheral present features and correct denials to questions about peripheral absent features followed the same pattern as performance with respect to central present and absent features. Recall and correct denials tended to be poorer when children reported knowing the outcome early in the game compared with performance when children reported knowing the outcome later.

Although speculative, it may be that once children determined that they were going to lose the game, they stopped encoding central event features. Thus, it may be that by focusing on less important or major events of stressful or other negative-emotion events provides a type of coping mechanism.

If the time of knowing the event outcome is a marker variable for encoding effects, we would expect few differences between outcome groups if their time of knowing was the end of the game. That is, if children in the negative outcome group

thought they might win up until the end of the game, then encoding mechanisms for this subgroup would be similar to the encoding for children in the positive outcome group who also did not know the game outcome. In this research, when children in the positive and negative outcome groups who reported knowing the outcome of the game only at the conclusion of the event were compared, there was only one group difference. Participants in the negative outcome group correctly denied a greater proportion of the suggestibility items relating to peripheral details of the event. Thus, in this study the emotion appeared to influence encoding more than recall or change over time in recall.

*Performance ratings as an alternative valence measure.* Participants who rated their team performance as “our best game ever” used a greater proportion of central propositions at the second interview than they had at the first interview, and participants who rated their team performance as less positive exhibited a less striking shift. Ratings in all other levels were nearly the same. No differences emerged in the proportion of peripheral, evaluative or mentalistic comments or in the coherence of the narrative. Hence, when children thought it was their “best game ever”, they were more likely over time to focus on the central details.

Similarly, children who rated performance more positively also recalled more central details of the event, and correctly denied questions about central absent features, in the elicited recall portion of the interview. Ratings of team performance were unrelated to correct recall of peripheral information, but higher ratings tended to be related to more correct denials of questions about peripheral absent features in the elicited recall portion of the interview. There was also a tendency for time and

performance ratings to interact, such that participants who rated performance in the lowest and highest categories exhibited decline over time in their ability to correctly deny peripheral absent feature questions, but participants who used the two middle ratings of performance were stable in their performance over time.

The findings involving performance ratings mimic those concerning time of knowing. Just as children who determined they were going to lose the game focused more on peripheral versus central events, children who determined the game was “their best ever” focused more on central versus peripheral features. If accepted, this interpretation lends further credence to the view that focusing on peripheral versus central event features acts as some type of coping mechanism that is, obviously, unnecessary in positive-emotion inducing experiences.

#### *Limitations to the Present Study*

*Participant recruitment.* Although numerous attempts were made to recruit families well in advance of the event, approximately 90% of participants agreed to participate in the study on the day of the tournament either just prior to or following the target event. Thus, it was not possible to obtain any pre-game ratings or other information from the participants, and responses to questions about emotions and event salience prior to the event may have been colored by participants’ knowledge of the event outcome. While self-report measures are informative, they are yet imperfect measures of emotion and event salience even under the best of circumstances. However, in this research pre-game emotion and ratings of event salience were not related to event outcome and so suggest that concerns regarding the accuracy of pre-game feelings are not a major threat to the study.

*Target event.* Although the event was salient to the children, this was a normal course event that did not involve threat or a blocked goal. It was neither traumatic nor life influencing; to the contrary it was an understandable, familiar event. Stress associated with the event appeared to be minimal and, if present, would be expected to be short-lived. Further this was a single event, limiting the opportunity to generalize the results to more traumatic events. However, children regularly experience stress linked to daily or routine endeavors whereas traumatic events are infrequent. Thus, understanding the effects of children's emotions for more regular or routine events is critical in understanding the everyday effects of emotion on event memory.

*Time of measurement.* As discussed above, the failure to replicate group differences in the content of spontaneous recall may have been partially a result of the immediacy of the first interview compared with the pilot study when the interview took place in the days following the event. This suggests that there may be a trajectory for memory consolidation that is different for the two groups, such that narratives are quite similar if measured just after the event, diverge in the ensuing days when the event is being consolidated into memory, and then begin to converge again over time so that by the time of the second interview the differences are less pronounced.

#### *Future Considerations*

In this study, pre-game emotion may have been reinstated using methods developed in connection with the Cognitive Interview (Fisher & Giselman, 1992). The Cognitive Interview is used to interview children in forensic settings in an effort

to minimize children's tendency to provide very brief responses when speaking to unfamiliar adults. Using strategies from the Cognitive Interview, participants in this study were encouraged to mentally recreate the environmental, cognitive, physiological, and affective states that existed at the time of the original event. These strategies are expected to provide the most effective retrieval cue possible by maximizing the overlap with the originally encoded event (Flexser & Tulving, 1978; Tulving & Thomson, 1973).

Additionally, participants may have several mental representations of an event (Fisher & Chandler, 1991). Some representations are highly detailed and reflect minute, sensory properties; other representations are more generic and reflect a more abstract interpretation of the event. To induce recall based on the more detailed representation, participants were encouraged to close their eyes and use mental imagery to guide their responses.

While this method was an appropriate one for this study and is also valuable in forensic settings with trained clinicians, it should be used with caution in research examining more traumatic or stressful events. How might the use of these techniques facilitate children's recall at different points in their reports (e.g., earlier or later) and how might the use of these techniques versus not using them impact comparisons across studies of both positive and negative-emotion events? To begin to understand this, future examinations of valence and salience on children's memories should use a variety of interviewing techniques to compare their facilitative effects.

Another area of interest concerning the influence of emotion on memory concerns development. Because there are so few studies examining valence and

salience based on the outcome of a shared event, this study examined the effects of such in only one age group. However, as these relationships become more defined and better understood, researchers should attempt to unpack the developmental nature of the processes by examining emotion and memory across age. This will be a challenging task as present studies in the area have significant differences in the operationalization of emotion and thus inferences about developmental trajectories is difficult. Likewise, developing events that produce similar levels of valence and salience for different age groups is methodologically difficult.

### *Conclusions*

Theoretically, the research regarding the influence of emotional valence and emotional intensity on encoding, recall, and memory decay is interesting because of the potential to shed light on processes that are active when we attend to and engage in our environment. Practical interests associated with elucidating this relationship include predictions about what children in particular, but generally all persons, might reasonably be expected to recall about an event and how expectations should be adjusted based on the valence of the to-be-remembered event and its salience to the rememberer.

This study's findings add to a program of research that addresses these questions by examining the effects of positive and negative emotion on children's encoding of a personally salient event, and the change over time in children's ability to accurately recall details about the event and correctly deny questions about plausible absent features of the event. This research also explores alternative ways of measuring event salience and valence by exploring children's reports of event

importance, perceived performance, self-reported emotion and the time of onset of emotion, in an effort to contribute to a more ecologically valid model of relationship between emotion and memory.

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## Appendix A

Parent Invitation Letter and Parent and Child Consent Forms

April 1, 2003

Dear Parent or Guardian:

We are inviting local young athletes in the U-9/U-10/U-11 age bracket who are participating in an end-of season tournament to take part in a research project. The purpose of this study is to examine children's accounts of normally occurring, emotional experiences and their perceptions of their performance during athletic events. We are writing to describe our project, and to ask if we may call you to discuss the possibility of including your child in this research.

With your consent, we will schedule an interview at the field just after your child's final tournament game, or in your home at a time convenient for your family, within a few days after the tournament. The interview consists of questions regarding actions that occurred or could have occurred during the game. (For example, "Who scored the goals?"). Each child will be interviewed again about six weeks later, and the same questions will be asked. In addition, we will ask your child to complete a widely used questionnaire so that we can obtain his or her ratings of the importance of athletic involvement. (For example, "Some children would rather play outdoors in their spare time, but other children would rather watch TV. How about you?") Each visit will involve less than 30 minutes and will be conducted by members of our research team, all of whom are students in psychology who are skilled in working with children and are supervised by faculty members.

Your soccer league and the appropriate NC State University review board have agreed to all of the procedures in this research. To protect your child's rights, the information in the study records will be kept strictly confidential (as described in the accompanying consent form), and no reference will be made in any reports that could link your child to the study.

Of course, participation is voluntary. If you or your child choose to withdraw from the study at any time, your wishes will be respected and any data will be destroyed. As a token of appreciation, each participant will receive a gift card worth \$5 at each of the two interviews.

Please return the attached consent form, or contact us at the numbers shown below to discuss this project further or sign up for the study. Thank you for your consideration.

Sincerely,

Kimberly Eaton, MS  
(919) 881-4161  
keaton@unity.ncsu.edu or  
ncsu\_soccer\_study@earthlink.net

Lynne Baker-Ward, Ph.D

## INFORMED CONSENT FORM

**Title of Study:** Memory and emotion: The influence of valence on recall for a stressful event

**Principal Investigator**

Kimberly L. Eaton, M.S.

**Faculty Sponsor (if applicable)**

Lynne Baker-Ward, Ph.D.

You are invited to participate in a research study. The purpose of this study is to examine children's memories for normally occurring, emotional events. We are testing the idea that individual differences in how the event is initially construed may affect a child's recall of that event.

**INFORMATION**

1. Children in the study will participate in a soccer tournament on May 17-18 and will be members of teams in the U-9/U-10/U-11 age group. Final games in this bracket will be scored, and the players will be interviewed on two occasions: once immediately following the game, and once 5 to 6 weeks later. One paper-and-pencil questionnaire will be administered prior to the first interview.
2. Demographic questions will be asked at the end of the interview, including your child's age. This information will be used to calculate group averages based on age.
3. The interview will take approximately 25 minutes, and the total time your child will participate in this study will be one hour or less.

**RISKS:** Some children may recall negative game-related events in their interviews. Our purpose is not to manipulate the child's experience in any way, and children will be assured that we are asking about aspects of the game only to understand how children remember exciting events. Further, they will be told that individual scores will not be reported since the research is not intended to compare their memory to that of other team members, but rather to develop a general picture of how children remember events. Children will be assured that it is often difficult to remember things accurately and that it is quite normal for people to confuse details for specific events. We will make every effort to correct any possible misconceptions resulting from the questions, and remove any concern children might have if they become aware that they provided incomplete or incorrect information in response to the questions.

**BENEFITS:** The process of telling or writing about an event has been demonstrated to improve mental and physical health. Children in this study will be guided through a series of questions on two occasions that may help them to organize their thoughts about their experience of the game, thus forming a more coherent personal narrative about the event.

**CONFIDENTIALITY:** The information in the study records will be kept strictly confidential. Data will be stored securely and will be made available only to persons conducting the study unless you specifically give permission in writing to do otherwise. No reference will be made in oral or written reports which could link your child to the

study. Tapes of the interviews with children will be destroyed after a transcript (omitting your child's name) has been typed, or after one year, whichever comes first.

**COMPENSATION:** For participating in this study children will receive a \$5 gift card at each interview. If you or your child withdraw from the study prior to its completion, you will still receive compensation if you so desire.

**CONTACT:** If you have questions at any time about the study or the procedures, you may contact either of us at the numbers below. If you feel you have not been treated according to the descriptions in this form, or your rights as a participant in research have been violated during the course of this project, you may contact Dr. Matthew Zingraff, Chair of the NCSU IRB for the Use of Human Subjects in Research Committee, Box 7514, NCSU Campus (919/513-1834) or Mr. Matthew Ronning, Assistant Vice Chancellor, Research Administration, Box 7514, NCSU Campus (919/513-2148).

**PARTICIPATION:** Your participation and your child's participation in this study is voluntary; you may decline to participate without penalty. If you decide to participate, you may withdraw from the study at any time without penalty and without loss of benefits to which you are otherwise entitled. If you withdraw from the study before data collection is completed your data will be returned to you or destroyed.

**CONSENT:** "I have read and understand the above information. I have received a copy of this form. I agree to participate in this study."

Parent signature \_\_\_\_\_ Date \_\_\_\_\_

PHONE \_\_\_\_\_

TEAM NAME \_\_\_\_\_ AGE: U-\_\_\_\_\_

Investigator's signature \_\_\_\_\_ Date \_\_\_\_\_

Participant (Child) Consent Form

NCSU Soccer Study

I know that taking part in this study is my choice and that if I do not want to be interviewed, that is OK. If I decide to go ahead with the interview, I can decide to stop it any time. If I decide to stop, the research team will not keep the tape of my interview. I understand that I will receive a \$5 gift card for this interview. If I stop the interview or choose not to take part in the second interview, I will still receive the gift card. I know that I only have to answer the questions I want to answer.

\_\_\_\_\_ I would like to take part in this study.

\_\_\_\_\_ I do not want to take part in this study.

---

Participant Signature

Date

---

Investigator signature

Date

Appendix B

Interview Protocol

**Section 1: Introduction (Rapport Building, Identification, Permission)**

Interviewer: **Hello, [child's name]. My name is [interviewer's name]. I'm a student at NC State. Thank you for talking with me today. I want to learn more about how kids like you remember soccer games.**

**Your [mom/dad/parents] have given me permission to talk with you about soccer. But I need to know that it's OK with you, too. Here's a permission form. I'm going to read it to you . . . Do you have any questions . . . Are you willing to talk with me? Thanks so much!**

*Get child's written permission to take part in the study . . .*

**I'm going to ask you some questions. Remember to let me know if I ask you something you don't want to talk about, or if you want to stop.**

**I didn't see everything that went on in your game, so don't leave anything out when we talk. I'm going to tape record what you say so I don't have to write everything down. Is that OK?**

*Turn on tape recorder now . . . Make sure that tape recorder is working . . . Test with child and play it back.*

Interviewer: **First, I'd like to get to know a little about you. Would you please tell me your birth date? Make sure to get the month and the year.**

Child:

Interviewer: **OK. What's the name of your school?**

Child:

Interviewer: **What grade are you in now?**

Child:

Interviewer: **Right. Tell me about some of the things you like to do.**

Child:

*Interviewer:* Comment on child's responses. Ask for elaborations of responses. If you have similar interests, share them with the child. Continue until child has made eye contact with you and has spontaneously provided some information in response to general prompts.

*Interviewer:* If child does not mention soccer, make transition. **I know that one of the things you do is play soccer. What is the name of your team?**

*Child:*

*Interviewer:* **How long have you been playing soccer on a recreational team like the one you are on now?**

*Child:*

## Section 2: Narrative Generation

*Interviewer:* **I know that the [team name] just played in a big tournament. I want to know about the last game you played in the Tournament. Tell me what happened.**

*Child:*

*Interviewer:* [Prompt as needed to keep the child's narrative flowing. Acceptable prompts include:

**Tell me some more about that.  
OK, what else happened?  
Anything else?**

*You may also repeat what child said without adding anything . . .  
You told me about the goal, you told me about the foul . . . what else happened?]*

*After child has been unable to generate any additional information after interviewer has repeated what child said, interviewer says one more time:*  
**What else happened?**

*If child says "That's all," then interviewer asks:*  
**Do you remember anything else?**

*When child cannot provide additional information, then interviewer says:*  
**You're doing a great job! You're really helping me out.**

### Section 3: Closed Recall Questions

*Check to make sure the recorder is working . . .*

*Interviewer :* **OK, now I have a few questions about some things that happen during soccer games. I might ask you about something you've already talked about. Also, if I ask you about something that didn't take place in this game, just tell me it didn't happen. Ready? Here's the first question.**

*Interviewer:* **What was the name of the team you played?**

*Child:*

*Interviewer:* **How many times did a player kick the ball over the goalpost when they were trying to score?**

*Child:*

*Interviewer :* **What did your team get as a snack after the game? What did you have to drink? To eat?**

*Child:*

*Interviewer :* **Who was the goalie for your team? *What for child's response.* Did she play that position the whole game or did someone else sub for her?**

*Child:*

*Interviewer:* **How many times was play stopped because someone got hurt (and had to wait for them to leave the field)?**

*Child:*

*Interviewer:* **What kind of drills did you do at half-time?**

*Child:*

*Interviewer :* **How many times were there “drop balls”?**

*Child:*

Interviewer : **Which team scored on a penalty kick inside the box?**

Child:

Interviewer: **What did the goalies' jersey look like? [Wait for child's response.]  
Was it just a penny, or a colored shirt? What color?**

Child:

Interviewer : **How many times did a player score from midfield?**

Child:

Interviewer: **How many times did the ref stop the game so you could have a water break?**

Child:

Interviewer : **How many times was a player called for offsides?**

Child:

Interviewer : **Who scored the goals for your team?**

Child:

Interviewer: **What color uniforms did the other team wear?**

Child:

Interviewer: **Some teams do "the tunnel" or something else like it when they come off the field. What did your team do?**

Child:

Interviewer: **Which team won the toss and got the ball first when the game started?**

Child:

Interviewer: **Sometimes teams line up in the center of the field after the game and congratulate each other in some way. What did your team do?**

Child:

Interviewer: **How many times did a player score with a shot that went over the goalie's head?**

Child:

Interviewer : **How many personal fouls were called?**

Child:

Interviewer: **Describe the ref for your game. [Pause. If child does not report gender, ask: ] Was the ref for your game a man or a woman?**

Child:

Interviewer : **How many hand balls were called?**

Child:

Interviewer : **How many times did the other team score on a penalty kick?**

Child:

Interviewer : **What warm-up drills did you do before the game started?**

Child:

Interviewer: **What did the referee check players for before the game started?**

Child:

Interviewer: **How many times did the ref stop the game to talk to a player or grown-up?**

Child:

Interviewer : **What was the weather like during the game?**

Child:

Interviewer : **Sometimes teams wear something special at a tournament or dress up in a special way. What did your team do that was special?**

Child:

*Interviewer* : **What did one of the teams set up on the sidelines? ?** [sometimes teams have a banner or a bench or something like that]

*Child*:

*Interviewer*: **How many times did a player score on a ball that hit the goalpost first, and then went in?**

*Child*:

*Interviewer* : **What special cheer did your team do?**

*Child*:

*Interviewer* : **How many times did a ball from another game come onto your field?**

*Child*:

*Interviewer*: **During the first half of the game, was your goal (the one you were defending) closer to the parking lot or was it the one that was farther away?**

*Child*:

*Interviewer* : **Who won?**

*Child*:

*Interviewer* : **What was the score?**

*Child*:

#### **Section 4: Items Eliciting Children's Soccer Attitudes**

*Continue to tape record the interview but write the child's answer on the rating form.*

*Interviewer* : **To show you how this next part works, I am going to ask you a question and then ask you to rate your answer on a scale of 7 pts. Let me show you how it works, OK?**

**Try to remember and then tell me the most recent movie or video that you've seen. What was it? *Wait for child's response.* OK, now tell me what you thought about [name of movie]?**

**All right—now, I would like for you to take a look at this scale and try to rate how well you liked the movie on a scale from 1-7.**

- 7 (Loved it!)
- 6 (Liked it a lot)
- 5 (Like it a little)
- 4 (It was OK.)
- 3 (It wasn't very good.)
- 2 (Didn't like it at all)
- 1 (Hated it!)

*Interviewer reads the descriptions that correspond to each number.  
If the answer that the child gives doesn't reflect their previous response, try with another example.*

**OK, now it looks like we're ready to move on to more soccer questions using this same scale. Thank you for practicing with me first.**

*Interviewer :* **Think about the time just before your last Tournament game. You're on the field with your team and the game is going to start in just a few minutes. Close your eyes and imagine yourself on the field just before the game. What are all the things you are thinking and feeling? Wait for child's response. Can you tell me something else?**

*Child:*

*Interviewer :* **OK, keep thinking about the time just before the game started. You knew that it was a really big game and that only one team would win. How much did you want to win the game? Let's use my scale again. [Show Likert scale.]**

- 7 (I wanted to win as much as I've ever wanted anything in my life.)
- 6 (I wanted to win a whole, whole lot.)
- 5 (I wanted to win a lot.)
- 4 (I wanted to win a quite a bit.)
- 3 (I wanted to win a medium amount.)
- 2 (I wanted to win but just a little.)
- 1 (I didn't care if we won or lost.)

*Interviewer :* **In a typical week for you, how many days do you kick a soccer ball around just for fun, not when it's for PE or with the team?**

*Child:*

Interviewer : **How do you feel about how your last Tournament game turned out for you?** [*Likert scale.*]

- 7 (It was my best game ever)
- 6 (It was a really good game for me.)
- 5 (It was a pretty good game for me.)
- 4 (It was an OK game for me.)
- 3 (It wasn't awful but it wasn't good.)
- 2 (I didn't play very well.)
- 1 (It was my worst game ever.)

Child:

Interviewer : **Why do you think it was** [child's response]?

Child:

Interviewer : **How do you feel about how your team played this game?** [*Likert scale.*]

- 7 (It was our best game ever)
- 6 (It was a really good game for us.)
- 5 (It was a pretty good game for us.)
- 4 (It was an OK game for us.)
- 3 (It wasn't awful but it wasn't good.)
- 2 (We didn't play very well.)
- 1 (It was our worst game ever.)

Interviewer : **Why do you think it was** [child's response]?

Child:

Interviewer: **Now, think about the time just after your last Tournament game. You're on the field with your team and the game has just ended. Close your eyes and imagine yourself on the field just after the game. What are all the things you are thinking and feeling? *Wait for child's response.* Can you tell me something else?**

Child:

Interviewer: **When in the game did you know who would win?**

Child:

*Interviewer:* **This is my last question. Tell me about the things you're going to do when school is out. [Wait . . .]**

***End with profuse thanks! Make sure child leaves with a good feeling . . . it was really fun to talk with you . . . I learned a lot from you . . . Thank you so much for talking with me!***

**Remember to label the tape, the interview form and the consent form with the Player's ID Number and to bring everything back to the lab . . . and thank you for making this research possible!**

## Appendix C

### Elicited Recall Questions by Category

#### Central present and absent feature questions

1. How many times did a player kick the ball over the goalpost when they were trying to score?
2. How many times was play stopped because someone got hurt (and had to wait for them to leave the field)?
3. Who was the goalie for your team? Did she play that position the whole game or did someone else sub for her?
4. How many times were there “drop balls”?
5. Which team scored on a penalty kick inside the box?
6. Who scored the goals for your team?
7. How many times did a player score from midfield?
8. How many times was a player called for offsides?
9. Which team won the toss and got the ball first when the game started?
10. How many hand balls were called?
11. How many times did a player score with a shot that went over the goalie's head?
12. How many personal fouls were called?
13. How many times did the other team score on a penalty kick?
14. How many times did a player score on a ball that hit the goalpost first, and then went in?
15. What was the score?

16. Who won?
17. How many times did the ref stop the game to talk to a player or grown-up?

Peripheral present and absent feature questions

1. What was the name of the team you played?
2. What did your team get as a snack after the game? What did you have to drink? To eat?
3. What kind of drills did you do at half-time?
4. What did the goalies' jersey look like? Was it just a penny, or a colored shirt? What color?
5. How many times did the ref stop the game so you could have a water break?
6. What color uniforms did the other team wear?
7. Some teams do "the tunnel" or something else like it when they come off the field. What did your team do?
8. Sometimes teams line up in the center of the field after the game and congratulate each other in some way. What did your team do?
9. Describe the ref for your game. Was the ref for your game a man or a woman?
10. What warm-up drills did you do before the game started?
11. What did the referee check players for before the game started?
12. What did one of the teams set up on the sidelines? ? [Sometimes teams have a banner or a bench]

13. What was the weather like during the game?
14. Sometimes teams wear something special at a tournament or dress up in a special way. What did your team do that was special?
15. What special cheer did your team do?
16. How many times did a ball from another game come onto your field?
17. During the first half of the game, was your goal (the one you were defending) closer to the parking lot or was it the one that was farther away?

Appendix D

Event Saliience items

Wanted to Win: OK, keep thinking about the time just before the game started.  
You knew that it was a really big game and that only one team would win. How much did you want to win the game?

- 7 I wanted to win as much as I've ever wanted anything in my life.
- 6 I wanted to win a whole, whole lot.
- 5 I wanted to win a lot.
- 4 I wanted to win a quite a bit.
- 3 I wanted to win a medium amount.
- 2 I wanted to win but just a little.
- 1 I didn't care if we won or lost.

Personal performance: How do you feel about how your last Tournament game turned out for you?

- 7 It was my best game ever.
- 6 It was a really good game for me.
- 5 It was a pretty good game for me
- 4 It was an OK game for me.
- 3 It wasn't awful but it wasn't good.
- 2 I didn't play very well.
- 1 It was my worst game ever.)

Team performance:      How do you feel about how your team played this game?

- 7    It was our best game ever.
- 6    It was a really good game for us.
- 5    It was a pretty good game for us
- 4    It was an OK game for us.
- 3    It wasn't awful but it wasn't good.
- 2    We didn't play very well.
- 1    It was our worst game ever.)

## Appendix E

### Emotion items

Pre-game emotion: Think about the time just before your last Tournament game. You're on the field with your team and the game is going to start in just a few minutes. Close your eyes and imagine yourself on the field just before the game. What are all the things you are thinking and feeling?

Post-game emotion: Now, think about the time just after your last Tournament game. You're on the field with your team and the game has just ended. Close your eyes and imagine yourself on the field just after the game. What are all the things you are thinking and feeling?