THE CATHOLIC UNIVERSITY OF AMERICA

Remembering Long-term Positive and Negative Memories: The Curse and the Shock

A DISSERTATION

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How the emotional valence of an experience affects memory accuracy has been investigated in three studies of public events (Bohn & Berntsen, 2007; Kensinger & Schacter, 2006; Levine & Bluck, 2004). These studies all found that individuals who evaluated an event positively remembered details less accurately, but felt greater confidence or vividness in their memories, than those who evaluated the event negatively. However, individuals who viewed an event positively likely differed in many ways from those who viewed that event negatively. The present study therefore investigated accuracy and vividness of long-term memory for two comparable public events, chosen so that those who experienced one event as positive likely experienced the other as negative, and vice versa.

The events were the deciding games in the 2003 and 2004 Major League Baseball (MLB) American League Championship Series between the Yankees (2003 winners) and Red Sox (2004 winners). In 2008, 1563 fans who reported having attended, watched, or read about both games completed questionnaires that asked them to recognize details and indicate subjective memories about the games.

Both between and within groups, fans remembered the positively valenced game (the one their team won) significantly more accurately than the negatively valenced game. Fans also reported more vividness and more rehearsal for the game their team won versus the game their team lost. Self-reported rehearsal mediated the effects of valence on accuracy, and
partially mediated the effects of valence on vividness. While rehearsal led to accuracy in our study, in other situations factual inaccuracies may be rehearsed and that could lead to inaccurate memories. We conclude that valence of an event affects what gets rehearsed rather than the accuracy of recall. Positive events are more likely than negative events to be rehearsed, but that rehearsal could lead to either increased or decreased accuracy.

Additionally, we investigated how age affects memory for the positive and negative events. The older adults were less accurate, and reported less vividness and rehearsal, than younger adults, but no differential positivity effect was found for older adults.
This dissertation by Carolyn W. Breslin fulfills the dissertation requirement for the doctoral degree in Clinical Psychology approved by Martin A. Safer, Ph.D., as Director, and by James H. Howard Jr., Ph.D. and Christopher S. Sarampote, Ph.D. as readers.

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Introduction

Emotionally-arousing experiences are recalled better than neutral ones (for reviews, see Levine & Edelstein, 2008 and Levine & Pizarro, 2004). However, different emotions may affect different aspects of memory, and these effects may not be consistent across the adult lifespan (Kensinger, 2009a). As reviewed below, one key issue is how the positive versus negative valence of a stimulus, experience, or event impacts memory. Laboratory studies (e.g., Kensinger, Garoff-Eaton, & Schacter, 2006; Storbeck & Clore, 2005), autobiographical memory studies (e.g., Wagenaar, 1986; Walker, Skowronski, & Thompson, 2003) and studies of memories for public events (e.g., Bohn & Berntsen, 2007; Kensinger & Schacter, 2006; Levine and Bluck, 2004) have all suggested that valence may indeed influence memory of objective details about an event as well as the subjective qualities of one’s memory. Moreover, an important moderator of valence effects on memory may be the individual’s age, as elderly individuals may show a differential preference for remembering positively-valenced information (for a review, see Mather & Carstensen, 2005).

The current study will examine valence and age effects in comparing memory for the decisive 2003 and 2004 baseball league championship games between the New York Yankees and the Boston Red Sox. The Yankees won in 2003 and the Red Sox in 2004; thus, one game should be associated with positive emotion and one game with negative emotion for fans of the two teams.

Valence and Memory

The effects of valence on memory has been tested in laboratory studies, autobiographical memory studies, and studies of memory for public events.
Laboratory Studies. Laboratory studies have produced mixed results in terms of valence’s effect on memory. In the 1970’s and 1980’s, some word list recall studies in the lab suggested that one tended to remember positive stimuli better than negative stimuli, particularly as the delay between word presentation and recall increased (as reviewed in Matlin & Stang, 1978). Called the “Pollyanna Principle,” Matlin and Stang’s review claimed that positive stimuli are favored in memory vis a vis negative stimuli over time.

However, other laboratory studies and theories challenge this Pollyanna – induced advantage for recall of positive versus negative stimuli. Indeed, the affect-as-information hypothesis (Schwarz & Clore, 1983; Schwarz, 1990) posits that negative affect is a signal to the brain that there is a problem; it thus triggers detailed-oriented attending and processing, that can be helpful in problem solving. Positive affect, on the other hand, signals that everything is fine, and triggers no particular action requirement or processing motivation. Thus, positive affect evokes less detail-oriented processing and relies more heavily on general scripts and knowledge. This hypothesis has been supported in laboratory studies of emotion and memory. For example, Bless et al. (1996) had participants listen to a story about going out to dinner, and then later presented them with items on a computer screen which either had, or had not, been part of the story. They found that those in a happy mood appeared to rely more heavily on general knowledge or scripts during encoding as well as during recognition. As a result, happy participants made more errors during recall of specific details than did sad or neutral participants. Similar results have been found in word list recall studies (e.g., Storbeck & Clore, 2005), including evidence that negative emotions evoked a focus on specific details rather than general heuristics or scripts. Other lab studies have found that negative stimuli are remembered more vividly and more accurately than positive
or neutral stimuli (Kensinger, Garoff-Eaton, & Schacter, 2006; Ochsner, 2000). Additionally, lab studies involving memories of negative stimuli have found a narrowing in memory on the most central details of the experience, implying a loss of peripheral details (e.g., Safer, Christianson, Autry, Osterlund, 1998). It is unclear whether such tunnel memory effects occur for all emotions, negative emotions, or just certain negative emotions. (See Appendix A for a review of memory for central versus peripheral information.) One problem is that laboratory stimuli are often artificial and a poor reflection of real-world stimuli in real-world conditions. For this reason, one must also examine what autobiographical research and studies of real world events indicate about valence and memory.

**Autobiographical memory studies.** These studies have examined memory for one’s own positive and negative experiences. However, given the idiosyncratic nature of autobiographical experiences, investigators have had to examine the reliability or consistency of reported memories, rather than accuracy for details of the experience. Research on autobiographical memories generally supports a positivity bias (Walker, Skowronski & Thompson, 2003), such that people have better recall of positive memories from their life than negative memories (e.g. Wagenaar, 1986; Walker, Vogl, & Thompson, 1997). Many studies have found positive autobiographical memories involve more imagery or seem more clear than negative autobiographical memories (e.g. Byrne, Hyman & Scott, 2001; Schafer & Philippot, 2005). Moreover, negative memories are talked about less relative to positive memories (Byrne et al., 2001; Tromp, Koss, Figueredo & Tharan, 1995) and tend to show a focus on central rather than peripheral details (e.g. Bernsten, 2002; Christianson & Loftus, 1990). Additionally, researchers have found that the intensity of the affect in negative memories fades faster than the intensity of affect in positive memories, which has been called
the fading affect bias (e.g., Walker & Skowronski, 2009; Walker, Skowronski & Thompson, 2003; Walker, Vogl, & Thompson, 1997). Taken together, these studies suggest that positive memories may have a memory advantage in terms of subjective aspects of memory, such as vividness or confidence, but may have no advantage for objective aspects of memory, such as accuracy. Indeed variables that predict subjective aspects of memory may differ from those that predict objective aspects. (See Appendix B for a review of the relationship between objective and subjective aspects of memory).

**Memories of Emotional Public Events.** An alternative to laboratory and autobiographical memory studies is to investigate accuracy for remembering details of public events. Memories of emotional, public events tend to be more vivid than memories of neutral events (e.g., Reisberg & Heuer, 2004). This research has generally investigated recall of details of unexpected and consequential negative public events, such as the sudden death of public figures such as U.S. President Kennedy (Brown & Kulik, 1977) and disasters such as the 9/11 attacks (Hirst et al., 2009). Investigation of these so–called “flashbulb memories” generally finds self-reports of considerable vividness and confidence in one’s memories accompanied by relatively lower levels of accuracy for event details (e.g., Luminet & Curci, 2009; Neisser & Harsh, 1992; Wolters & Goudsmit, 2005). (See Appendix B for more on the dissociation of subjective and objective measures of memory in flashbulb memory studies.)

There have been attempts to investigate valence effects for public events. Scott and Ponsoda (1996) and Tekcan (2001) compared the memory of two events in the same year – one assumed to be positive and one assumed to be negative. Neither study found differences in memory characteristics due to valence, although Tekcan (2001) found that positive events
were rehearsed more than negative events. However, these studies were flawed in that the researchers assigned valence to the event, and compared events that likely differed on many other variables besides valence.

Recently, investigators have compared the accuracy, confidence and/or vividness of memory for a single event which was regarded as positive by some individuals and negative by others. Specifically, Levine and Bluck (2004) investigated memories of the televised verdict in the O.J. Simpson trial for those who agreed or disagreed with the verdict. They asked participants familiar with the trial to indicate their emotions upon hearing the verdict, as well as to rate the clarity of their memory of ten specific details that may or may not have occurred during the verdict scene. Compared to those who disagreed with the verdict, those who were happy with the verdict reported more clarity and recognized more events, including those events that would have been consistent with the scene but did not actually occur. The results appear consistent with the affect as information formulation as positive valence was associated with more memory malleability and negative valence with accuracy for details. However, a major limitation of this study is that those who found the verdict to be positive likely differed on other relevant variables, including demographics, from those who found the event to be negative.

A similar approach, with a similar limitation, occurred in an investigation of memories thirteen years after the fall of the Berlin Wall among individuals involved in the political parties of the former East and West Germany (Bohn & Berntsen, 2007). They asked participants to characterize their affective attitude when the Wall fell, as well as to recall personal details and public facts about the event. There was no group difference in the number of correct answers about the public facts, but it appears that the happy respondents
(West Germans) were more willing than the East Germans to attempt to answer questions, rather than skip them. When the accuracy measure was calculated for only those who answered all the questions, which was less than half of the sample, those who rated the event as positive performed worse on accuracy measures than those who rated the event as negative. If positive participants were more willing to answer questions than negative participants, this finding may indicate more about willingness to guess than memory accuracy per se. In terms of other memory characteristics, the positive group reported more clarity and intensity of their memories at recall, as well as ‘reliving’ their memories more strongly, than the negative group. Thus there was some suggestion that accuracy for details was inversely related to subjective measures of memory.

In a study which was the basis for the present study, Kensinger and Schacter (2006) asked Red Sox and Yankee fans to recall and report both personal and event-related details concerning the 2004 American League Championship Series (ALCS) game 7 that the Red Sox won. After a six month delay, Yankee fans, who were unhappy about the result, recalled marginally more details about the game than the happy Red Sox Fans. Yankee fans were also more consistent in their personal memories from Time 1 to Time 2. However, Red Sox fans were more confident in their memories than Yankee fans. Notably, in this study the negatively valenced group consisted of 20 college aged Yankee fans living in Boston at the time of the biggest win in Red Sox history since 1918. Red Sox fans and the city of Boston were undoubtedly “basking in reflected glory” (Cialdini, et al., 1976), and their celebration likely intensified the negative emotions of Yankee fans living in Boston (Lench, Safer, & Levine, in press) which may have altered the result. Another limitation with this study is that the game 7 was the final game of the season for the Yankees, whereas the Red Sox played 4
more games to win the World Series. Perhaps the Red Sox fans confused some of the details of the game 7 against the Yankees with details from the World Series games.

Taken together, these three studies would suggest that those in the positive valence group were more prone to memory errors, yet scored higher on other subjective factors of memory (i.e. confidence, vividness, intensity) versus those in the negative valence group. The authors explain this malleability of positive memories as consistent with the affect-as-information processing theory (e.g., Schwarz, 1990; Storbeck & Clore, 2005), discussed previously in the context of laboratory studies. The theory predicts that negative memories would invoke more detail oriented processing, whereas positive memories would rely on general scripts, allowing for more error.

Effects of Aging on Memory

The age of a respondent may be an important moderator of the effects of emotional valence on memory. While declines in memory for the elderly are well researched and documented (e.g., Prull, Gabrielei & Bunge, 2000; Kensinger, 2009a), there are relatively few studies that focus on valence and include young, middle aged, and older adult samples in the same study (see Charles, Reynolds & Gatz, 2001 for an exception). Interestingly, there is evidence that contrary to other cognitive declines in the elderly, emotional regulation actually improves with age (e.g., Charles, Mather, & Carstensen, 2003; Mather & Carstensen, 2005). This improvement may be explained by the socioemotional selectivity theory (e.g. Carstensen, 1993; Carstensen, Isaacowitz & Charles, 1999), which states that as adults age, emotionally meaningful goals become relatively more important, and engage cognitive and behavioral resources that lead to better emotional regulation. As a result, older adults experience less negative emotion, focus less on negative stimuli versus positive stimuli, and
remember more positive versus negative events (Charles, Mather, & Carstensen, 2003; Mather et al., 2004). This positivity effect in the memories of older adults has been documented in laboratory studies (Charles, et al., 2003), in autobiographical memory studies (Levine & Bluck, 1997; see Mather & Carstensen, 2005 for a review), and in neuropsychological studies (e.g., Addis, Leclerc, Muscatell, & Kensinger, 2010). (See Appendix C for a review of neuropsychological theories of arousal and valence in emotional memory.) However, Kensinger (2009a) points out that several laboratory studies (e.g., Kensinger, Garoff-Eaton, & Schacter, 2006; Kensinger, Garoff-Eaton, & Schacter, 2007) indicate that negatively valenced stimuli seem to confer an advantage for memory of details relative to positive stimuli, even for older adults. Other autobiographical studies (e.g., Comblain, D’argembeau, & Van der Linden, 2005) have found few differences in the characteristics of positive and negative memories between older and younger adults. Thus, there are still questions about if, and when, the positivity effect may occur. The present study is, we believe, the first study of memory for positive and negative public events to have a large number of respondents of all ages, so that it may be possible to determine at what age, if any, social-emotional selectivity of memories begins to occur.

**Present Study**

In summary, prior research suggests that valence of stimuli or an event may influence accuracy, vividness, and other characteristics of what is remembered, although there are few studies in natural settings that control for event differences as well as differences in individual participants. The present study was thus designed to investigate the effects of valence, and aging, on the accuracy of memories for emotional events.
The study asked Red Sox and Yankee fans, and baseball fans of neither team to answer questions about what they recalled about two emotional, decisive games involving the Red Sox and Yankees. Each team won once. Based on the literature, we predicted that participants would recall verifiable details about the negatively valenced event, the one their team lost, more accurately than details about the positively valenced event. The fans of neither team should remember the least about these games (Hypotheses 1). We also predicted that in contrast to accuracy, fans would report more vividness for the positively valenced than for the negatively valenced event (Hypotheses 2). Age was predicted to affect the type of information remembered about the events. Compared to younger adults, older adults (age 65 and above) were predicted to remember fewer details accurately (Hypothesis 3), to remember events with less reported vividness (Hypothesis 4), and to differentially remember more details from positive than from negative events (Hypothesis 5).

Additionally, we attempted to investigate central and peripheral details, binding of details, and emotional essence in the present study. However, these concepts proved to be peripheral to our main findings. Thus, we have discussed hypotheses related to these concepts in Appendices A, D, and E, and the corresponding results in Appendices F, G and H. Specifically, in Appendix A we predicted that central details would be remembered more accurately than peripheral details (Hypothesis 6). As described in Appendix D, memory for specific details was predicted to be associated with, or bound to, memory for other linked details (Hypothesis 7). As described in Appendix E, priming memory with emotional essence was predicted to affect the subjective experience of the memory, such that those who were primed would report remembering the events with greater vividness than those not primed (Hypothesis 8).
Method

Participants

Participants were 1563 baseball fans who attended, watched, or read about the 2003 and 2004 American League Championship Games between the New York Yankees and Boston Red Sox. Of the 1563 participants, 277 were baseball fans who attended the following Major League Baseball (MLB) games in the summer of 2008: St. Louis Cardinals @ Washington Nationals, June 3, 2008; San Francisco Giants @ Washington Nationals, June 6, 2008; San Francisco Giants @ Washington Nationals, June 7, 2008; Boston Red Sox @ Cincinnati Reds, June 13, 2008; Houston Astros @ Washington Nationals, July 11, 2008; Houston Astros @ Washington Nationals, July 12, 2008; Minnesota Twins @ New York Yankees, July 22, 2008; Toronto Blue Jays @ Boston Red Sox, August 15, 2008.


Procedure

Game Attendees. Nine graduate and undergraduate student volunteers attended the baseball games listed above, in order to recruit participants. The volunteers were provided tickets to the game, a $20.00 food and beverage stipend, a stack of questionnaires, and a
supply of Red Sox, Yankee, Nationals, and Orioles pens. The stack of questionnaires contained both emotional and control versions of the questionnaires, put in randomized order by using a random number table. Volunteers were instructed to look for fans older than 18, who ‘looked’ like real baseball fans. For ‘neutral’ fans (i.e., anyone other than Red Sox or Yankee fans), volunteers were instructed to use the following approach: “Do you follow major league baseball? Do you usually follow the playoffs? I am a psychology student involved in some research of what people remember about baseball games. Would you mind filling out an anonymous survey in exchange for this Nats / Orioles pen?” For Red Sox or Yankee fans, volunteers were instructed to use the following approach: “Do you follow the Red Sox / Yankees? Do you usually follow the playoffs? I am a psychology student involved in some research of what people remember about baseball games. Would you mind filling out an anonymous survey in exchange for this Red Sox/ Yankees pen?” In most cases, participants completed the questionnaire in about 10 minutes. Because the questionnaire was anonymous (exempt from human subjects), completion of the questionnaire served as written consent. Volunteers then collected the completed questionnaires, and coded them to indicate the date and game.

**Online Respondents.** Links to an electronic version of the questionnaire were posted on seven websites and in an email newsletter. The questionnaire was introduced as a short, 5-10 minute survey which asked specific questions about two notable games in the Red Sox-Yankee rivalry. Participants clicked on the link and were connected with either the control or essence version of the questionnaire, depending on which second (even or odd) they were connected to the questionnaire. All responses went to a database that was converted to Excel and then to SPSS.
We experienced a number of technical problems with the internet data collection. In two instances, the link used in the online newsletter “The Remy Report” was hardwired to a particular survey version. This resulted in non-randomization for 251 control surveys and 261 essence surveys. Once discovered, the link was fixed. The data from the affected surveys were not used in the emotional essence analysis. We also had seven duplicate surveys in the control database which had an exact duplicate saved under it; we deleted these duplicate entries from the database.

**Measure**

Participants completed an original questionnaire which asked them to recognize or recall details about the games, and to indicate their subjective memories of the games (see Appendices I and J). Two pages of the questionnaire consisted of multiple choice questions that asked about details from the games, such as the final score for the Yankees and Red Sox, winning and losing pitchers, location of the game, whether it required extra innings, and who hit a specific home run. One page asked about players and actions from a critical moment in the 2003 game, as depicted in a photograph. Basic demographic information (sex and age) was collected, as well as how they characterized themselves: strong or casual Red Sox fan, strong or casual Yankee fan, or fan of neither team.

Two versions of the questionnaire were used, which differed only in the two instruction pages (page 2 and 5) that preceded each page of questions about game details (page 3 and 6). Emotional versions of the survey contained a one paragraph instruction that attempted to re-create the emotional essence of that specific game. The emotional essence paragraph for 2003 described the Curse of the Bambino as a reason for why the Yankees always finished ahead of the Red Sox, and the paragraph for 2004 described the collapse of
one team and the shock of the other team winning. Control versions of the questionnaire contained instruction pages with control paragraphs, matched for length with the corresponding experimental paragraph in the emotional version of the questionnaire. Both emotional and control paragraphs ended by giving the result of the series (i.e., “in the end, New York defeated Boston in 7 games, and went on to play in the World Series”). Participants were then instructed to try to remember the decisive Game 7 of the specific ALCS, before answering questions on the following page.

Note that the analysis of the emotional essence issue did not yield any significant or otherwise interesting results, and are thus reported in Appendix H only.
Results

Demographics

There were 1866 participants who started the internet survey, and 1286 participants (69%) who completed it. There were also 277 participants who completed the paper survey. The 1563 participants with completed surveys included 1216 (78%) Red Sox fans, 218 (14%) Yankee fans, and 129 (8%) fans of neither team. Among internet participants, 86% were Red Sox fans, 13% were Yankee fans, and 1% were fans of neither team. Among paper participants, 41% were Red Sox fans, 19% were Yankee fans, and 40% were fans of neither team. The mean age of all participants was 42.34, with Red Sox fans being older ($M = 43.78$, $SD = 13.15$) than Yankee fans ($M = 36.79$, $SD = 12.54$), $F (2, 1546) = 34.11$, $p < .001$, $\eta^2 = .04$. Internet participants ($M = 43.63$, $SD = 12.93$) were older than paper participants ($M = 35.99$, $SD = 13.92$), $F (1, 1547) = 74.31$, $p < .001$, $\eta^2 = .05$. Overall, 68% of participants were males, with the percentage of males being lower for Red Sox fans (63%) than for Yankee fans (88%), $\chi^2 = 63.95$, $p < .001$.

Accuracy: Fan Type by Year

We calculated accuracy based on the number of correct answers for the same 6 details about each game: final score for the Yankees and Red Sox, winning and losing pitchers, location of the game, and whether it required extra innings. Fortuitously, combining across all participants, the mean accuracy and the coefficient alpha for the 6-item scale were almost identical for 2003 ($M = 3.71$, $SD = 1.64$, $\alpha = .67$) and 2004 ($M = 3.72$, $SD = 1.60$, $\alpha = .66$), $F (1,1452) = 0.02$, $p = .877$. As expected, the neutral fans were much less accurate than the combined Yankee and Red Sox fans: for 2003, neutral $M = 2.49$, $SD = 1.56$, Red Sox and
Yankee $M = 3.76, SD = 1.62; F(1, 1466) = 49.09, p < .001, \eta^2 = .03$. For 2004, neutral $M = 2.25, SD = 1.18$, Red Sox and Yankee $M = 3.78, SD = 1.59; F(1, 1475) = 78.93, p < .001, \eta^2 = .05$. But more importantly, neutral fans did not differ in accuracy for 2003 ($M = 2.55, SD = 1.58$) versus 2004 ($M = 2.29, SD = 1.22$), $F(1, 77) = 1.84, p = .179$. Thus, these two games were more or less, equally memorable at the time of the survey, which facilitated the following comparisons.

Our first hypothesis was that Yankee and Red Sox fans would remember more details about the game their team lost than the game their team won. A 2 (fan) $\times$ 2 (year) mixed analysis of variance indicated a significant fan by year interaction, $F(1, 1373) = 36.19, p < .001, \eta_p^2 = .026$. A simple effects analysis of the interaction indicated that for 2003, Yankee fans ($M = 4.12, SD = 1.63$) were significantly more accurate than Red Sox fans ($M = 3.72, SD = 1.61), $F(1, 1373) = 10.32, p < .001, \eta_p^2 = .01$. For 2004, Red Sox fans ($M = 3.84, SD = 1.57$) were significantly more accurate than Yankee fans ($M = 3.55, SD = 1.66), $F(1, 1373) = 5.73, p = .017, \eta_p^2 = .004$. See Figure 1.
Within groups, Yankee fans were more accurate about 2003 than about 2004 details, $F(1, 199) = 26.41, p < .001, \eta^2_p = .12$ and Red Sox fans were more accurate about 2004 than about 2003 details, $F(1, 1174) = 7.84, p = .005, \eta^2_p = .01$. Thus, across and within groups, fans remembered more accurately the details of the game which their team won, which was contrary to our predictions. Indeed, among fans who were not equally accurate for the two games, 67% of Yankee fans (94 of 141) were more accurate for 2003 than for 2004, and 52% of Red Sox fans (416 of 799) were more accurate for 2004 than for 2003.

**Vividness: Fan Type by Year**

A subjective quality of memory is vividness. Prior to answering the accuracy questions about the game, participants reported how vividly they remembered the game on a 1 ("not at all") to 7 ("extremely") scale. The two games were much less vivid for the neutral fans as compared with the combined Yankee and Red Sox fans: for 2003, neutral $M = 2.96$, 
For 2004, neutral $M = 3.09$, $SD = 1.66$, Red Sox and Yankee $M = 4.99$, $SD = 1.62$; $F(1, 1553) = 159.67$, $p < .001$, $\eta^2 = .09$. Moreover, the two games were equally vivid for the neutral fans, 2003 ($M = 2.93$, $SD = 1.58$) versus 2004 ($M = 3.08$, $SD = 1.66$), $F(1, 124) = 1.42$, $p = .236$.

The subjective and objective measures of memory, vividness and accuracy respectively, were significantly correlated within groups each year as follows: for neutral fans in 2003, $r = .22$, $p = .04$ and in 2004, $r = .32$, $p < .01$; for Yankee fans in 2003, $r = .36$, $p < .001$ and in 2004, $r = .42$, $p < .001$; for Red Sox fans in 2003, $r = .36$, $p < .001$ and in 2004, $r = .42$, $p < .001$. Thus the correlations between the objective and subjective measures of memory were approximately the same for both positive and negative memories.

Using Yankee and Red Sox fans, a 2 X 2 mixed analysis of variance indicated a significant fan by year interaction, $F(1, 1426), p = 119.23$, $p < .001$, $\eta^2 = .077$. A simple effects analysis of the interaction indicated that for 2003, Yankee fans ($M = 4.83$, $SD = 1.74$) reported marginally greater vividness than Red Sox fans ($M = 4.59$, $SD = 1.65$) $F(1, 1426) = 3.57$, $p = .059$, $\eta^p^2 = .00$, whereas for 2004, Red Sox fans ($M = 5.13$, $SD = 1.53$) reported significantly more vividness than Yankee fans ($M = 4.22$, $SD = 1.87$), $F(1, 1426) = 59.62$, $p < .001$, $\eta^2 = .04$. See Figure 2.
Within groups, Yankee fans reported greater vividness for 2003 than 2004, $F(1, 213) = 30.83$, $p < .000$, $\eta^2_p = .13$. Red Sox fans reported greater vividness for 2004 than 2003, $F(1, 1213) = 185.50$, $p < .001$, $\eta^2_p = .13$. Thus, both between and within groups, fans reported more vivid memories of the game which their team won.

**Rehearsal: Fan Type by Year**

Prior to answering the accuracy questions for each game, participants also reported how frequently they had thought about, or seen media of, the game on a 1 ("not at all") to 7 ("very frequently") scale. The two games were rehearsed less by the neutral fans as compared with the combined Yankee and Red Sox fans: for 2003, neutral $M = 2.10$, $SD = 1.28$, Red Sox and Yankee $M = 3.79$, $SD = 1.69$; $F(1, 1556) = 121.11$, $p < .001$, $\eta^2 = .07$. For 2004, neutral $M = 2.29$, $SD = 1.41$, Red Sox and Yankee $M = 4.60$, $SD = 1.74$; $F(1, 1553) = 212.04$, $p < .001$, $\eta^2 = .14$. Neutral fans did not differ in rehearsal for the 2003 versus 2004 years.
game, $F(1, 125) = 2.35, p = .128$. However, using Yankee and Red Sox fans, a 2 X 2 mixed analysis of variance indicated a significant interaction of fan by year, $F(1, 1425) = 163.34, p < .001, \eta^2_p = .10$. A simple effects analysis of the interaction indicated that for 2003, Yankee fans ($M= 4.22, SD = 1.70$) reported more rehearsal than Red Sox fans ($M=3.72, SD = 1.67$), $F(1, 1425) = 15.57, p < .001, \eta^2_p = .01$. For 2004, Red Sox fans ($M=4.75, SD = 1.66$) reported more rehearsal than Yankee fans ($M=3.78, SD = 1.90$), $F(1, 1425) = 59.72, p < .001, \eta^2_p = .04$. See Figure 3.

**Figure 3. Mean Rehearsal: Fan Type by Year**

![Mean Rehearsal: Fan Type by Year](image)

Within groups, Yankee fans reported greater rehearsal for 2003 than 2004, $F(1, 213) = 13.61, p < .001, \eta^2_p = .060$. Red Sox fans reported greater rehearsal for 2004 than 2003, $F(1, 1212) = 562.83, p < .001, \eta^2_p = .317$. Thus, between and within groups, fans reported more rehearsal of the game which their team won. Within groups, rehearsal and accuracy were significantly correlated as follows: Neutral fans in 2003, $r = .23, p = .04$ and 2004, $r$
=.29, p < .01; Yankee fans in 2003, \( r = .28, p < .000 \) and 2004, \( r = .32, p < .000 \); Red Sox fans in 2003, \( r = .28, p < .000 \) and in 2004, \( r = .30, p < .000 \).

We examined whether rehearsal mediated the relationship between fan type and accuracy using path analyses. In both years, rehearsal was a significant mediator: for 2003, Sobel \( t = 3.35, p < .001 \) and for 2004, Sobel \( t = 6.03, p < .001 \). Thus, one reason why fans may remember more details about their positive game and less about their negative game is that over the years, they think more about and see more media about the positive game. See Figure 4A and 4B.

We also examined whether rehearsal mediated the relationship between fan type and vividness. For 2003, while there was only a marginal relationship between fan type and vividness, it is still possible to examine mediation (MacKinnon & Fairchild, 2009); indeed, rehearsal was a significant mediator in 2003 for this relationship, Sobel \( t = 3.79, p < .001 \). In 2004, rehearsal was also a significant mediator, Sobel \( t = 6.72, p < .001 \). Thus, rehearsal is one reason why fans remember the positive game more vividly than the negative game. See Figure 4C and 4D.

Figure 4. Mediation Path Models

Figure 4A.
Figure 4. Path diagrams indicate that rehearsal mediated the relationship between fan and accuracy in 2003 and 2004 (4A and 4B), and fan and vividness in 2003 (4C). In 2004, rehearsal partially mediated the relationship between fan and vividness (4D).

** p < .001
Age Effects

Accuracy. In order to test for age differences in memory accuracy, we decided to limit the analysis to just the internet Red Sox fans. They were relatively homogeneous in that 97% described themselves as being a “strong,” as opposed to a “casual” fan. There was also a large number of fans for each age group: 25 and under (n = 73), 26-35 (n = 205), 36-45 (n = 278), 46-55 (n = 316), 56-65 (n =177), and over 65 (n = 54, of which only 2 were older than 75).

Using a 6 (age) X 2 (year) mixed analysis of variance on accuracy, there was no significant interaction of age by year, \( F(5, 1097) = 1.41, p = .22 \), and unlike in the full data set, no significant main effect for year \( F(1, 1097) = .94, p = .33 \). However, there was a main effect for age, \( F(5, 1097) = 7.37, \ p <.001, \eta^2 = .03 \). Tukey post hoc tests using experimentwise alpha of .05 indicated significant differences between the following pairs of means: over 65 versus 25 and under, 26-35, 36-45, and 46-55; and 56-65 versus 26-35.

Thus, the older participants remembered less than the other groups, but contrary to our hypothesis, there was no evidence of their differentially remembering more about the positive than the negative game. Indeed, the over 65 age group actually remembered slightly, but not significantly, more about 2003 than 2004. See Figure 5.
Vividness. Next, we investigated whether there were age differences in reported vividness of the memories. A 6 (age) X 2 (year) mixed analysis of variance on self-reported vividness found no significant interaction of age by year, \(F(5, 1097) = 1.86, p = .10\). However, 2004 was reported as more vivid than 2003, \(F(5, 1097) = 111.97, p < .001, \eta^2 = .09\), and older participants reported less vividness than younger participants, \(F(5, 1097) = 8.28, p < .000, \eta^2 = .04\). Tukey post hoc tests indicated significant differences between the following pairs of means: over 65 versus 25 and under, 26-35, 36-45, 46-55; and 26-35 versus 36-45 and 56-65. Thus, the oldest adults reported less vividness than younger adults, but there was no evidence that the positive game was especially vivid for older adults versus younger adults. See Figure 6.
Rehearsal. Finally, we tested whether age differences occurred for self-reported rehearsal. A 6 (age) X 2 (year) mixed analysis of variance on self-reported rehearsal found no significant interaction of age by year, $F(5, 1097) = 0.79, p = .56$. However, participants reported more rehearsal for 2004 than 2003, $F(5, 1097) = 361.67, p < .001, \eta^2 = .25$, and older participants reported less rehearsal than younger participants, $F(5, 1097) = 8.98, p < .001, \eta^2 = .04$. Tukey post hoc tests indicated significant differences between the following pairs of means: over 65 versus 25 and under, 26-35, 36-45, 46-55; 56-65 versus 25 and under, 26-35; 46-55 versus 26-35; and 36-35 versus 26-35. Thus, the oldest adults reported less rehearsal than younger adults, but there was no evidence that the rehearsal difference between the positive and negative game was greater for older adults than younger adults. See Figure 7.
Other Results

**Emotions.** Next we examined whether remembering an event as emotional might help in retaining details about the event. After answering the accuracy questions about a game, fans indicated whether their reaction to the outcome of the game was angry, happy, sad, surprised, or no strong emotion. They could answer more than one emotion. Using Red Sox internet fans only, we found that those reporting anger in 2003 were significantly more accurate on 2003 details ($M = 3.92$, $SD = 1.55$) than those not reporting anger ($M = 3.60$, $SD = 1.65$), $F(1,1101) = 11.12$, $p = .001$, $\eta^2 = .01$. Those reporting sadness in 2003 ($M = 3.72$, $SD = 1.63$) did not differ from those not sad ($M = 3.86$, $SD = 1.57$) on 2003 accuracy, $F(1,1101) = 2.06$, $p = .152$. In 2004, those reporting happiness ($M = 3.95$, $SD = 1.54$) were significantly more accurate on 2004 details than those not happy ($M = 2.74$, $SD = 1.58$), $F(1,1101) = 22.92$, $p < .000$, $\eta^2 = .02$. Those reporting surprise in 2004 ($M = 3.65$, $SD = 1.74$)
were significantly less accurate on 2004 details than those not surprised ($M = 3.94, SD = 1.53$), $F(1,1101) = 3.88, p = .05, \eta^2 = .004$.

Notably, those who reported anger in 2003 were also significantly more accurate on 2004 details ($M = 4.11, SD=1.49$) compared to those not angry in 2003 ($M = 3.66, SD= 1.60$), $F (1,1101) = 23.16, p < .000, = .02$. This suggests that the intensity of fan support, rather than any specific emotion, may be influencing accuracy.

**Other Analyses.** Finally, other analyses are reported in the Appendices. Specifically, the examination of recall for central versus peripheral details is reported in Appendix F. Analyses of the binding together of details is reported in Appendix G, and emotional essence effects are reported in Appendix H.
Discussion

Valence Effects on Memory

Accuracy. Emotional events were remembered more accurately than neutral events. Yankee and Red Sox fans remembered more details accurately about these games than did individuals who were not fans of either team. More importantly, this study found that event valence affected how fans remembered public events after more than 4 years. Both between and within groups, fans remembered the positively valenced game (the game their team won) significantly more accurately than the negatively valenced game (the game their team lost). This result contradicts the conclusion of three prior studies that found less accuracy for positive than for negative public events (Bohn & Berntsen, 2007; Kensinger & Schacter, 2006; Levine and Bluck, 2004). However, these studies compared memory accuracy for a single event for groups who viewed that event positively or negatively, but these intact groups might well differ in many ways. Critically, the present study had a stronger design which enabled both between-group and within-group comparisons for valence. Each participant remembered the same two events, of which one event was associated with positive emotion and the other with negative emotion, with event valence depending on fan loyalty.

Our results are more consistent with studies of autobiographical memories which find that most individuals recall more positive than negative memories about their lives (e.g., Wagenaar, 1986; Walker, Skowronski & Thompson, 2003), and of collective memories, which find that groups selectively remember more self-affirming than negative events (e.g., Pennebaker & Gonzales, 2009; Roediger, Zaromb, & Butler, 2009). Groups form collective memories by talking about and rehearsing positive events more than negative events. In
modern times, this rehearsal also involves media (Pennebaker & Gonzalez, 2009). In our study, there was strong evidence for such media-aided rehearsal for the 2004 World Series Champion Red Sox. The major local newspaper, the Boston Globe, covered the Red Sox in 689 stories the month after defeating the Yankees in 2004, as compared to 124 stories in a similar period in 2002, 240 stories in 2003 (after losing to the Yankees) and 252 stories in 2005 (Boston Globe Archives, 2010). (See Appendix K for Media Coverage and Sales Data for New York and Red Sox Fans.) In addition, sports fans often bask in reflected glory (Cialdini, et al., 1976) after victories, but not defeats, by buying and using team-related merchandise which provides ongoing rehearsal reminders to oneself and to others of the team’s success. Sales of Red Sox merchandise sales jumped dramatically after their victorious 2004 season (Rovell, 2005). The media and merchandise indicators of rehearsal were not as evident following the 2003 Yankee victory probably because the Yankees had won many prior World Series championships (e.g., in 1996, 1998, 1999, 2000) and because they lost the 2003 World Series.

Both between and within groups, fans also reported more rehearsal for the game their team won than the game their team lost. Indeed, frequency of self-reported rehearsal mediated the effects of valence on the long-term accuracy for the details of these well-documented games. However, rehearsal may not necessarily lead to accuracy for less well-documented public events. If factual inaccuracies are rehearsed and reinforced in memory as a way to glorify or justify one’s history (Blatz & Ross, 2009), then the lasting memory will be inaccurate (Roediger, Zaromb, & Butler, 2009). Thus our primary conclusion is that the valence of an event affects what gets rehearsed and recalled, rather than the accuracy of what is recalled. Positive events are generally more likely than negative events to be rehearsed, but
that rehearsal could lead to either increased or decreased accuracy. Accuracy for details per se is thus not a function of the valence of the event.

**Vividness.** Both between and within groups, fans reported more vividness in memory for their positive than for their negative game. Levine and Bluck (2004) similarly found that those who were happy with the O. J. Simpson verdict reported more “clarity” of memory after 2 months than did those who were unhappy with the verdict. Autobiographical studies have also found positive memories to involve more imagery or greater clarity than negative memories (e.g. Byrne, Hyman & Scott, 2001; Schafer & Philippot, 2005). Rehearsal partly mediated the association of positive valence with increased vividness. Fans reported more rehearsal for the game their team won, and this in part led to increased vividness for that game. Moreover, vividness (subjective memory) was correlated positively with accuracy (objective memory) in both years, for both Yankee and Red Sox fans.

We assert that a positive relationship between vividness and accuracy is not inevitable. While rehearsal will almost always increase subjective measures of memory such as vividness, rehearsal can increase or decrease accuracy depending on the nature of the to-be-remembered information. Thus, rehearsal may decrease accuracy in some studies, unlike ours, which allow for more false positives or guessing, or involve recalling details more subject to embellishment such as unverifiable personal memories. The relationship between objective and subjective measures of memory will, in part, depend on whether rehearsal strengthens both types of memory or only the subjective memories.

**A New Look at Past Studies**

Given our conclusion that positively valenced events will typically be rehearsed more, and confer a benefit to subjective but not necessarily objective measures of memory,
we now better understand the prior three real world studies of valence and memory for a single event (e.g., Bohn & Berntsen, 2007; Kensinger & Schacter, 2006; Levine and Bluck, 2004). Kensinger and Schacter found no difference in rehearsal between Red Sox and Yankee fans. This is not unexpected given their Yankee fans, unlike ours, were living in Boston just after the event. These fans must have been constantly exposed to all the various reminders of the Red Sox victory, such as media, merchandise, parades, and parties. With no difference in rehearsal, the groups also did not differ in vividness. There was thus no differential rehearsal to boost vividness in the positive group, and rehearsal could not have influenced accuracy (either way). However, the negative group recalled marginally more correct event details than the positive group in a free recall test of hard facts. In the absence of rehearsal effects, perhaps the specialized neural encoding mechanisms that may promote accuracy for negatively valenced stimuli (e.g., Kensinger, 2009b; Mather, 2007; Schacter, Gutchess & Kensinger, 2009) had an impact. This is in contrast to our study, where any such encoding differences were undoubtedly swamped by the strong effects of social, media, and merchandise – induced rehearsal of well documented details.

Bohn and Berntsen (2007) reported that the positive group talked more about the event than the negative group, and the positive group scored marginally higher on the overall rehearsal scale than the negative group. As expected, given greater rehearsal, the positive group scored higher than the negative group on three subjective measures of memory (reliving, clarity, and intensity). In terms of event details to be recalled, the study asked when the event occurred (time of day, day of the week, date), and who were the heads of State at the time of the event; these are arguably more peripheral details not part of the actual event itself. The authors reported that the negative group was more accurate on these event details.
than the positive group. In fact, the positive group was penalized for being more willing to
guess, which may reflect the greater subjective clarity of their memory. Across all
respondents, there was no difference between the positive and negative groups for number of
correct answers. Thus, with more rehearsal, the positive group scored higher compared to the
negative group on the majority of subjective measures and they were more willing to guess.

Finally, in the Levine and Bluck (2004) study, there was no difference in rehearsal
between the positive and negative groups, although rehearsal was only assessed at Time 1,
one week after the O.J. Simpson trial. This rehearsal was, however, positively associated
with memory clarity ratings, which is the primary subjective memory measure assessed in the
study. In terms of accuracy, recognition memory was tested for true and ‘false but plausible’
event details at the verdict scene. The positive group made more errors of commission after a
year, and endorsed more items overall, than the negative group. Rehearsal was thus
positively related to clarity (a subjective measure) at Time 1, but was not measured at Time 2
and Time 3. It is unknown then how rehearsal might have affected accuracy.

We thus conclude that when investigating the effect of valence on subjective and
objective measures of memory, it is vital to first examine their relationship to each other and
to rehearsal. If positive memories are rehearsed more, this will lead to an increase in
subjective measures of memory such as vividness and clarity relative to the negative group.
However, how rehearsal affects accuracy depends on the study design (for example, free
recall versus forced choice) and type of detail (e.g., loose or well documented facts) being
recalled.
Aging Effects on Memory

We used just the internet Red Sox fans to investigate how aging affects memory. As expected, adults aged 65 or older were less accurate in their memories of both games than younger adults, up to age 55. There was no significant difference between the accuracy of 55-65 year olds and those over 65. Social-emotional selectivity theory predicts that better emotion regulation in older adults leads to a focus on, and better memory for, more positive versus negative stimuli and events (Charles, Mather, & Carstensen, 2003; Mather et al., 2004). Thus, we had expected the elder groups to be differentially more accurate in remembering the positive than the negative game. However, there was no evidence for a positivity effect in these internet fans. In fact, the eldest group was non-significantly more accurate for the negative than for the positive game.

Similarly, adults over 65 reported less vividness and less rehearsal for both games than younger adults, again up to age 55. There were no significant differences for reported vividness, or reported rehearsal, between the 55-65 and over 65 age groups. Every age group reported the positive game to be more vivid and more rehearsed than the negative game. Contrary to expectation, there was no age effect in the magnitude of the positivity effect for vividness or rehearsal.

Although many studies have found differential positivity effects for older adults (e.g., Charles, et al., 2003; Levine & Bluck, 1997), there are also studies that have not (e.g., Alea, Bluck & Semegon, 2004). Indeed, Fernandes, Ross, Wiegand and Schryer (2008) failed to find a consistent differential positivity effect for older adults in recall of autobiographical, picture, or word list material. They did, however, find that in all three memory tasks, older adults were more prone to errors of commission for recalling positively valenced material.
versus negatively valenced material. They thus concluded that false positives may contribute to reports in the literature of positivity effects in older adults. False positives in free recall were not possible in our study because participants were encouraged to answer each multiple-choice question even if they had to guess.

Additional reasons why we did not obtain differential positivity effects for memory accuracy and vividness in the elderly may be that both games were likely rehearsed often and were highly relevant to these strong Red Sox fans. Both increased rehearsal and increased relevance of information have been shown to reduce positivity effects in the elderly. For example, when Kensinger, Brierley, Medford, Growdon, and Corkin (2002) allowed older adults to see words twice, they found positive and negative words were recalled equally. Also, Tomaszczyk, Fernandes and MacLeod (2008) found that when pictures were rated highly relevant, older adults recalled positive and negative pictures equally. Thus our finding of no differential positivity effect in the elderly is not without precedence.

Other Issues

There were three important issues where the data did not yield clear conclusions and so they should be investigated further: 1. whether and how specific emotions influenced recall of central versus peripheral details; 2. whether and how specific emotions influenced binding of details; and 3. whether and how emotional essence information provides a schema for remembering details of emotional events. Unlike laboratory studies where the researcher can generally designate peripheral and central details, we found it very difficult to categorize details as central or peripheral. For example, where the game was played may be seen as a background or peripheral detail, but playing in Yankee stadium, which meant the Yankees batted last, was very important to the “walk-off” home run which ended the 2003 game. We
found some suggestive evidence about the possible influence of recalled anger and other emotions on memory binding of details, but those who remembered experiencing these emotions also tended to be more ardent and knowledgeable fans and that made it difficult to reach a conclusion. Finally, we found no evidence that priming emotional essence influenced objective and subjective measures of memory. It could be that for our sample of knowledgeable, hardcore fans, priming essence was irrelevant as they already had strong emotional memories for these games. It could also be that our priming paragraphs did not adequately capture the essence for the fans, or that essence is so idiosyncratic that a generic rendering of it is ineffective.

Limitations

While this study with participants rating two comparable memories represents a substantial improvement over previous “real world” studies of memory for emotional events, there are several important limitation. A key limitation is that the final sample was heavily weighted towards hard core Red Sox fans (78% of sample). At the time of data collection, in the summer of 2008, the Red Sox were again playoff bound and the Yankees were having one of their worst seasons in a decade. Thus, the Red Sox fans were perhaps more eager to complete our survey than were Yankee fans, and they likely had more favorable current feelings about their team which may have affected participation and the results.

Another limitation was the high proportion of fans who completed the survey on the internet (82%). Internet fans were recruited via baseball websites and an on-line Red Sox newsletter and so are likely to be more knowledgeable and more intense than “average” fans. Also, there was no mechanism to prevent internet fans from looking up the answers as they completed the survey, although we have no reason to believe this occurred.
Additionally, while the outcome and overall drama of the two American League Championships Series were comparable (Miller, 2004), the decisive games of each series were not equally exciting. While the 2003 game was decided in extra innings on a game winning homerun, the outcome of the 2004 game was evident early in the game. It may be that Yankee fans attended less to the 2004 game which their team lost by a large margin, and this may account for the large difference in accuracy between 2003 and 2004 for Yankee fans.

Finally, our study involved recognition of semantic details about 2 public events, in a between and within subject design. Our results are somewhat novel compared to three recent real-world studies (Bohn & Berntsen, 2007; Kensinger & Schacter, 2006; Levine and Bluck, 2004); however, each of these studies tested memory differently, and involved different design features, compared to our study. As Roediger (2008) points out, the lack of replication and “the fact that simple laws do not hold reveals the complex interactive nature of memory phenomenon” (p. 225). Simply put, in memory studies, features like type of design, type of memory test, topic of study, variations in conditions, and other features, can make a big difference. Thus, while our findings are interesting and raise new issues for consideration, the specific features of the study no doubt influenced the results.

Clinical Implications and Future Directions

The rehearsal and lasting nature of positively valenced events in memory, as found in our study, fits with emerging research on the role and importance of positive emotions in everyday life. People retain the positive in positive memories by talking about and reliving them (Walker et al., 2009), while the negative in negative memories generally fades faster due to lack of such rehearsal. As Walker and Skowronski (2009) put it, “people’s mental
processes work over time to maintain a generally positive sense of self that is capable of overcoming adversity and looking towards the future with a sense of hope and anticipation” (p. 1133). There is evidence that this tendency to focus on the positive is healthy and adaptive; indeed, the broaden and build theory argues that positive emotions are associated with a broader repertoire of coping skills and a more optimistic and creative approach to life (Fredrickson, 2004). While clinicians generally help individuals attempt to understand negative influences in one’s life, perhaps they should emphasize more the benefits of a focus on the positive in promoting adaptive coping (e.g., Fredrickson, 2004; Safer, Bonnano, & Field, 2001) and the selective forgetting of negative feelings (Klimes-Dougan, Safer, Ronsaville, Tinsley, & Harris, 2007).

In terms of future directions, the interesting results of this study have confirmed that much can be learned using popular sports rivalries to test memory for real world events. Indeed, many local, college, and professional sports have intense rivalries that can be studied across years or even within the same season. These intense rivalries and frequent games may offer good opportunities for internet data collection to investigate topics such as recall of positive and negative sports events.
Appendix A: Remembering Central and Peripheral Details in Emotional Memory

Many studies demonstrate that, compared to neutral information or events, the central features of emotional information or an emotional event are remembered better than the peripheral features (e.g., Christianson & Hubinette, 1993; Kensinger, Garoff-Eaton, & Schacter, 2007; for reviews, see Reisberg & Heuer, 2004; Levine & Edelstein, 2009). Indeed, as discussed by Levine and Edelstein, and Reisberg and Heuer in their reviews, laboratory studies, as well as autobiographical and real world studies of emotional stimuli or events suggest that emotional arousal promotes memory for items central to an emotional scene’s gist, spatial, or temporal center. However, there is some seemingly contradictory evidence (see Levine & Edelstein, 2009 for a review) which has led to different theories embodying varying definitions of central and peripheral. This section will briefly review the research and different theories on central and peripheral issues in emotional memory.

Many laboratory studies (e.g., Canli, Zhao, Brewer, Gabrieli, & Cahill, 2000; Kensinger, Garoff-Eaton & Schacter, 2007) have compared memory for emotional versus neutral pictures or materials presented to subjects. In one such study, researchers presented pictures of a person hurt by a car, and assessed how the scene was later remembered (Safer, Christianson, Autry, & Osterlund, 1998). They found a memory narrowing effect, which they labeled “tunnel memory,” such that arousal seemed to help memory for the spatially central information and hurt memory for spatially peripheral information. In another study, Kensinger and colleagues (2007) had participants study negative (e.g., a snake) or neutral (e.g. a monkey) images placed in a neutral context (e.g., the jungle). They found that memory was enhanced for the central stimuli in the negative images (i.e. the snake), relative to the neutral backgrounds and to the neutral images (i.e., the monkey).
Similar to laboratory studies, autobiographical memory studies such as Berntsen (2002) have found a differential advantage for central versus peripheral details in emotional memories relative to neutral memories. As an example, Berntsen found that undergraduates reported more central than peripheral details when recalling highly positive and highly negative events. Additionally, real world studies (e.g. Christianson & Hubinette, 1993; Peterson & Whalen, 2001) have generally replicated this finding that in emotional memories, central details are more likely to be remembered than are peripheral details. In these cases, spatially and conceptually central details were remembered with more accuracy than spatially and conceptually peripheral details. Note that this central - peripheral phenomenon has also been found to occur for neutral memories, but the tendency is simply not as pronounced as in emotional memories (e.g. Safer, Christianson, Autry, & Osterlund, 1998).

However, within the body of central - peripheral research, there are contradictory findings as well as unresolved questions (Levine & Edelstein, 2009). For example, some trauma-related studies have found that stress activates hormones that interfere with the binding and encoding of some information to its central context (e.g. Jacobs & Nadel, 1998). Additionally, there is also evidence that without a visually shocking or salient stimuli, called an “attention magnet” (Laney, Heuer & Resiberg, 2003), an advantage for central items is not seen. Laney and colleagues tested this by presenting an emotional story or a neutral story with slides that had no magnets. Those who heard the emotional story experienced more arousal and remembered the slides better than those who heard the neutral story. However, both central and peripheral details were remembered equally well and no memory narrowing was thus observed. Additionally, Talarico, Berntsen, and Rubin (2007), in a study of autobiographical memories, found some emotion specific-differences in terms of what was
remembered. Specifically, they found that positively valenced memory enhanced recall of peripheral details, and anger produced greater tunnel memory effects than fear.

Given these and other contradictions, many theories (e.g., Kensinger, 2009; Levine & Edelstein, 2009; Mather, 2007) have been put forth to explain why there may be differential remembering of central and peripheral features in emotional memory. A key element in these theories is defining what is meant by central and peripheral.

In defining and explaining her working hypothesis for the central versus peripheral issue, Kenisnger (2009) posits that arousal increases memory for “intrinsic” details but not “extrinsic” details. An intrinsic detail is one that is infused with emotion, which can vary in form and substance, depending on how the stimulus is presented, interpreted, and processed. An extrinsic detail is separated from the emotional information, either spatially, temporally, or conceptually. Similarly, Mather (2007) distinguishes between “within item” features that are central and subject to memory binding, and “between-item” features that are not bound and considered peripheral. (See Appendix D for a further explanation of Mather’s theory). Other researchers have used definitions of central which mean spatially integral (e.g., Christianson & Loftus, 1991), temporally integral (e.g., Strange et al., 2003), or conceptually integral or relevant to the “plot” or action of the event (e.g., Peterson & Whalen, 2001).

Finally, Levine and Edelstein (2009) argue for a different way to think about centrality. They suggest that information relevant to one’s active goals will be enhanced by emotion and have a memory advantage. For example, information or stimuli that impedes goal accomplishment, or changes one’s goal, would be central. Information that is not directly related to one’s goal, or pertains to an already accomplished goal, would be
considered peripheral. This definition of central thus depends heavily on the goals of the individual who is doing the remembering.

In summary, there is broad evidence across laboratory, autobiographical, and real world studies that emotional arousal enhances memory for central information relative to peripheral information. Within this broad consensus, there are different definitions of central and peripheral, as well as contradictions that have yet to be explained.

In the current study, we attempted to ask about both conceptually and spatially central and peripheral details, and assess whether central details were remembered more accurately than peripheral details, as the research would predict. For example, we would expect that the conceptually central detail of who hit the game winning home run would be better remembered than who hit a home run in the middle of the game that was not central to the outcome. We also expected that in reviewing a photograph of a key moment in the game, participants would remember the spatially and conceptually central person of the scene more than the peripheral person. See Appendix F for analyses of central versus peripheral details.
Appendix B: Objective and Subjective Characteristics of Memory

A common finding is that objective measures of memory for an emotionally-arousing experience, such as accuracy for details, are unrelated to subjective measures of the memory, such as vividness, confidence, or a sense of recollection (Phelps & Sharot, 2008). In laboratory, autobiographical, and event-related emotional memory, strong reported emotions are typically positively correlated with vividness and confidence, although not always with accuracy (e.g., Reisberg & Heuer, 2004; Resiberg, Heuer, McLean & O’Shaughnessy, 1988, Sharot & Yonelines, 2008). For example, Sharot and Yonelines (2008) found that emotional photos were recalled with a stronger sense of recollection, but not more accuracy, than neutral photos. In a series of autobiographical studies, Reisberg et al. (1988) found that the quantity of emotion associated with the remembered event predicted reported vividness, such that the more emotion, the more vividness. However, accuracy was not assessed, as it is hard to verify autobiographical accuracy in such studies.

Flashbulb and other event related memory studies have found mixed results for the correlation between recalling objective details and subjective memory characteristics (e.g., Talarico & Rubin, 2003; Conway et al. 1994). In a study of the Shuttle Challenger explosion, Neisser and Harsch (1992) found inaccuracies in memories of both personal and event detail after 3 years, even though confidence in remembering the event and how one learned about it remained high. Conway and colleagues (1994), however, found that confidence and accuracy were relatively high for citizens of the UK in their memory of Margaret Thatcher’s resignation. Those who were not United Kingdom citizens, however, were lower both in confidence and accuracy. Indeed, Conway and colleagues posit that there may be several factors which boost accuracy, including the importance and consequentiality
of the event, the amount of discussion and retrieval that happens about the event, and the timing of follow up questions about the event. Similarly, in studies of eyewitness memory, there is considerable evidence that different factors can affect witness confidence and witness accuracy, so that confidence can be raised or lowered independently of accuracy (for a review, see Wells & Olsen, 2003).

Three studies relevant to our study have found a disassociation between objective and subjective characteristics. Levine and Bluck (2004) found that those happy about the O.J. Simpson verdict reported more clarity in their recall, but were more prone to errors, than those unhappy with the verdict. Kensinger and Schacter (2006) found that Red Sox fans happy with their team’s 2004 victory showed more confidence, yet less accuracy, than their Yankee fan rivals. Finally, Bohn and Berntsen (2007) found that many years later, those participants who felt positively about the fall of the Berlin Wall reported more re-living, more intensity of emotion, and more clarity in their memories relative to those unhappy about the event. The authors also concluded that the happy group was less accurate in recalling facts than the negative group. Their data suggests that those in the happy group were perhaps not less knowledgeable but were simply more willing to guess in answering questions.

Phelps and Sharot (2008) proposed that in cases where there is a disassociation between objective and subjective factors, it may be that the quality and strength of a few, strongly emotional details results in a vivid, confidence-inducing memory. However, accuracy for the non-emotional, particularly peripheral, details of the memory may suffer. They also speculated that from an evolutionary viewpoint, it may be beneficial to remember just a few key details vividly in order to make faster decisions in threatening situations.
The current study examines memory accuracy and vividness for naturally-occurring positive and negative emotional events over a 4-5 year period. The results should illuminate whether the relationship between objective and subjective memory factors differs for positive versus negative memories.
Appendix C:

Neuropsychological Theories of Arousal and Valence in Emotional Memory

Within the emotional memory literature, there are several key theories that attempt to provide neuropsychological explanations for why emotional memories differ from neutral memories. This section will briefly describe these main theories, including an explanation of why positive and negative emotional memories may differ.

In general, many researchers (e.g., Mather, 2007; Hadley & MacKay, 2006; Mather & Sutherland, 2009) posit that an arousing, emotional stimulus has a memory advantage because it attracts attention. This is in part due to the involvement of the amygdala, which enhances visual processing for emotional stimuli relative to neutral stimuli. However, some researchers (e.g., Jacobs & Nadel, 1998; Metcalfe & Jacobs, 1998; Nadel & Jacobs, 1998) have found that extreme arousal (which is typically associated with traumatic, very negative events) leads to the release of stress hormones which interfere with the function of the hippocampus and pre-frontal cortex, which are responsible for binding and consolidation of information to its context. So while the amygdala function is enhanced, and thus “unbound” emotional items receive more visual processing, the binding of these items to context is impaired due to interference with hippocampal and pre-frontal cortex function. Mather’s (2007) object-based framework attempts to explain, within this neuropsychological context, what is then “bound,” and more available for retrieval versus what is not bound. (See Appendix D: Binding of Details in Emotional Memory.)

In a somewhat similar explanation, Kensinger (e.g., 2009) presents the hypothesis that while negative and positive stimuli are enhanced in memory relative to neutral stimuli, the negative information will benefit from more detailed encoding due to the involvement of
sensory processing regions in the brain. For example, in a study involving fMRI scans of participants viewing pleasant and unpleasant images, Kensinger and Schacter (2008) found that the encoding of negatively valenced information involved more sensory processing regions of the brain, including the occipital cortex, relative to positively valenced stimuli. This they found to be consistent with a more detailed approach to encoding for negative versus positive stimuli. They also found that the positive stimuli involved more semantic or conceptual processing regions of the brain, including the lateral prefrontal and temporal regions, which they found to be consistent with more heuristic processing. This study, and others like it (e.g., Mickley & Kensinger, 2008; for a review, see Kensinger, 2009b), seem to provide some neural evidence for the laboratory findings of the affect-as-information processing approach (e.g., Schwartz & Clore, 1983), which posits that negative affect invokes more detail-oriented processing, and positive affect invokes more reliance on scripts and general information. Interestingly, Mather and Sutherland (2009) have attributed this detailed-processing advantage to arousal, and not specifically negative valance, which they infer often incurs more arousal than positive stimuli.

Finally, a recent study by Botzung, Rubin, Miles, Cabeza & LaBar (2010) has found results that challenge the findings of the theories above. Botzung and colleagues conducted fMRI scans of Duke and University of North Carolina basketball fans who were asked to recall the outcome of 64 key shots from an intense Duke –UNC game. During the fMRI scan, the participants were shown clips of a game that they had watched three times during the prior week. The study found that participants were more accurate in their memory of the outcome of positively valenced shots (i.e. shots that their team made or the other team missed) versus negatively valenced shots, as well as rating the positive plays as more intense.
The authors found that upon memory retrieval, the participants recruited brain areas – such as the frontocinguloparietal area – during the positively valenced recall that may reflect a broader allocation of attention and thus support Frederickson’s (2001) broaden-and-build theory of emotions. Importantly, this study examined brain areas during memory retrieval and not encoding; as such, it may be that the memory advantage conferred on positive stimuli in this study is a result of consolidation or other processes that happen after encoding. It reinforces the notion that little is known about how long-term consolidation affects the advantages that may have been realized in the encoding and working memory stages (Mather, 2007, p.45).

In summary, neuropsychological theories generally agree that amygdala, hippocampal, and pre-frontal cortex brain regions are important in the encoding, binding, and consolidation of emotional memories. Questions remain as to whether arousal in general or negative valence is responsible for invoking more detailed encoding. In addition, more research is needed to determine the influence of this encoding on what is ultimately retrieved. The current study attempts to examine recall and binding of positive and negative emotional memories in a long-term context. The results may thus provide some evidence as to how the theories discussed above play out in a long-term context.
Appendix D: Binding of Details in Emotional Memory

Accurate memory of a past event depends upon one’s ability to encode the specific details of the event and bind these details together with their spatial, temporal, and conceptual context (Mather, 2007; Ranganath, 2010). The bound information must then be consolidated into a lasting memory representation and later retrieved (Kensinger, 2009; Mather 2007). While there is broad agreement that emotional arousal plays a role in this binding of information during the encoding process, different theories make different predictions about arousal’s effect on binding, which in turn affects what is remembered (e.g., Hadley & MacKay, 2006; Jacobs & Nadel, 1998; Kensinger, 2009; Mather, 2007). In this section I briefly review key theories of how arousal affects memory binding.

The first theory for examination is the priority-binding theory put forth by MacKay and his associates (e.g., Hadley & MacKay, 2006). This theory proposes that the emotional arousal accompanying emotional stimuli (i.e. presenting taboo words in a list of neutral words) triggers priority binding of the stimuli to its context (MacKay, Shafto, Taylor, Marian, Abrams, & Dyer, 2004; Mather, 2007). This priority binding is at the expense of binding more neutral items to their context. Mather (2007, p.34) calls this the “arousal-enhances binding” hypothesis, which leads to better recall of emotional stimuli and context as compared with neutral stimuli and context. However, this theory seemingly contradicts other research presented by Jacobs, Nadel and colleagues (e.g., Jacobs & Nadel, 1998).

The research and theory put forth by Jacobs and colleagues (e.g., Jacobs & Nadel, 1998; Metcalfe & Jacobs, 1998; Nadel & Jacobs, 1998) discusses disaggregated memories and the processes that lead to them, which Mather (2007) calls the “arousal-impairs-binding hypothesis” (Mather, 2007, p. 34). In this theory, arousing events or items may be
remembered in fragments, without their context. This is hypothesized to be due to stress hormones produced by arousal, which interfere with the function of the hippocampus and other brain regions in the binding process of items to their associated context. Therefore, this theory suggests that arousal can interfere with binding. Indeed, the fragmented memories of trauma that PTSD patients often report provides support for this hypothesis. (Payne, Nadel, Britton, & Jacobs, 2004; Mather, 2007). In order to reconcile these seemingly contradictory theories, Mather (2007) presents evidence that an object-based framework can explain the contradictions, at least in terms of short-term retention and working memory.

Essentially, Mather’s (2007) object-based framework says that emotional arousal associated with an ‘object’ elicits focused attention that enhances within-object binding. This seems to be true at the perceptual binding stage, such that in the instant that the arousing stimuli is perceived, the within-object features (such as color and location of arousing words) receive priority binding of feature to item. However, perception of objects and object features does not necessarily mean that these will translate into working memory or explicit short-term memory. However, Mather discusses that studies have shown that emotionally arousing objects appear to be less subject to the ‘attentional blink’ and thus more likely to make it into working memory. She argues that these arousing items and the within-object features associated with them should show the same benefit, and have “privileged access to working memory” (Mather, 2007, p. 37).

But while Mather’s research focuses on the encoding stage, there is still little known about consolidation of these ‘bound’ working and short-term memories into long-term episodic memories. Indeed, Mather admits that there is little research with humans that looks at long-term explicit memory in the context of binding, associative or contextual memory.
She predicts that stress during emotional arousal of an event may impair the long-term consolidation of item to other item binding because of the negative effects that stress hormones have on the hippocampus. However, it may also be the case that stress hormones enhance consolidation of ‘central details’ via the positive effects these hormones have on the amygdala. Mather (2007) argues that the “thematic content of memory is intact or enhanced because of amygdala-based enhancement of emotional memories” (p.43). Thus, she argues “whatever is considered to be an integral component of the emotionally arousing object will…show enhanced long-term consolidation. In contrast, connections between the integral component and other objects or contextual details may not get the same degree of consolidation” (p.44). This suggests that within-object features that are key to the thematic or emotional content of the memory could benefit from enhanced long-term consolidation relative to inter-object features which would not receive this benefit.

Mather’s (2007) object-based framework is similar to Kensinger’s hypothesis that with arousal, intrinsic item features will be bound together and remembered better than extrinsic features (Kensinger, 2009). Kensinger’s definition of intrinsic seems to be broader than Mather’s within-object definition, such that Kensinger would include information that was not a fixed property of the stimulus. For example, a decision made about an emotional stimulus, if it was conceptually tied to the stimulus and infused with emotion, could be intrinsic and thus bound together with the stimulus during encoding (Kensinger, 2009). However, Kensinger makes the point that the object-based framework and the intrinsic-extrinsic hypothesis are similar and agree on the key concept: emotional arousal leads to memory enhancement due to increased attention and binding together of integral components during the encoding and consolidation process (Kensinger, 2009, p.102).
In the current study, we attempted to investigate the effect of emotional arousal on the binding together of details from one key decision in the 2003 ALCS game between the Yankees and Red Sox. Specifically, we were interested to see, after 5 years, which details from a key, emotionally arousing scene depicted in a picture would be bound together or show an association in memory, and if these details would be considered intrinsic to the key event pictured. We then investigated the specific effect of anger on these memory associations, to see if there was evidence that anger seemed to help or hinder the binding together, and eventual recall, of key information.
Appendix E: Emotional Essence

There are several studies that suggest a role for ‘emotional essence’ in the recall of long-term emotional memory. Safer, Breslin, Boesch, Cerqueira (2007) describe emotional essence as “the deeper, affective themes that an individual extracts about an experience, or across multiple experiences” (p.862). For example, in his classic article about John Dean’s memory for the events surrounding the Watergate scandal, Neisser (1981) found that although John Dean was rarely accurate in the details of events and conversations, and only occasionally accurate for gist, Dean did retain the underlying emotional “tone” or essence of what had happened. Indeed, Neisser says Dean’s “testimony had much truth in it, but not at the level of gist. It was true at a deeper level” (Neisser, 1981, p.13). Essentially, Dean was aware of the broader, deeper meaning of what had happened (e.g. Nixon’s knowledge of the cover-up and the motivations behind his actions) and he represented this emotional essence accurately.

In examining this idea of emotional essence, Safer and colleagues (2007) found that even after 4 years, individuals retained the emotional essence of an intimate conversation, and subjects may have used this to infer gist level behaviors. To our knowledge, Neisser’s John Dean study and Safer and colleagues’ 2007 study are the only two papers examining this idea of emotional essence in natural settings, although Bartlett (1932/1995) and Reisberg (e.g., Laney, Heuer & Reisberg, 2003) discuss similar ideas described as emotional attitude and emotional themes. Both these studies examined the role of emotional essence retrospectively, and to date there are seemingly no studies that prime or manipulate the presence of emotional essence to see if it can act as a memory aid. Indeed, it may be that emotional essence aids in the consolidation processes of memory, providing a schema into
which the central and other details of the memory can fit. If so, essence-congruent details and context may be remembered long-term, whether accurate or not. Additionally, by providing a schema for the objects of the memory to fit into, emotional essence may also increase subjective characteristics, such as perceived vividness, of the long-term memory. With this in mind, the current study attempted to capture the emotional essence of the 2003 and 2004 games that were asked about in the survey. Priming this emotional essence in a half-page paragraph before specific game questions were asked was predicted to serve as a memory aid that would boost recall for essence-congruent details as well as subjective characteristics of the memories.
Appendix F: Central versus Peripheral Results

We conducted analyses examining whether central details were remembered more accurately than peripheral details, defining central as conceptually central and then spatially central. Specifically, we predicted that central details would be remembered more accurately than peripheral details (Hypothesis 6). We first attempted to categorize details as central and peripheral, and then conducted four different analyses, as described below. As will be discussed, we found it very difficult to decide what was conceptually central and what was conceptually peripheral, even when further narrowing the definition.

First, using all participants, we added six details (three from each game) deemed conceptually central to the outcome of the game to create a Central scale ($\alpha = .70$). The central details were: the difference in the final score of 2003, did the game go into extra innings in 2003, who hit the last inning home run in 2003, the difference in the final score of 2004, the winning pitcher in 2004, the losing pitcher in 2004. We then added six details (three from each game) deemed conceptually peripheral to the outcome of the game to create a Peripheral scale ($\alpha = .58$). The peripheral details were: where was the game played in 2003, winning pitcher in 2003, losing pitcher in 2003, did the game go into extra innings in 2004, where was the game played in 2004, and who hit the grand slam home run in 2004.

Using all participants, we used a paired sample t-test to compare mean accuracy of each scale. Contrary to our predictions, mean accuracy for the peripheral scale was significantly higher than mean accuracy for the central scale, $t (1,1452) = 17.79 , p =.000$. This is likely due to the difficulty of categorizing details as conceptually central or peripheral in these games. What is central in one fan’s view is often peripheral to another. For example, one
could argue that the winning pitcher in 2004, Derek Lowe, was central to the outcome because he pitched so well and gave up only one run. However, one could also argue that his pitching was peripheral relative to the Red Sox offense which scored six runs in two innings.

In order to try to narrow the focus to the most central and peripheral details, we added what we viewed were two core thematically central details (one from each game) to create a more focused Central scale ($\alpha = .49$). We then added two thematically peripheral details (one from each game) to create a more focused Peripheral scale ($\alpha = .40$). Again the items were selected based on thematic centrality, that is, whether the detail had a material effect on the game. The central items were whether the game went into extra innings or not in 2003, and who the losing pitcher was in 2004. These items were deemed thematically central because the 2003 game was tied up in the 8th inning, and had a dramatic finish in the 11th inning. The drama in the extra innings was a central aspect of the game. The losing pitcher, Kevin Brown, was also central to the Yankee defeat in 2004, because he was responsible for five runs before being taken out of the game in the second inning, making it hard for the Yankees to recover. Indeed, the game was not close, and Kevin Brown had much to do with that. The peripheral items were who was the winning pitcher in 2003, and where was the 2004 game played, two details that had little to do with the outcome of the game.

Using a paired samples t-test to analyze any difference in accuracy, the peripheral scale was found to be recalled more accurately than the central scale, $t (1,1519) = 15.30, p < .001$. We then looked at the items separately, and found that the winning pitcher of 2003 (Mariano Rivera, a peripheral detail) was remembered more accurately than the losing pitcher of 2004 (Kevin Brown, a central detail), $t (1, 1532) = 11.64, p <.001$. This may be
due to the fact that Kevin Brown is much less well known than Mariano Rivera, who is a future hall-of-famer and has been the closer for the New York Yankees since 1997. Interestingly, the peripheral item of where the game was played in 2004 was remembered more accurately than the central detail of whether the 2003 game went into extra innings, $t (1, 1530) = 10.83, p < .001$. This may be due to the fact that the sample was dominated by Red Sox fans, and overall, positive memories were recalled more accurately than negative memories. Therefore, a 2004 detail was part of a positive memory for the majority of the sample, and may have been subject to a memory benefit vis a vis a 2003 detail. Additionally, the celebration on the field in Yankee Stadium was depicted in newspapers and media after the event, and may have been particularly memorable for Red Sox fans since they won on their rival’s home field.

Next, we examined the two home run questions, namely who hit the game winning home run in 2003, and who hit the grand slam home run in 2004. The 2003 home run won the game, and was thus central; the 2004 home run was inconsequential to the game, as the Red Sox won by a seven point margin. As expected, this analysis showed that the central home run was recalled significantly more accurately than the peripheral home run, $t (1, 1535) = 10.42, p < .001$. However, these results are likely due in part to the fact that the central, Aaron Boone home run is consistently shown in commercials during advertisements for the MLB playoffs and World Series every year. Thus, it has benefited from repeated rehearsal. So better recall of this homerun over the 2004 homerun may not be a central – peripheral issue at all; it is likely a rehearsal issue.

Finally, we examined visual and thematic centrality by examining the results of the picture identity questions. Specifically, a photograph of a key moment in the game was
shown in the survey, and participants were asked to identify all three players. We compared whether participants would remember Grady Little – central to the picture and central to the action in the picture – better than Kevin Millar, peripheral in a visual and thematic sense. As expected, this analysis showed that Grady Little was recalled significantly more accurately than Kevin Millar, $t(1, 1429) = 35.84, p < .001$. However, Grady Little was subject to much discussion (and hence rehearsal) in the media and among Red Sox fans after the events of 2003, when he was fired from the Red Sox. So again, increased rehearsal is likely a key factor in these results, rather than centrality per se.

Overall, we had difficulty applying the central versus peripheral question to our current study. While it is relatively easy in the laboratory to categorize an arousing stimulus as central when set against a neutral, peripheral background, real-life details are much more difficult to categorize. We thus had problems, and different opinions, in categorizing central or peripheral details in terms of their conceptual meaning to the game. Even when we compared home runs that seemingly were distinct in their centrality, and looked at spatial and conceptual centrality in our picture analysis, strong rehearsal effects likely influenced the results and thus makes it difficult to assess whether centrality was a factor.
Appendix G: Results Concerning Binding of Details

To explore Hypothesis 7, whether memory for specific details was associated with or bound to memory for other linked details, we used a chi square test to examine 18 linkages of specific details surrounding one key decision in the 2003 game which was perhaps central to the outcome of the game, and represented by a picture in the survey. Using Red Sox internet fans only, those who accurately identified the pitcher (Pedro Martinez) in the survey photo were more likely to identify the Manager (Grady Little), as well as the first baseman (Kevin Millar). And those who accurately identified the Manager, were more likely to recall the action the Manager took, as well as other details about what happened next. Indeed, all linkages tested were significant with the exception of 2: recall of the pitcher (Pedro Martinez) to the next batter, and recall of the first baseman (Kevin Millar) to the next batter.

Interestingly, while the next batter hit a double which tied the game, it does not seem to matter who hit the double. (See Table G1 for complete results with these two exceptions bolded.) In sum, perhaps not surprisingly, remembering one detail about the picture was associated with remembering other details.

Next, we explored binding under various emotions. In our first analysis, we compared those who reported anger in 2003 versus those who did not report anger. (See Table G2.) The effect size for those not angry is greater than the effect size for those who are angry in 13 of 16 comparisons (and 2 ties). The three (in bold) where the angry fans have larger effect sizes are: 1) the binding of (correctly identifying) Pedro to (correctly identifying) Grady; 2) correctly identifying Grady to leaving Pedro in the game, and 3) the binding of (correctly identifying) Pedro to leaving Pedro in the game. Thus, being angry would seem to hurt
binding, as evidenced by smaller effect sizes, except perhaps for the very central detail of
Grady leaving Pedro in the game. This may support the idea that the tunnel memory effects
are strongest for angry memories (Talarico, Berntsen & Rubin, 2009).

Table G1

*Red Sox Internet Fans (n=1103): Binding*

<table>
<thead>
<tr>
<th>Person A correct (Pedro Martinez) a to:</th>
<th>Chi Square</th>
<th>Cramer V</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person B correct (Grady Little)</td>
<td>41.57</td>
<td>0.19</td>
<td>0.000</td>
</tr>
<tr>
<td>Person C correct (Kevin Millar)</td>
<td>4.95</td>
<td>0.07</td>
<td>0.026</td>
</tr>
<tr>
<td>Left Pedro in game</td>
<td>45.52</td>
<td>0.20</td>
<td>0.000</td>
</tr>
<tr>
<td>A Answer to who was winning (Red Sox)</td>
<td>7.54</td>
<td>0.08</td>
<td>0.006</td>
</tr>
<tr>
<td>A Answer to what next batter did (double)</td>
<td>21.22</td>
<td>0.14</td>
<td>0.000</td>
</tr>
<tr>
<td>A Answer to what was next inning (8th)</td>
<td>6.79</td>
<td>0.08</td>
<td>0.009</td>
</tr>
<tr>
<td>A Answer to who was next batter</td>
<td><strong>1.54</strong></td>
<td><strong>0.04</strong></td>
<td><strong>0.214</strong></td>
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<tr>
<th>Person B correct (Grady Little) b to:</th>
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<tbody>
<tr>
<td>Person C correct (Kevin Millar)</td>
</tr>
<tr>
<td>Left Pedro in game</td>
</tr>
<tr>
<td>A Answer to who was winning (Red Sox)</td>
</tr>
<tr>
<td>A Answer to what next batter did (double)</td>
</tr>
<tr>
<td>A Answer to what inning was it (8th)</td>
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<tr>
<td>A Answer to who was next batter</td>
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<th>Person C correct (Kevin Millar) c to:</th>
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<td>A Answer to what was next inning (8th)</td>
</tr>
<tr>
<td>A Answer to who was next batter</td>
</tr>
</tbody>
</table>

Note: Linkages which were not significant are bolded.

* Number of Red Sox Internet fans who got Person A correct: n = 1092
* Number of Red Sox Internet fans who got Person B correct: n = 946
* Number of Red Sox Internet fans who got Person C correct: n = 340
Table G2

Angry vs. Not Angry Binding

Note: Linkages where angry fans have larger effect sizes than not angry fans are bolded.

<table>
<thead>
<tr>
<th>Binding Variables</th>
<th>Angry RS Internet fans (n = 603)</th>
<th>Not Angry RS Internet fans (n = 500)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Chi Square</td>
<td>Cramer V</td>
</tr>
<tr>
<td>Person A (Pedro) to:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Person B (Grady)</td>
<td>24.53</td>
<td><strong>0.20</strong></td>
</tr>
<tr>
<td>Person C (Millar)</td>
<td>1.66</td>
<td>0.05</td>
</tr>
<tr>
<td>Left Pedro in game</td>
<td>30.04</td>
<td><strong>0.22</strong></td>
</tr>
<tr>
<td>Who was winning</td>
<td>0.056</td>
<td>0.01</td>
</tr>
<tr>
<td>What next batter did</td>
<td>0.999</td>
<td>0.04</td>
</tr>
<tr>
<td>What inning was it</td>
<td>4.09</td>
<td>0.08</td>
</tr>
<tr>
<td>Who was next batter</td>
<td>0.054</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Got Person B (Grady) to:

| Person C (Millar) | 13.39 | 0.15 | 0.000 | 20.43 | 0.20 | 0.000 |
| Left Pedro in game| 16.55 | **0.17** | 0.000 | 10.59 | **0.15** | 0.001 |
| Who was winning    | 3.064 | 0.07 | 0.080 | 18.63 | 0.19 | 0.000 |
| What next batter did| 5.26 | 0.09 | 0.022 | 9.07  | 0.14 | 0.003 |
| What inning was it | 5.62  | 0.10 | 0.018 | 8.60  | 0.13 | 0.003 |
| Who was next batter| 0.801 | 0.04 | 0.370 | 3.48  | 0.08 | 0.062 |

Got Person C correct (Millar) to:

| Left Pedro in game | 7.92 | 0.12 | 0.005 | 9.28  | 0.14 | 0.002 |
| Who was winning    | 3.41 | 0.08 | 0.065 | 4.46  | 0.09 | 0.035 |
| What next batter did| 12.26 | 0.14 | 0.000 | 13.60 | 0.17 | 0.000 |
| What inning was it | 9.45  | 0.13 | 0.002 | 8.82  | 0.13 | 0.003 |
| Who was next batter| 1.08  | 0.04 | 0.299 | 1.68  | 0.06 | 0.196 |

In a different analysis, we then examined the effect of anger on recall of the relevant details surrounding the key decision depicted in the picture, controlling for correctly identifying each person in the picture. Beginning with Grady Little (who seemingly invoked
the most anger amongst Red Sox fans), we looked at those fans who correctly identified him, and then examined how remembering being angry or not angry would affect their identification of the other two players, and their recall of five key details about the picture incident. We then repeated this analysis for those fans who correctly identified Pedro Martinez, and then Kevin Millar. (See Table G3 for complete results.)

The results indicate that, controlling for identifying Grady Little, and relative to those who did not report anger, those who do report anger were significantly more likely to: 1) identify Kevin Millar, and recall that 2) Pedro was left in the game, and 3) the next batter hit a double. Likewise, controlling for identifying Pedro Martinez, and relative to those who did not report anger, those who do report anger were more likely to get all the details correct, except remembering what inning it was and who the next batter was. These results suggest that anger confers an advantage on recall of details, as Kensinger (2009) suggests. It may be that for angry fans, they remember well the action or detail that blocked their goal, namely Grady Little leaving Pedro Martinez in the game which led to the Yankees tying the score and eventually winning the game. This is consistent with the goal relevant definition of centrality (e.g. Levine & Edelstein, 2009), which should confer a memory advantage, as discussed in Appendix A.

However, it also may be that reporting anger about the 2003 game is a measure of fandom. That is, those who remembered being angry are those who know the team, and what happened, best. Indeed, as reported in the main results (p. 25), those who remembered being angry in 2003 were also more accurate than the non-angry fans for details about the 2004 game. Interestingly, in those who correctly identified Kevin Millar (1/3 of the sample), being angry made little difference as to whether most details were recalled or not.
Finally, as a control, we repeated the above analysis for those correctly identifying Grady Little and then reporting being sad or not sad. (See Table G4 for results). We found only one significant result, in which being sad made it less likely to recall what the next batter did, relative to those who did not report sadness. Thus, anger and not sadness seems to confer more of a memory advantage – or in fact a fandom advantage – in this analysis of our study. Overall, we found some evidence to suggest that anger may help one remember the central details (Table G3), but in fact may hurt the binding together or associations of details (Table G2) in memory.

Table G3

Effects of Anger on Recall of Picture Details

<table>
<thead>
<tr>
<th>Got Grady Little Correct (n=946)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Angry / Not Angry to:</td>
<td>CH</td>
<td>P</td>
</tr>
<tr>
<td>Got Pedro Martinez correct / incorrect</td>
<td>2.63</td>
<td>0.11</td>
</tr>
<tr>
<td>Got Kevin Millar correct / incorrect</td>
<td>7.71</td>
<td>0.01</td>
</tr>
<tr>
<td>Left Pedro in game - correct / incorrect</td>
<td>4.05</td>
<td>0.04</td>
</tr>
<tr>
<td>Who was winning (RS) - correct / incorrect</td>
<td>3.05</td>
<td>0.08</td>
</tr>
<tr>
<td>What next batter (double) - correct / incorrect</td>
<td>15.94</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>What inning was it (8th) - correct / incorrect</td>
<td>0.00</td>
<td>0.99</td>
</tr>
<tr>
<td>Who was next batter (Matsui) - correct / incorrect</td>
<td>1.45</td>
<td>0.23</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Got Pedro Martinez correct (n=1092)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Angry / Not Angry to:</td>
<td>CH</td>
<td>P</td>
</tr>
<tr>
<td>Got Grady Little correct / incorrect</td>
<td>10.6</td>
<td>.001</td>
</tr>
<tr>
<td>Got Kevin Millar correct / incorrect</td>
<td>12.75</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Left Pedro in game - correct / incorrect</td>
<td>4.91</td>
<td>0.03</td>
</tr>
<tr>
<td>Who was winning (RS) - correct / incorrect</td>
<td>8.08</td>
<td>0.004</td>
</tr>
<tr>
<td>What next batter (double) - correct / incorrect</td>
<td>19.94</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>What inning was it (8th) - correct / incorrect</td>
<td>0.16</td>
<td>0.69</td>
</tr>
<tr>
<td>Who was next batter (Matsui) - correct / incorrect</td>
<td>2.47</td>
<td>0.12</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Got Kevin Millar Correct (n=340)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Angry / Not Angry to:</td>
<td>CH</td>
<td>P</td>
</tr>
<tr>
<td>Got Pedro Martinez correct / incorrect</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Got Kevin Millar correct / incorrect</td>
<td>0.001</td>
<td>0.97</td>
</tr>
<tr>
<td>Left Pedro in game - correct / incorrect</td>
<td>0.13</td>
<td>0.72</td>
</tr>
<tr>
<td>Who was winning (RS) - correct / incorrect</td>
<td>1.14</td>
<td>0.29</td>
</tr>
<tr>
<td>What next batter (double) - correct / incorrect</td>
<td>3.1</td>
<td>0.08</td>
</tr>
<tr>
<td>What inning was it (8th) - correct / incorrect</td>
<td>0.09</td>
<td>0.77</td>
</tr>
<tr>
<td>Who was next batter (Matsui) - correct / incorrect</td>
<td>0.33</td>
<td>0.57</td>
</tr>
</tbody>
</table>
Table G4

Effects of Sadness on Recall of Picture Details

<table>
<thead>
<tr>
<th>Got Grady Little Correct (n=946)</th>
<th>Chi Square</th>
<th>p</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sad / Not Sad to:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Got Pedro Martinez correct / incorrect</td>
<td>1.55</td>
<td>0.21</td>
<td></td>
</tr>
<tr>
<td>Got Kevin Millar correct / incorrect</td>
<td>0.81</td>
<td>0.37</td>
<td></td>
</tr>
<tr>
<td>Left Pedro in game - correct / incorrect</td>
<td>0.34</td>
<td>0.56</td>
<td></td>
</tr>
<tr>
<td>Who was winning (RS) - correct / incorrect</td>
<td>0.27</td>
<td>0.60</td>
<td></td>
</tr>
<tr>
<td>What next batter did (double) - correct / incorrect</td>
<td>9.99</td>
<td>0.002</td>
<td>88% not sad fans were correct vs 80% sad fans</td>
</tr>
<tr>
<td>What inning was it (8th) - correct / incorrect</td>
<td>0.04</td>
<td>0.84</td>
<td></td>
</tr>
<tr>
<td>Who was next batter (Matsui) - correct / incorrect</td>
<td>1.36</td>
<td>0.24</td>
<td></td>
</tr>
</tbody>
</table>
Appendix H: Emotional Essence Results

We conducted analyses examining the influence of emotional essence. Specifically, we addressed Hypothesis 8: Priming memory with emotional essence was predicted to affect the subjective experience of the memory, such that those who were primed would report remembering the events with greater vividness relative to those not primed. We also examined whether emotional essence affected accuracy. We were unable to test whether priming essence was related to an increase in memory for essence-congruent details due to a lack of consensus on which details were essence-congruent. As mentioned previously, we took out the non-randomized internet data (251 control surveys and 261 essence surveys) before doing this analysis.

Using a one-way analysis of variance, there was no difference in reported 2003 vividness between control and essence groups, $F (1, 1045) = 1.072, p = .30$. Similarly, there was no difference in reported 2004 vividness between control and essence groups, $F (1, 1042) = 0.33, p = .57$. An examination of the influence of priming emotional essence on accuracy yielded similar results. Using a one-way analysis of variance, there was no difference in reported 2003 accuracy between control and essence groups, $F (1, 955) = 0.60, p = .44$. Similarly, there was no difference in reported 2004 accuracy between control and essence groups, $F (1, 964) = 1.17, p = .28$. 
Appendix I: Control Version of Questionnaire

Survey for Baseball Fans

Thank you for completing this questionnaire. It should take about 5-10 minutes. I am a psychology graduate student who is studying how people remember everyday events. The Yankees and Red Sox have played each other in a number of memorable American League Championship playoff games over the past few years. We want to see how well you remember two of these great games.

To begin, please answer the following questions:

1. **How interested are you in Major League Baseball?** (circle one):

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not at all</td>
<td>somewhat</td>
<td>interested</td>
<td>interested</td>
<td>extremely</td>
<td>interested</td>
<td></td>
</tr>
</tbody>
</table>

2. **How would you characterize yourself?** (circle one):
   
   A. Casual Red Sox fan
   B. Strong Red Sox fan
   C. Casual Yankee fan
   D. Strong Yankee fan
   E. Fan of neither team
In 2003, the New York Yankees and the Boston Red Sox met in the American League Championship Series. This was the first time since 1999 that the Red Sox and Yankees had played in the league championship series. The series featured great pitching, timely hitting, controversial calls and umpiring, defensive gems, unsung heroes, slumping superstars, stolen bases, errors, come-from-behind victories, hit batters, and so on - the full range of plays that makes baseball so enjoyable. Because it was so exciting, and there were so many memorable plays, many people thought this was the best series in the postseason that year. In the end, New York defeated Boston in 7 games, and went on to play in the World Series.

Take a moment now to try to remember the decisive Game 7 of this 2003 American League Championship Series.

Once you remember Game 7 as best you can, please go on to page 3.
Answer the following questions about Game 7 of the 2003 American League Championship Series as best you can, even if you have to guess. (Choices of players are listed alphabetically.)

1. How vividly do you remember this 7th game? (circle one):
   
   1     2     3     4     5     6      7
   Not at all                   somewhat vividly                               Extremely vividly

2. How frequently have you thought about the game, or seen media of the game, since it happened?
   
   1     2     3     4     5     6      7
   Not at all                            somewhat often                  very frequently

3. How do you know about this game? (circle one answer):
   a. attended the game in person   b. watched most or all of it on TV   c. just watched the highlights on TV
   d. just read about it            e. didn’t watch it or read about it

4. What was the final score? _____ New York _____ Boston

5. How confident are you about your answer to question #4 above? (circle one):
   
   1     2     3     4     5     6      7
   Not confident    somewhat confident                  extremely confident

6. Did the game go into extra innings? (circle one):          No                 Yes

7. Where was the game played? (circle one):        Fenway Park (BOS)   Yankee Stadium (NY)

8. a. Circle the winning pitcher for New York (listed alphabetically):
   Roger Clemens               Felix Heredia             Mike Mussina          Mariano Rivera

8. b. Circle the losing pitcher for Boston (listed alphabetically):
   Pedro Martinez   Mike Myers                   Tim Wakefield               Scott Williamson

9. Who hit a home run in the last inning of the game? (circle one):
   Aaron Boone          Jason Giambi          Derek Jeter          Doug Mirabelli          David Ortiz       Manny Ramirez

10. How confident are you about your answer to question # 9 above? (circle one):
    
    1     2     3     4     5     6      7
    Not confident    somewhat confident                  extremely confident

11. What was your reaction to the outcome of game? (Circle all that apply):
    Angry                  Happy                     Sad                       Surprised                   No strong reaction

12. Who won the 2003 World Series? (circle one):            Cubs          Marlins                 Yankees
Above is a picture from Game 7 of the 2003 ALCS. Some people, particularly Red Sox fans, thought this was the turning point in the game. Please answer the questions about the picture, even if you have to guess.

1. Name the 3 people in this picture:
   Person A ___________________ Person B ___________________ Person C ___________________

2. Who was winning at the time of this picture? (circle one): Boston New York

3. What action did Person B take in the picture? (circle one):
   a. Brought Person A into the game to pitch as a reliever
   b. Let Person A stay in the game
   c. Took Person A out of the game
   d. Took Person C out of the game

4. How confident are you about your answer to question #3 above? (circle one):
   1 Not confident 2 3 4 5 6 7 extremely confident

5. Who was the next batter? (circle one):
   Derek Jeter Hideki Matsui Jorge Posada Bernie Williams Enrique Wilson

6. What did the next batter do? (circle one letter):
   A. Hit a double B. Hit a home run C. Hit by a pitch
   D. Hit into a double play E. Struck out F. Walked

7. How confident are you about your answer to question #6 above? (circle one):
   1 Not confident 2 3 4 5 6 7 extremely confident

8. In what inning was this picture taken? ___ inning
In 2004, the New York Yankees and the Boston Red Sox again met in the American League Championship Series. There was a lot of excitement about the series as both teams were playing well and the match-up was in many ways a repeat of the prior year. After 6 games, the series was knotted at 3 games each, to force a game 7. With the series on the line, it was certainly one of the most watched games in recent times. This time, the Red Sox defeated the Yankees in 7 games, and went on to the World Series.

Take a moment now to try to remember the decisive Game 7 of this 2004 American League Championship Series.

Once you remember it as best you can, please go on to page 6.
Answer the questions about Game 7 of the 2004 American League Championship Series as best you can, even if you have to guess. (Note that choices of players are listed alphabetically.)

1. How vividly do you remember this 7th game? (circle one):
   1     2     3     4     5     6     7
   Not at all   somewhat vividly   Extremely vividly

2. How frequently have you thought about the game, or seen media of the game, since it happened?
   1     2     3     4     5     6     7
   Not at all   somewhat often   very frequently

3. How do you know about this game? (circle one answer):
   a. attended the game in person   b. watched most or all of it on TV   c. just watched the highlights on TV
   d. just read about it   e. didn’t watch it or read about it

4. What was the final score? Boston ______ New York _______

5. How confident are you about your answer to question #4 above? (circle one):
   1     2     3     4     5     6     7
   Not confident   somewhat confident   extremely confident

6. Did the game go into extra innings? (circle one): No Yes

7. Where was the game played? (circle one): Fenway Park (BOS) Yankee Stadium (NY)

8. a. Circle the winning pitcher for Boston (listed alphabetically):
   Curtis Leskanic Derek Lowe Curt Schilling Mike Timlin

   b. Circle the losing pitcher for New York (listed alphabetically):
   Kevin Brown Mike Mussina Paul Quantrill Mariano Rivera

9. Who hit the only grand slam homerun in this game? (circle one):
   Johnny Damon Jason Giambi Derek Jeter Hideki Matsui David Ortiz Manny Ramirez

10. How confident are you about your answer to question #9 above? (circle one):
    1     2     3     4     5     6     7
    Not confident   somewhat confident   extremely confident

11. What was your reaction to the outcome of game? (Circle all that apply):
    Angry Happy Sad Surprised No strong reaction

12. Who won the 2004 World Series? (circle one): Astros Cardinals Red Sox

13. What is your gender? Male / Female

14. How old are you? ______ years

THANK YOU FOR COMPLETING THE SURVEY!
Appendix J: Emotional Essence Version of Questionnaire

Survey for Baseball Fans

Thank you for completing this questionnaire. It should take about 5-10 minutes. I am a psychology graduate student who is studying how people remember every day events. The Yankees and Red Sox have played each other in a number of memorable American League Championship playoff games over the past few years. We want to see how well you remember two of these great games.

To begin, please answer the following questions:

3. **How interested are you in Major League Baseball?** (circle one):

   |   | 2 | 3 | 4 | 5 | 6 | 7 |
---|---|---|---|---|---|---|---|
   | Not at all interested | somewhat interested | extremely interested |

4. **How would you characterize yourself?** (circle one):

   F. Casual Red Sox fan
   G. Strong Red Sox fan
   H. Casual Yankee fan
   I. Strong Yankee fan
   J. Fan of neither team
In 2003, the New York Yankees and the Boston Red Sox met in the American League Championship Series for the first time since 1999. The Yankees, winners of 26 World Series since 1920, came to the match-up with a sense of self-confidence and pride. They expected to win. In contrast, the Red Sox and their fans had gone 85 years without a championship. Indeed, due to their many near misses and collapses, people joked that the Red Sox organization suffered from the ‘Curse of the Bambino’ for having traded Babe Ruth to the Yankees in 1920. People wondered whether Boston could ever overcome the curse. In the end, the curse continued as New York defeated Boston in 7 games.

Take a moment now to try to remember the decisive Game 7 of this 2003 American League Championship Series.

Once you remember Game 7 as best you can, please go on to page 3.
Answer the following questions about Game 7 of the 2003 American League Championship Series as best you can, even if you have to guess. (Choices of players are listed alphabetically.)

1. How vividly do you remember this 7th game? (circle one):
   
   Not at all     somewhat vividly     Extremely vividly
   1        2        3        4        5        6        7

2. How frequently have you thought about the game, or seen media of the game, since it happened?
   
   Not at all     somewhat often     very frequently
   1        2        3        4        5        6        7

3. How do you know about this game? (circle one answer):
   
   a. attended the game in person     b. watched most or all of it on TV     c. just watched the highlights on TV
   d. just read about it     e. didn’t watch it or read about it

4. What was the final score?
   
   ______ New York ______ Boston

5. How confident are you about your answer to question #4 above? (circle one):
   
   Not confident     somewhat confident     extremely confident
   1        2        3        4        5        6        7

6. Did the game go into extra innings? (circle one):
   
   No                 Yes

7. Where was the game played? (circle one):
   
   Fenway Park (BOS)   Yankee Stadium (NY)

8. a. Circle the winning pitcher for New York (listed alphabetically):
   
   Roger Clemens               Felix Heredia             Mike Mussina          Mariano Rivera

   b. Circle the losing pitcher for Boston (listed alphabetically):
   
   Pedro Martinez   Mike Myers                   Tim Wakefield               Scott Williamson

9. Who hit a home run in the last inning of the game? (circle one):
   
   Aaron Boone          Jason Giambi          Derek Jeter          Doug Mirabelli          David Ortiz       Manny Ramirez

10. How confident are you about your answer to question #9 above? (circle one):
    
    Not confident     somewhat confident     extremely confident
    1        2        3        4        5        6        7

11. What was your reaction to the outcome of game? (Circle all that apply):
    
    Angry                  Happy                Sad                  Surprised                  No strong reaction

12. Who won the 2003 World Series? (circle one):  
    
    Cubs             Marlins             Yankees
Above is a picture from Game 7 of the 2003 ALCS. Some people, particularly Red Sox fans, thought this was the turning point in the game. Please answer the questions about the picture, even if you have to guess.

1. **Name the 3 people in this picture:**
   Person A ___________________  Person B ___________________  Person C ___________________

2. **Who was winning at the time of this picture?** (circle one): Boston  New York

3. **What action did Person B take in the picture?** (circle one):
   a. Brought Person A into the game to pitch as a reliever
   b. Let Person A stay in the game
   c. Took Person A out of the game
   d. Took Person C out of the game

4. **How confident are you about your answer to question #3 above?** (circle one):
   1 Not confident  2  3  4 somewhat confident  5  6  7 extremely confident

5. **Who was the next batter?** (circle one):
   Derek Jeter  Hideki Matsui  Jorge Posada  Bernie Williams  Enrique Wilson

6. **What did the next batter do?** (circle one letter):
   A. Hit a double  B. Hit a home run  C. Hit by a pitch
   D. Hit into a double play  E. Struck out  F. Walked

7. **How confident are you about your answer to question #6 above?** (circle one):
   1 Not confident  2  3  4 somewhat confident  5  6  7 extremely confident

8. **In what inning was this picture taken?** ___ inning
In 2004, the New York Yankees and the Boston Red Sox met again in the American League Championship Series. The Yankees were expected to win and the Red Sox to lose. This playoff series would prove to make sports history, in terms of one team’s incredible comeback and the other team’s historic collapse. Like the 2003 series, this series went to a game 7. This time, the Red Sox broke the curse and defeated the Yankees in 7 games. Many baseball people say that in this series ‘the Red Sox shocked the Yankees and the world.’

Take a moment now to try to remember the decisive Game 7 of this 2004 American League Championship Series.

Once you remember it as best you can, please go on to page 6.
Answer the questions about Game 7 of the 2004 American League Championship Series as best you can, even if you have to guess. (Note that choices of players are listed alphabetically.)

1. How vividly do you remember this 7th game? (circle one):
   1     2     3     4     5     6      7
   Not at all                     somewhat vividly                                Extremely vividly

2. How frequently have you thought about the game, or seen media of the game, since it happened?
   1     2     3     4     5     6      7
   Not at all                      somewhat often                     very frequently

3. How do you know about this game? (circle one answer):
   a. attended the game in person     b. watched most or all of it on TV     c. just watched the highlights on TV
   d. just read about it  e. didn’t watch it or read about it

4. What was the final score?  Boston ______    New York _______

5. How confident are you about your answer to question #4 above? (circle one):
   1     2     3     4     5     6      7
   Not confident    somewhat confident               extremely confident

6. Did the game go into extra innings? (circle one):          No                 Yes

7. Where was the game played? (circle one):   Fenway Park (BOS)                 Yankee Stadium (NY)

8. a. Circle the winning pitcher for Boston (listed alphabetically):
       Curtis Leskanic                   Derek Lowe                     Curt Schilling                    Mike Timlin

     b. Circle the losing pitcher for New York (listed alphabetically):
       Kevin Brown                     Mike Mussina                   Paul Quantrill                   Mariano Rivera

9. Who hit the only grand slam homerun in this game? (circle one):
   Johnny Damon         Jason Giambi         Derek Jeter         Hideki Matsui         David Ortiz           Manny Ramirez

10. How confident are you about your answer to question #9 above? (circle one):
    1     2     3     4     5     6      7
    Not confident    somewhat confident               extremely confident

11. What was your reaction to the outcome of game? (Circle all that apply):
    Angry                    Happy                    Sad                     Surprised                    No strong reaction

12. Who won the 2004 World Series? (circle one):               Astros              Cardinals                Red Sox

13. What is your gender ?    Male   /   Female

14. How old are you?     _____ years                              THANK YOU FOR COMPLETING THE SURVEY!
Appendix K: Media Coverage and Sales Data for Yankee and Red Sox Fans

The following data was collected with the help of Michael Palmedo, Assistant Director, Program for Information Justice and Intellectual Property, American University Washington College of Law. In order to investigate whether media coverage increased for the winning teams after their victory, we searched the archives of the Boston Globe and the New York Times for one month and two months after each team’s win. We compared these results to the same dates in other years. We also did a general Google News search, which includes major national print media, for each team for the same dates. As reported in Table K1 and Table K2 below, the data clearly shows a jump in coverage after the Red Sox win in 2004. The data is more mixed for the Yankees, who received more New York Times coverage after they lost in 2004 than after they won in 2003 (see Table K2). However, with the exception of 2004 (which was the first time in MLB history that a team had lost a seven game series after winning the first three games), the data in Table K3 and K4 shows the general trend of more media coverage in the years the Yankees won the ALCS or the World Series.
Table K1

*Boston Globe Archives Search Results for “Red Sox”*

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Stories</th>
<th>Year</th>
<th>Number of Stories</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>143</td>
<td>2001</td>
<td>292</td>
</tr>
<tr>
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<td>2002</td>
<td>239</td>
</tr>
<tr>
<td>2003</td>
<td>240</td>
<td>2003</td>
<td>426</td>
</tr>
<tr>
<td>2004(^a)</td>
<td>689</td>
<td>2004(^a)</td>
<td>911</td>
</tr>
<tr>
<td>2005</td>
<td>252</td>
<td>2005</td>
<td>418</td>
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<tr>
<td>2006</td>
<td>176</td>
<td>2006</td>
<td>305</td>
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</tbody>
</table>

\(^a\) Year of the Red Sox victory in the ALCS and World Series

Table K2

*Google News Search Results for “Red Sox”*

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Stories</th>
<th>Year</th>
<th>Number of Stories</th>
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<tr>
<td>2001</td>
<td>445</td>
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<td>1910</td>
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<td>2002</td>
<td>1130</td>
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<td>2210</td>
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<tr>
<td>2003</td>
<td>2070</td>
<td>2003</td>
<td>4300</td>
</tr>
<tr>
<td>2004(^a)</td>
<td>6890</td>
<td>2004(^a)</td>
<td>8830</td>
</tr>
<tr>
<td>2005</td>
<td>2300</td>
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<td>3940</td>
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<tr>
<td>2006</td>
<td>1700</td>
<td>2006</td>
<td>2970</td>
</tr>
</tbody>
</table>

\(^a\) Year of the Red Sox victory in the ALCS and World Series

Table K3

*New York Times Archives Search Results for “Yankees”*

<table>
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<th>Year</th>
<th>Number of Stories</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000(^a)</td>
<td>394</td>
<td>2000(^a)</td>
<td>518</td>
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<tr>
<td>2001(^b)</td>
<td>361</td>
<td>2001(^b)</td>
<td>485</td>
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<td>115</td>
<td>2002</td>
<td>195</td>
</tr>
<tr>
<td>2003(^c)</td>
<td>238</td>
<td>2003(^c)</td>
<td>367</td>
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<tr>
<td>2004</td>
<td>276</td>
<td>2004</td>
<td>408</td>
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<tr>
<td>2005</td>
<td>125</td>
<td>2005</td>
<td>216</td>
</tr>
</tbody>
</table>

\(^a\) Year that the Yankees won the ALCS and World Series
\(^b\) Year that the Yankees won the ALCS and lost World Series
\(^c\) Year that the Yankees won the ALCS and lost World Series
Table K4

Google News Search Results for “Yankees”

<table>
<thead>
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<th>Year</th>
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<th>Oct 17 – Dec 17</th>
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<tbody>
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<td>2002</td>
<td>5330</td>
<td>2002</td>
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<tr>
<td>2003&lt;sup&gt;c&lt;/sup&gt;</td>
<td>8350</td>
<td>2003&lt;sup&gt;c&lt;/sup&gt;</td>
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<tr>
<td>2004</td>
<td>7780</td>
<td>2004</td>
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<tr>
<td>2005</td>
<td>4050</td>
<td>2005</td>
</tr>
</tbody>
</table>

<sup>a</sup> Year that the Yankees won the ALCS and World Series
<sup>b</sup> Year that the Yankees won the ALCS and lost World Series
<sup>c</sup> Year that the Yankees won the ALCS and lost World Series

Additionally, we looked for evidence that Red Sox and Yankee merchandise sales increased relative to prior years after their victories. While such data is not reported by Major League Baseball, a March 31, 2005 story from ESPN (Rovell, 2005) reports that Red Sox merchandise sales equaled 21% of MLB’s total for the first quarter of 2005, up from 12% the year before. (No equivalent data for the Yankees was found.) Thus, at least in the case of the Red Sox, there is evidence of increased merchandise which likely led to further rehearsal after the 2004 ALCS and World Series victories.
References


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