

Emotional Telescoping:
Distorted Memories and Predictions
of Emotional Intensity for the Events of 9/11

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Abstract

The strong connection between emotion and memory is apparent in the vividness of flashbulb memories formed from an emotionally arousing event, such as the terrorist attacks of September 11th, 2001. In addition, older adults are thought to differ from young adults in both their memory abilities and their emotional experience. I analyzed the emotional intensities reported by people of different age groups in response to the events of 9/11, as well as the accuracy of their remembered and predicted reactions over the course of 3 years. Sadness was the most intensely experienced emotion by all age groups. An overall trend of increased intensity with age was also observed for all emotions except fear and frustration, which remained constant across age groups, and confusion, which declined with age. Emotional intensity significantly decreased one year following the attack, but then stabilized, with the exception of shock, which continued to decline. Additionally, people overestimated the intensity of their previous emotional reactions and underestimated their future feelings toward the attack, regardless of age group. Historical events may differ from personal events in terms of age and cohort differences in emotional intensity and in people's ability to remember or predict how their emotions change over time.

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Memory and emotion are closely intertwined. We remember emotional events more vividly than non-emotional ones. For example, many people have vivid memories for where they were when they learned of the attacks on 9/11/2001. However, very few people could tell you where they were or what they were doing on 9/21/2010, even though that date is much more recent. The connections between memory and emotion may help to guide our future behaviors; it has been suggested that one of the major advantages of memory for the past is to help us plan for the future, and that emotion directs those plans by telling us what we value and what we want to avoid (Schacter, Addis, & Buckner, 2007; see also David Brooks's new popular book *The Social Animal*, 2011). ("Last time I sat next to that person, they gave me a dirty look and made me feel bad; I'm going to sit next to that other person, who bought me a drink last time and made me feel pretty good!").

If this system is to work optimally, we should remember our past emotions and predict our future ones with a high degree of accuracy. Do we? In this thesis, I tried to answer that question by analyzing people's current, remembered, and predicted emotional intensities for the events on 9/11/2001, and examining how they changed over the course of three years. In addition, older adults are often thought to have less intense emotions (Schiebe & Carstensen, 2010; Charles & Piazza, 2007), to be better at handling their emotions (Kafetsios, 2004), and to be biased against negative emotions (Charles & Carstensen, 2008). I therefore also examined how emotional intensity and the accuracy of remembered and predicted emotions might differ across different adult age groups, from 17 to 73 year olds.

Brown and Kulik (1977) coined the term “flashbulb” to describe the vivid memory of a surprising and emotionally arousing event, such as the 9/11 attacks. According to research, flashbulb events are rated as more important and emotional than control events (Kvavilashvili, Mirani, Schlagman, Erskine, & Kornbrot, 2010). There is some controversy as to whether these highly emotional memories are also more accurate. For followers of Pope John Paul II at the time of his death (Tinti, Schmidt, Sotgio, Testa, & Curci, 2009) and victims of Turkey’s Marmara earthquake in 1999 (Er, 2003), remembrance of the event was directly dependent on the strength of their emotional response. That is, if the event was rated as highly emotional, it was recalled with greater accuracy. However, this is not always the case. Despite self-reports of intense emotional responses to the attacks of 9/11, several studies have shown that accuracy for flashbulb memories decreased over time at the same rate as accuracy for control memories. (Wolters & Goudsmit, 2005; Talarico & Rubin, 2003). Hirst et al. (2009) demonstrated that the emotional aspects of memories of 9/11 are actually forgotten more quickly than these memories’ other features even though emotions are important to each individual when forming the memory.

There is much less research available pertaining to the prediction of one’s emotional state than there is about remembering it. However, it has been found that certain biases exist that consistently lead to inaccurate predictions. For both positive and negative events (e.g., good or bad grades on an academic exam; passing or failing a driving exam), emotional reactions were anticipated to be much more intense than they were actually experienced at the time of the event (Buehler & McFarland, 2001). When making these anticipatory judgments, people appear to focus solely on the event in question, magnifying its importance, while failing to take into account to take their past experience or the impact that other events that will occur at the same time as the target event. Manipulations that encourage the consideration of the target event in

these contexts can reduce the future intensity bias (Buehler & McFarland, 2001; Wesp, Sandry, Prisco, & Sarte, 2009; Wilson & Gilbert, 2005).

Older adults present an interesting set of contradictions when considering emotion's interactions with memory and future predictions. On the one hand, older adults typically have worse memories than young adults. However, they also have more experience in facilitating, managing and understanding their emotions (Kafetsios, 2004), which might lead to the hypothesis that they would be better at predicting how their emotions will change over time. Nielsen, Knutson and Carstensen (2008) showed that when predicting future emotions, the elderly report less of a valence change than young adults, possibly because they have more insight into their affective states. In another set of contradictions, older adults initially react less strongly to emotional events (Schiebe & Carstensen, 2010) and report less intense reactions overall (Charles & Piazza, 2007), but are also often described as being more emotion-focused than are young adults (Kafetsios, 2004; McConatha, Leone, & Armstrong, 1997).

Some of these age effects may be especially pronounced for negative emotions, which are presumably the predominant ones surrounding an event like 9/11. Research has shown that, over the course of a lifetime, negative emotions decline with age, whereas positive ones tend to increase (Grühn, Kotter-Grühn, & Röcke, 2010; Charles & Carstensen, 2009; Magai, Consedine, Krivoshekova, Kudadjie-Gyamfi, & McPherson, 2006; Mroczek & Kolarz, 1998). For instance, the elderly report lower levels of anger than their youthful counterparts in unpleasant situations (Charles & Carstensen, 2008), during social interactions (Charles & Piazza, 2007) and in regards to a family loss (Kunzman & Richter, 2009). This could be a result of their tendency to ruminate less about emotionally upsetting events than younger generations (McConatha et al., 1997). This correlation between old age and attention towards positive and away from negative stimuli has

been termed the “positivity effect” (Charles & Carstensen, 2008; Comblan, D’Argenbeau, & Van der Linden, 2005).

This particular study focuses specifically on the flashbulb memories people formed following the terrorist attacks of September 11th, 2001. It seeks to investigate not only which, if any, emotions are experienced more intensely than others, but also how emotional responses change over time. It is also a goal to examine the accuracy with which people are able to predict and recall their emotional reactions. Based on the fact that older adults experience emotions less intensely than young adults, older adults are expected to report lower intensities than their younger counterparts, while emotional intensity will decrease during the time between the actual attack and the following three years for every age group. Research indicating that flashbulb memories are rapidly forgotten predicts that people will underestimate their initial emotional responses when remembering the event. Conversely, when predicting their future emotions, people will overestimate their feelings due to the tendency to anticipate intense emotions in the future. Possible effects of age on these phenomena will also be examined.

Method

Participants and Recruitment

This is a secondary analysis of an existing dataset. One week after September 11th, subjects were recruited on or around the college campuses of the original collaborators (Hirst et al., 2009) to complete a survey about the attack. Participants were from New York, NY; Boston and Cambridge, MA; New Haven, CT; Washington, DC; St. Louis, MO; Santa Cruz, CA; and Palo Alto, CA. All participants were asked to indicate if they were willing to be contacted the following year for a second survey. Eleven months later, these participants were re-contacted and sent the second survey if they consented to receive it. Additional subjects were also recruited in the same manner in order to control for possible effects of previous participation. A third survey

was sent two years later to the same participants from the initial two questionnaires who also consented, as well as a new group of control subjects.

For Survey 1, subjects were recruited between September 17th and September 21st, 2001; between August 5th and August 26th, 2002 for Survey 2; and between August 9th and August 20th, 2004 for Survey 3. Participants were given one week to fill out a paper survey and return it to experimenters. An electronic version was also available for Surveys 2 and 3; those choosing to complete the Web-based version were given two weeks to return their surveys to experimenters.

Thirty-eight percent of those completing the first survey completed the second, whereas both Surveys 2 and 3 were completed by 18% of participants that completed Survey 1 (Hirst et al., 2009). Data from both the electronic and paper forms were merged to yield 384 participants that responded to all three surveys. The current analysis is restricted to these participants. In addition, I restricted analysis to those subjects 73 years old and younger, as the sample sizes for participants older than this were very small, bringing the final number of participants to 352.

Surveys

Three separate surveys were written for each of the testing periods. They were all approximately 17 pages in length and took about 45 minutes to complete. A copy of each survey can be found at <http://911memory.nyu.edu> (Hirst et al., 2009).

Each survey began with a general statement of the aim of the experiment and a consent form. Various probes were used and questions were grouped accordingly. For Survey 1, administered within the 2 weeks after the attack, Questions 1-6 pertained to flashbulb memories and their consistency, Questions 7-11 were concerned with the accuracy of event memories, and Questions 12-23 were relevant to predictors. Some examples of these predictors include consequentiality in terms of personal loss and inconvenience, the intensity of emotional

responses, and rehearsal, as assessed by attention to media coverage of the event. This study focuses on the six basic emotions that participants rated on a 5-point scale, with 5 being the most intense reaction and 1 being the least intense. These emotions are Sadness, Anger, Fear, Confusion, Frustration, and Shock. The survey concluded with 8 demographic questions.

Surveys 2 and 3 consisted of these same questions, plus additional questions for the flashbulb memory predictors. Participants were asked how confident they were that their recollection of the time, source, place, etc. of the event was accurate, as well as how accurately they believed they would remember the time, source, place, etc. in the future. Survey 2 asked subjects to predict two years from the time of the survey while Survey 3 inquired about seven years in the future. Responses were rated in a scale of 1-5, with 5 being the highest rating.

Coding

A coding manual was developed after 50 responses to Survey 1 were assessed, in order to establish the nature of each question's reply. This manual can be found at <http://911memory.nyu.edu> (Hirst et al., 2009).

At the end of the coding process for each survey, 10% of the surveys were randomly selected for re-coding. This was to evaluate the interrater reliability of the coding manual. Either kappas or Cronbach's alphas (whichever was appropriate) were then calculated for each question. For both short-answer and open-ended questions, reliability ratings all exceeded 0.80 (Hirst et al., 2009).

Results

Examination of the data showed that chronological age did not have a linear relationship with most of the dependent variables. Because of the historical nature of the event in question, a generational cohort might be a more appropriate independent variable. I therefore divided the

subjects into five cohort groups, as defined by Schuman and Scott (1989). See Table 1 for the birth years, age at Survey 1, number of participants, and a description of the memorable events and key characteristics associated with each cohort.

The Greenhouse-Geisser correction for sphericity was used in all analyses, but in the text degrees of freedom are reported in integers for easier readability. A significance level of .01 was used in order to avoid misleading statistically significant differences of little or no practical import (for a discussion of this issue and how it specifically relates to relatively large-sample studies of memories for 9/11, see Luminet et al., 2004).

Initial Emotional Intensities

There was a main effect of Emotion, $F(5, 1735) = 67.88, p < .0005$. As seen in Figure 1, Sadness was the most intensely experienced emotion for all cohort groups and confusion was rated the lowest. Anger, Fear, Frustration, and shock were all experienced at intermediate levels. The cohorts did not differ in their overall ratings of emotional intensity, $F(4, 347) = 1.16, p = .33$, however, there was a significant Emotion x Cohort interaction, $F(20, 1735) = 2.74, p < .0005$. One-way ANOVAs for each emotion using Cohort as the independent variable found that the different emotions showed different patterns across the cohorts. Fear and Frustration were generally equal across the cohorts, both $F < 1$. Sadness ($F(4,351) = 3.18, p = .014$) and Shock ($F(4,351) = 2.07, p = .08$), showed marginal increases until the third cohort (Baby Boomers 2), then flattened out. Anger showed the largest cohort effects, sharply increasing after the first two cohorts, $F(4,351) = 4.66, p = .001$. Confusion showed a trend in the opposite direction, $F(4,351) = 2.13, p = .08$; it was highest for the youngest cohorts and tended to decrease for the older cohorts.

The reduction in confusion ratings across the cohorts helps to ameliorate the potential concern that participants of different ages and cohorts might be using the rating scales differently (e.g., that older cohorts might simply be less likely to use the lower end of the scale; Schwarz & Knäuper, 2000). To further address this concern, I conducted a parallel analysis for confidence in reported memories. There was no observable difference between cohorts, $F < 1$. Figure 2 shows that the confidence ratings for most memory types are stable across age groups. Overall, these results do not support the idea that the cohorts systematically differed in their use of the rating scales in a way that could confound the analysis of emotion-related variables.

Change in Emotional Response

The Occasion x Emotion x Cohort interaction did not yield a significant result, $F(40, 3470) = 1.25, p = .16$, although there was a significant Occasion x Emotion effect, $F(10, 3470) = 13.67, p < .0005$. To break down the Occasion x Emotion interaction, separate within-subjects ANOVAs for each emotion were run using Occasion as the within-subjects variable, with repeated contrasts. All emotions showed a significant effect of occasion and a significant drop in emotional intensity from Survey 1 to Survey 2, all $p < .0001$. Between Surveys 2 and 3, emotional intensity remained flat (all $F < 1$ except Confusion, which showed a nonsignificant trend to increase, $p = .08$), with the exception of Shock, which continued to show sharp declines, $F(1, 351) = 37.82, p < .0005$, as seen in Figure 3f.

There was also a significant Occasion x Cohort interaction, $F(8, 694) = 2.55, p = .01$. Tests of within-subjects contrasts indicated that the cohorts did not differ from each other in their change from Survey 1 to Survey 2, $F < 1$. However, there was a marginal difference between the cohorts in how they changed from Survey 2 to Survey 3, $F(4, 347) = 2.42, p = .05$. Inspection of the means (See Figures 3a-f) suggested that while most cohorts showed consistent responses

between Surveys 2 and 3, Cohort 3 still tended to decline, and the oldest cohort actually showed a tendency towards increased emotion.

Accuracy in Remembering Initial Emotional Response

Accuracy in remembering emotion was analyzed using a 5 (Cohort: 0-4) x 3 (Occasion: Actual emotion at time 1, remembered emotion at time 2, remembered emotion at time 3) x 6 (Emotion) design. At all occasions, the emotion being rated (or recalled) was the emotional intensity experienced within the two weeks following the attacks.

In general, people remembered their emotions following the attack as being more intense than they actually were, as seen in Figure 4. This effect differed by emotion, with a significant Occasion x Emotion interaction, $F(10, 3460) = 13.32, p < .0005$. However, all cohorts showed similar patterns of over-remembering the intensity of their emotions: Cohort did not interact with Occasion ($p > .30$ for both the 3-way Cohort x Occasion x Emotion and the 2-way Cohort x Occasion interactions).

To understand the Occasion x Emotion interaction, separate ANOVAs with Occasion as the within-subjects factor were run for each emotion, with contrasts comparing each occasion. The pattern for most emotions was that people's memories of their emotional intensity at Occasion 2 was greater than their actual emotional intensity rating at Occasion 1, $p < .0005$, but that memory for emotional intensity at Occasion 1 was stable between Occasions 2 and 3, $F < 1$. Confusion and Anger presented minor exceptions to this general trend. Confusion continued to show a marginal trend towards exaggerated emotional intensity when comparing Occasions 2 and 3, $F(1, 351) = 7.16, p = .01$. Anger had a more linear increase over occasions than did the other emotions, with a marginal difference between actual emotion at Occasion 1 and remembered emotion at Occasion 2, $F(1, 351) = 5.95, p = .015$, and a continued numerical trend

towards exaggeration between Occasions 2 and 3, $F(1,351) = 2.77, p = .09$. However, the emotion showing the largest departure from the general pattern was Frustration, which showed no differences between Occasions, $F < 1$.

Accuracy in Predicting Future Emotions

Accuracy in predicting future emotional intensity was analyzed using a 5 (Cohort: 0-4) x 2 (Occasion: 2, 3) x 2 (Rating: Actual, Predicted) x 6 (Emotion) design. The 4-way interaction did not approach significance, $p > .30$. Because the central conceptual question of this analysis concerns the Rating factor (i.e., how do predicted versus actual ratings of emotional intensity differ), significant interactions not involving this factor (e.g., the 2-way interactions of Cohort and Emotion and of Occasion and Emotion) are not further discussed. Means and standard deviations for all cells in the 4-factor design are presented in Tables 2a and 2b.

The 3-way interaction between Occasion, Rating, and Emotion was statistically significant, $F(5,1735) = 7.87, p < .0005$, indicating that the accuracy of predictions across occasions was not the same across the different emotions. Inspection of the data suggested that for most emotions, when surveyed immediately after the attacks, people underestimated the intensity of their future emotions a year later whereas both predicted and actual emotions remained relatively stable between the second and third surveys. Shock was the exception, with exceptionally severe underestimation of future emotion at Occasion 1, and a numerical (though not significant) overestimation at Occasion 2. (See statistics below.) This tendency towards reversal for predictions at time 2 occurred because although predictions of future Shock remained largely stable (as was the case for other emotions), actual Shock continued to decline, as previously described.

In other words, although people generally underestimated the intensity of their future emotional responses, for most emotions, both actual and predicted intensity were stable one year after the attack. People were also relatively consistent in their predictions of future Shock, but the actual intensity ratings for this emotion continued to decline (as described earlier). Separate Rating x Occasion ANOVAs for each emotion confirmed these impressions. Predicted intensities were reliably higher than actual intensities ($p < .01$ for all emotions except Sadness ($p = .03$) and Fear ($p = .09$)). Only Shock showed a significant Rating x Occasion interaction, $F(1, 351) = 34.02, p < .0005$. (All other emotions $p > .40$ except Sadness, $p = .17$). There was a significant difference between predicted and actual shock values between Surveys 1 and 2, $t(351) = -7.03, p < .0005$, but not between Surveys 2 and 3, $t(351) = .58, p = .56$. Actual shock showed a significant decline between Occasions 2 and 3, $t(351) = 6.15, p < .0005$, but predictions of Shock were relatively stable and, if anything, showed an effect in the opposite direction, $t(351) = -2.42, p = .02$.

There was a statistically significant 3-way interaction between Rating, Emotion, and Cohort as well, $F(20,1735) = 2.43, p = .001$. Separate ANOVAs were run per each emotion with Rating as the within-subjects factor. The Rating x Cohort interaction did not approach significance for Sadness, Confusion, or Shock, both $p > .20$, suggesting that the degree of over-prediction was equivalent across cohorts for these emotions. Marginal Rating x Cohort interactions were found for Anger, $F(4, 347) = 2.28, p = .06$; Fear, $F(4,347) = 2.71, p = .09$; and Frustration, $F(4, 347) = 2.01, p = .09$. Inspection of the means revealed that the pattern for Frustration differed from the other two. The Rating effect (collapsed across Occasion) was then examined for each emotion within each cohort. For Anger and Fear, the youngest cohort had significant under-prediction of emotional intensity, $F(1,80) = 12.29, p < .005$ for Anger, $F(1,80)$

= 8.52, $p < .01$ for Fear, whereas the other cohorts generally showed smaller, marginal or nonsignificant differences, all $p > .09$. These findings are shown in Figures 5a and 5b.

Frustration showed the opposite pattern: the youngest cohort was quite accurate, $F < 1$ whereas all other cohorts showed at least a trend towards underestimating future intensity, all $p < .08$, as seen in Figure 5c.

Consistencies across Ratings and Occasions

There were significant correlations between immediate emotional responses and those of Occasions 2 and 3. Current emotional response was also significantly correlated with people's predictions of their future emotions on all three occasions. There were also significant correlations between projected emotional responses on Occasions 1 and 2 and actual responses. Remembrances of initial emotional intensity on Occasions 2 and 3 are correlated significantly with initial emotional intensities, with the exception of immediate intensity and recollection of shock from Occasion 3, $r = .12$, $p = .027$. For each of the previous correlations, $p < .0005$.

Discussion

Overall, the findings of this study indicate that our perceptions of past and future emotions for an event like 9/11 are distorted. Past emotions are recalled as more intense than they were initially experienced, whereas the intensity of future emotions is underestimated. These findings bear some similarities to the distortions that occur when people make recency judgments about past events, or judge how long something will take them in the future. In many cases, especially if judging events that occurred quite a while ago, past events are judged as being more recent than they actually are – as if they are viewed from a telescope and therefore perceived as “too close” (Loftus & Marberger, 1983; Rubin & Baddeley, 1989). Likewise, in the present study, memories of past emotional intensities are exaggerated. When planning a future

project, people tend to show the opposite effect, as if the deadline were viewed through a “reverse telescope” and subjectively perceived as further away than it is in reality (see recent study by Peetz, Buehler, & Wilson, 2010, for discussion). Likewise, in the present study, the intensity of future emotions was underestimated, as if they were viewed from an exaggerated distance.

Somewhat surprisingly, the oldest cohort reported the most intense anger initially, with sadness and shock showing trends of increased intensity for older cohorts. Their memories of all six emotions showed similar distortions as each of the other age groups, yet their predictions differed from younger cohorts for anger, fear and frustration. Accuracy of predictions increased with cohort for the former two emotions and decreased for the latter one. Below, the findings are briefly summarized, as well as their connections to the existing literature and potential areas for future research.

Immediate Emotions and Change over Time

In the time period immediately following the attacks, the youngest cohort generally reported the least intense emotions. Most emotions then showed a small increase between the first three cohorts, then a generally stable level between the oldest two cohorts. Anger, however, continued its upward trajectory, with the oldest cohort reporting the most intense level. These findings stand in contrast to the idea that older adults show blunted emotional responses and to the usual finding that they are less sensitive to negative emotions than are younger adults.

One possible reason for this discrepancy in anger between older and younger age groups is the specific historical significance of the events of 9/11 and their meaning to the cohorts included in my analysis. The oldest group, the “World War II Cohort,” is defined by the Japanese attack at Pearl Harbor, the first major surprise attack on American soil and the catalyst

of the United States' involvement in the war. It could be that since this age group lived through an event similar to 9/11, they exhibit a stronger response of anger than those who do not have this prior experience since they are more aware of the consequences of the situation. Importantly, the higher ratings of emotional intensity given by this group for most emotions do not appear to be an artifact of a general tendency to use the upper end of the rating scale (Schwarz & Knäuper, 2000), as shown by their low ratings for initial intensity of confusion and a lack of age differences when rating other variables, such as memory confidence.

Cohort effects might also explain why the youngest group had the least intense emotions overall, but ranked highest in confusion. While 60% of the World War II cohort (in this study, Cohort 4) reported following news about public affairs most of the time, only 32% of Generation X (Cohort 1) and a staggering 8% of Generation Y (Cohort 0) could say the same (Bennett, 2000). This notion is further supported in popular literature with David T. Z. Mindich's book *Tuned Out: Why Americans Under 40 Don't Follow the News* (2004), in which Mindich argues that young people have abandoned both general interest and political news. This lack of knowledge suggests that young adults would be less likely to understand the implications of 9/11.

Immediate reactions of fear and frustration were experienced at relatively constant levels for all cohorts. Previous research has suggested that age has no effect on either of these emotions. Lau (2001) noted that self-reports of fear of snakes did not differ significantly between old and young adults, while LaBar, Cook, Torpey and Welsh-Bohmer (2004) demonstrated aging did not play a role in the ability to condition fear responses. In terms of frustration, it has been shown that not only is there no projected difference in frustration levels on the Rosenzweig Picture-Frustration Study once adolescence is reached (Lata, Mujtaba, & Joshi, 1992), but also

that age did not influence intensity of frustration when operating complicated electronic devices (Kang & Yoon, 2008).

For all cohorts, emotional intensity dropped during the year following 9/11, and then stabilized, remaining at the same level at the second and third testing occasions. Shock was an exception, showing a steady decrease across assessments. This could be a result of the mere passing of time, which facilitates the loss of novelty that accompanies shock. An additional explanation could be that discussions of emotionally-charged events, such as those pertaining to treatment options for prostate cancer patients (Christie, Meyerowitz, Giedzinska-Simons, Gross, & Agus, 2009) or to watching a reenactment of a real-life rape (Lepore, Fernandez-Berrocal, Ragan, & Ramos, 2004), facilitate adjustment to that event and improve cognitive processing of it. People also use such discussions to deal with the trauma associated with public tragic events (e.g., the death of Princess Diana), and these discussions decrease in frequency in as little as one month (Stone & Pennebaker, 2002). The events of 9/11 were widely discussed both in the general media and interpersonally, which could have contributed to the decline in shock across occasions.

Emotions are Remembered More Intensely than They Actually Occurred

In this study, when subjects remembered their initial reactions a year later, all cohort groups overestimated the intensity they previously experienced. These inaccurate memories remained stable two years later, a finding that is comparable to the consistency of memory inaccuracies surrounding the reception event (i.e., how you found out about the attacks, who you were with, etc.) found by Berntsen and Thomsen (2005) and Hirst et al. (2009). These studies reported that the most rapid rate of decline in memory accuracy was seen within the first year, and significantly slowed in the following years, leading to consistent, yet false, memories

between Surveys 2 and 3. Nonetheless, why did participants overestimate their emotional reactions?

Social desirability effects may have played a role. Media coverage of the attack and its aftermath consistently portrayed it as a highly emotional event, and tied such strong emotional reactions to positive constructs, such as patriotism. Journalists emphasized the same sentiments as the federal government's public announcements, 94% of which demonized terrorists and blamed them for the events of 9/11 (Hutcheson, Domke, Billeaudeau, & Garland, 2004; see Gelpi, 2010, for a discussion of how such coverage influenced public attitudes towards related events such as the Iraq war). This may have especially been the case for older cohorts, who make up most of the audience for conservative media; over 60% of the viewers for Fox News shows such as Hannity and O'Reilly are over age 50 (Pew Research Center, 2010). In contrast, young adults make up the majority audiences for more liberal shows that were less likely to encourage aggressive responses (over 70% of the viewers of the Daily Show and Colbert Report are younger than 50).

Predictions about Future Emotions Underestimate Their Intensity

Conversely from memories of emotions, predictions for all six emotions were underestimated by every cohort. Li and Brewer (2004) showed that nationalism surrounding 9/11 is defined as unity in facing a common problem (i.e. fighting terrorism), a definition similar to the appraisal of a stressful situation as shared between group members in communal coping. Participants could have anticipated coping with their emotional reactions through the support of others due to the large amount of nationalist ideals being circulated by the media (Hutcheson et al., 2004). Research has shown that communal coping strategies elicited predictions of lower levels of emotional intensity for both survivors of genocide in Guatemala (Gasparre, Bosco, &

Bellelli, 2010) and people displaced from their homes in post-conflict Ethiopia (Araya, Chotai, Komproe, & de Jong, 2007) before therapy was completed, as opposed to actual feeling post-treatment. That is, prior to group therapy, people predicted their emotions would be less intense than they actually were at its close. The ideas of nationalism developed from following the news coverage of 9/11 led to Americans participating in communal coping strategies, such as discussing the events with the people around them. At the time they made the predictions of future emotions, these coping strategies were still in effect.. Therefore, they experienced lower emotional intensities than they anticipated.

The interactions between the degrees of under-prediction for different emotions across the cohorts are also of some interest. The youngest cohort underestimated their future anger and fear, whereas older cohorts underestimated future frustration. Although speculative, one possibility is that the group differences in historical experience may have played a role in these distortions. Specifically, the youngest cohort would likely have been too young to have had much media exposure to US military conflicts, such as the Gulf War (Desert Shield/Desert Storm), and thus would not have experienced how such media could amplify such negative emotions towards opponent nations. Conversely, older cohorts who did have such experience with these conflicts, which were relatively easily resolved from the US perspective as compared to the still-ongoing “War on Terror”, may have had overly-optimistic expectations for how the foreign-policy implications of 9/11 would be resolved. This speculation receives some support from the rise in frustration shown by the oldest cohort on Occasion 3, especially since one of this generation’s defining characteristics was the success of World War II.

Even though there exists a relationship between the vividness of a memory and its emotional content, the connection is not necessarily applicable to the accuracy of the emotions

experienced recalled by flashbulb memories. This assumption is also relevant to one's ability to predict their future emotions. That is, people of all ages are inaccurate in both recalling and predicting their emotional responses, at least in relation to the terrorist attacks of September 11th. Furthermore, the patterns of overestimated remembrances and underestimated predictions of emotion are the opposite of what is usually found in the literature. This suggests that emotions surrounding such public events are judged differently than those related to more personal events. Further research linking flashbulb memories and emotions is needed to explore this relationship.

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Table 1

Cohort Information

Cohort	N	Birth Years	Age at Survey 1	Memorable Events	Key Characteristics
0	81	1984-1981	17-20	Internet, 9/11, iPods	Acceptance of Change, Technically Savvy
1	118	1980-1966	21-35	AIDS, Divorce/Single-Parent Families, Fall of Berlin Wall	Independent, Entrepreneurial
2	54	1965-1954	36-47	Watergate/Nixon Resigns, The Cold War, Disco	Less Optimistic, Pragmatic
3	39	1953-1946	48-55	Assassinations of JFK & MLK, Vietnam War, Protests and Riots	Social-Cause Oriented, Experimental
4	60	1945-1928	56-73	World War II, Economic Growth	Conservative, Traditional Family Values

Table 2a

Average Predicted vs. Actual Emotional Intensities between Surveys 1 and 2 by Cohort

Cohort		Emotions					
		Sadness	Anger	Fear	Confusion	Frustration	Shock
0	Predicted	3.20 (1.24)	2.62 (1.24)	2.05 (1.06)	2.10 (1.14)	2.71 (1.42)	2.24 (1.31)
	Actual	3.45 (1.14)	3.06 (1.40)	2.47 (1.09)	2.32 (1.29)	2.80 (1.33)	2.91 (1.79)
	Difference	0.25 (1.27)	0.44 (1.18)	0.42 (1.06)	0.22 (1.49)	0.09 (1.31)	0.67 (2.00)
1	Predicted	3.25 (1.17)	2.60 (1.18)	2.27 (1.08)	1.94 (1.03)	2.47 (1.30)	2.05 (1.07)
	Actual	3.36 (1.18)	2.57 (1.30)	2.24 (1.14)	1.95 (1.09)	2.55 (1.24)	2.96 (1.81)
	Difference	0.11 (1.2)	-0.03 (1.11)	-0.03 (1.17)	0.01 (1.08)	0.08 (1.30)	0.91 (1.98)
2	Predicted	3.24 (1.16)	2.85 (1.37)	2.45 (1.29)	1.99 (1.07)	2.24 (1.17)	2.03 (1.04)
	Actual	3.57 (1.16)	3.07 (1.29)	2.47 (1.29)	2.25 (1.06)	2.68 (1.36)	2.74 (1.34)
	Difference	0.33 (1.15)	0.22 (1.13)	0.02 (1.17)	0.26 (0.91)	0.44 (1.42)	0.71 (1.29)
3	Predicted	3.19 (1.26)	3.17 (1.41)	2.76 (1.27)	2.08 (1.28)	2.68 (1.37)	2.65 (1.47)
	Actual	3.47 (1.37)	3.26 (1.59)	2.60 (1.33)	2.31 (1.34)	3.23 (1.51)	3.06 (1.59)
	Difference	0.28 (1.47)	0.09 (1.33)	-0.16 (1.41)	0.23 (0.98)	0.55 (1.53)	0.41 (1.56)
4	Predicted	3.78 (1.10)	3.51 (1.37)	2.45 (1.37)	2.23 (1.30)	3.06 (1.44)	2.89 (1.53)
	Actual	3.63 (1.12)	3.39 (1.34)	2.58 (1.20)	2.28 (1.32)	3.13 (1.40)	3.23 (1.38)
	Difference	-0.15 (1.14)	-0.12 (1.21)	0.13 (1.40)	0.05 (0.95)	0.07 (1.41)	0.34 (1.57)

Note. Difference was calculated by subtracting Predicted from Actual values.

Table 2b

Average Predicted vs. Actual Emotional Intensities between Surveys 2 and 3 by Cohort

Cohort		Emotions					
		Sadness	Anger	Fear	Confusion	Frustration	Shock
0	Predicted	3.49 (1.10)	2.90 (1.28)	2.46 (1.17)	2.27 (1.19)	2.88 (1.30)	2.43 (1.30)
	Actual	3.30 (1.09)	3.10 (1.27)	2.55 (1.17)	2.35 (1.21)	2.92 (1.30)	2.29 (1.20)
	Difference	-0.19 (0.95)	0.20 (1.17)	0.09 (1.28)	0.08 (1.25)	0.04 (1.25)	-0.14 (1.09)
1	Predicted	3.28 (1.16)	2.45 (1.24)	2.14 (1.00)	1.91 (1.06)	2.44 (1.27)	2.17 (1.15)
	Actual	3.36 (1.23)	2.81 (1.22)	2.17 (1.21)	2.05 (1.15)	2.67 (1.40)	2.24 (1.29)
	Difference	0.08 (1.23)	0.36 (1.21)	0.03 (1.04)	0.14 (1.45)	0.23 (1.31)	0.07 (1.23)
2	Predicted	3.70 (1.07)	3.15 (1.40)	2.49 (1.17)	2.14 (1.32)	2.29 (1.35)	2.44 (1.43)
	Actual	3.49 (1.20)	2.81 (1.30)	2.62 (1.15)	2.09 (1.21)	2.75 (1.35)	2.35 (1.16)
	Difference	-0.21 (1.11)	-0.34 (1.31)	0.13 (1.32)	-0.05 (1.45)	0.46 (1.30)	-0.09 (1.20)
3	Predicted	3.33 (1.26)	3.19 (1.13)	2.50 (1.13)	2.05 (1.28)	2.71 (1.44)	2.49 (1.24)
	Actual	3.34 (1.21)	3.06 (1.44)	2.24 (1.15)	2.06 (1.28)	3.06 (1.52)	2.42 (1.39)
	Difference	0.01 (1.12)	-0.13 (1.07)	-0.26 (1.38)	0.01 (1.71)	0.35 (1.38)	-0.07 (1.21)
4	Predicted	3.50 (1.20)	3.33 (1.51)	2.50 (1.27)	2.07 (1.29)	3.05 (1.49)	3.16 (1.30)
	Actual	3.93 (1.10)	3.75 (1.26)	2.66 (1.24)	2.48 (1.34)	3.49 (1.34)	3.09 (1.41)
	Difference	0.43 (1.02)	0.42 (1.18)	0.16 (1.13)	0.41 (1.53)	0.44 (1.46)	-0.07 (1.10)

Note. Difference was calculated by subtracting Predicted from Actual values.

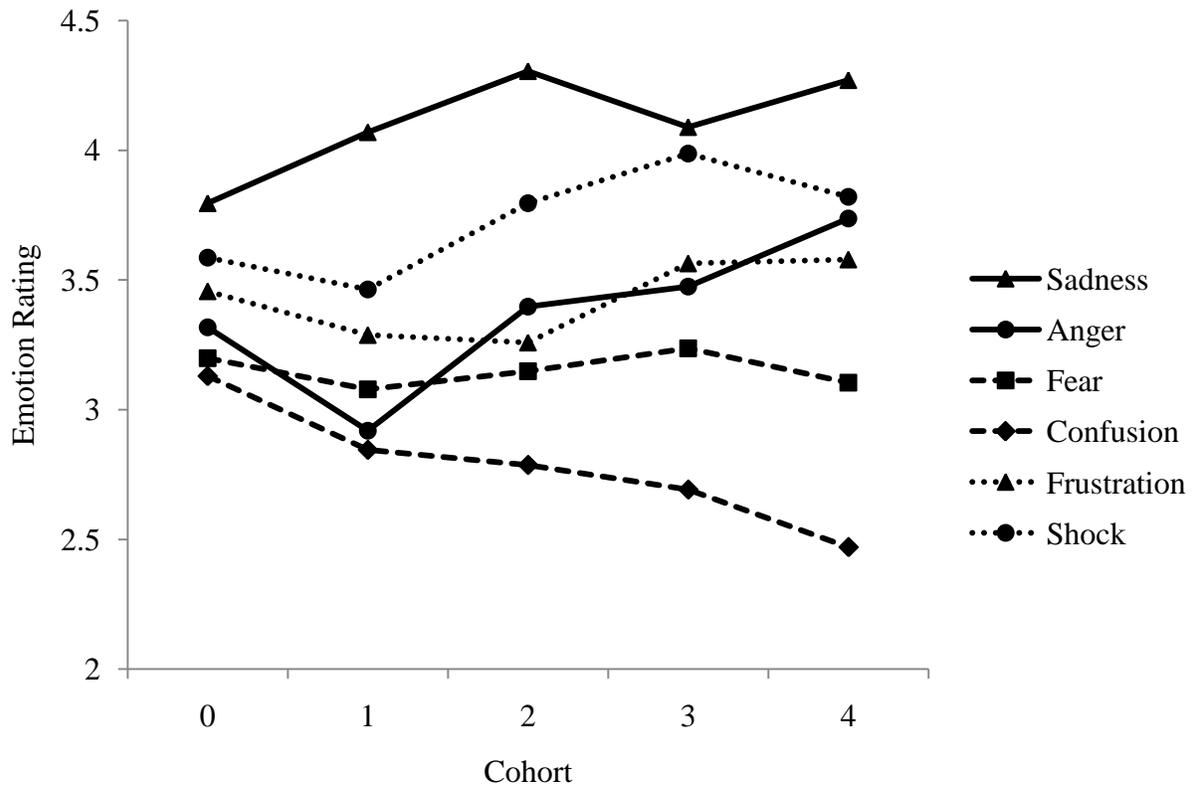


Figure 1. Initial emotional intensity by cohort.

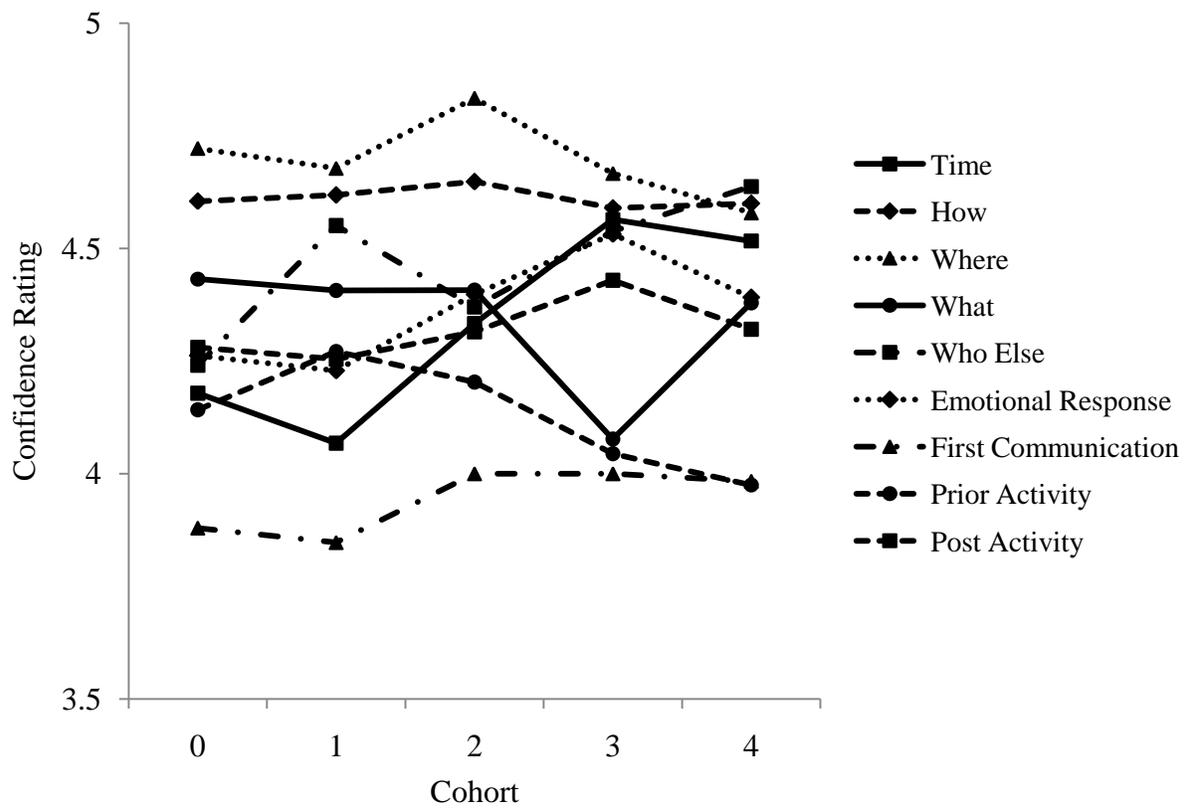


Figure 2. Confidence in memory types by cohort. There is no statistical difference between cohorts, $F(4, 347) = .32, p = .87$.

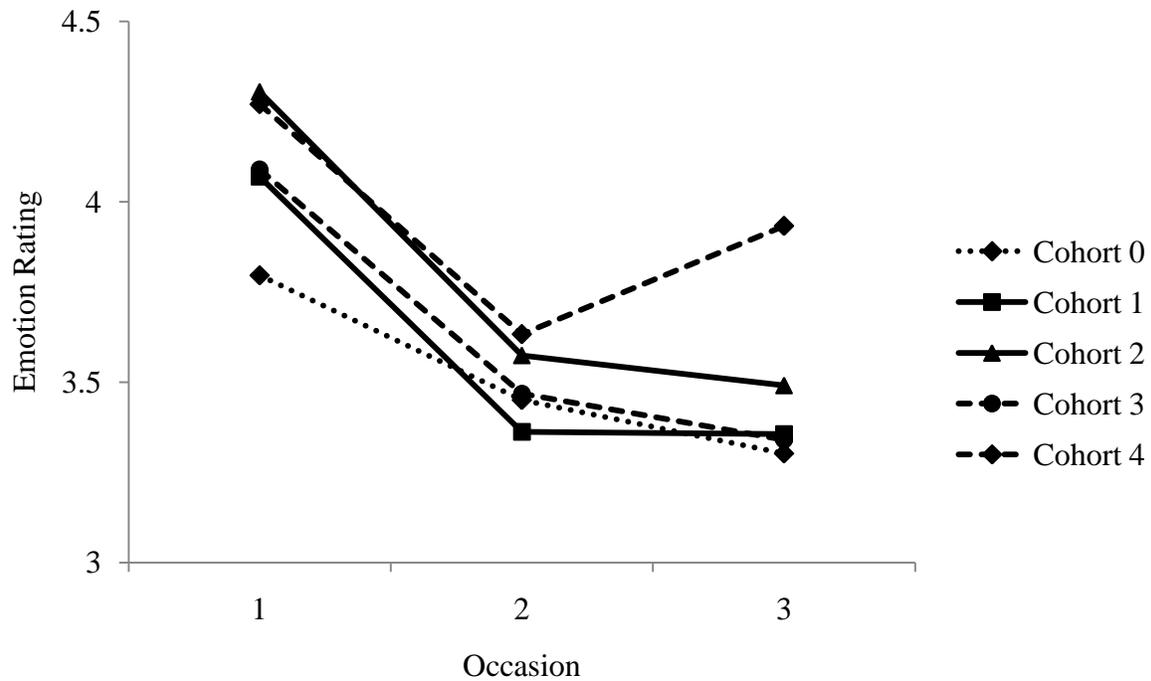


Figure 3a. Average change in Sadness from Surveys 1 to 3. There is a main effect of Occasion, $F(2, 702) = 68.70, p < .0005$. While ratings from Surveys 1 and 2 are significantly different ($p < .0005$), Surveys 2 and 3 are not, $F(1, 351) = .04, p = .84$.

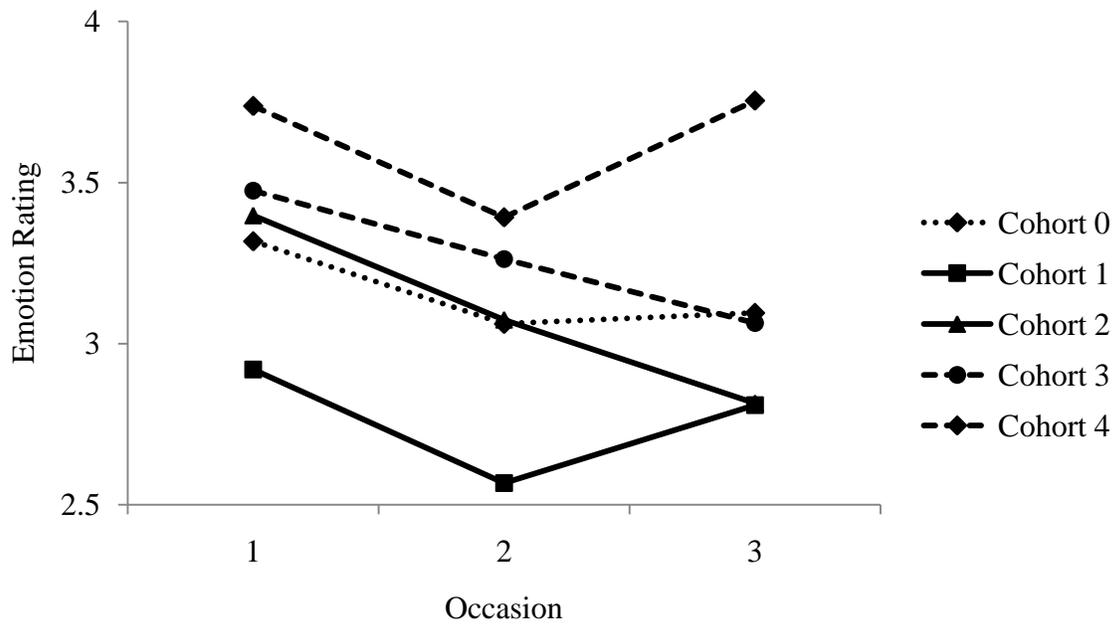


Figure 3b. Average change in Anger from Surveys 1 to 3. There is a main effect of Occasion, $F(2, 702) = 11.91, p < .0005$. While ratings from Surveys 1 and 2 are significantly different ($p < .0005$), Surveys 2 and 3 are not, $F(1, 351) = 1.86, p = .17$.

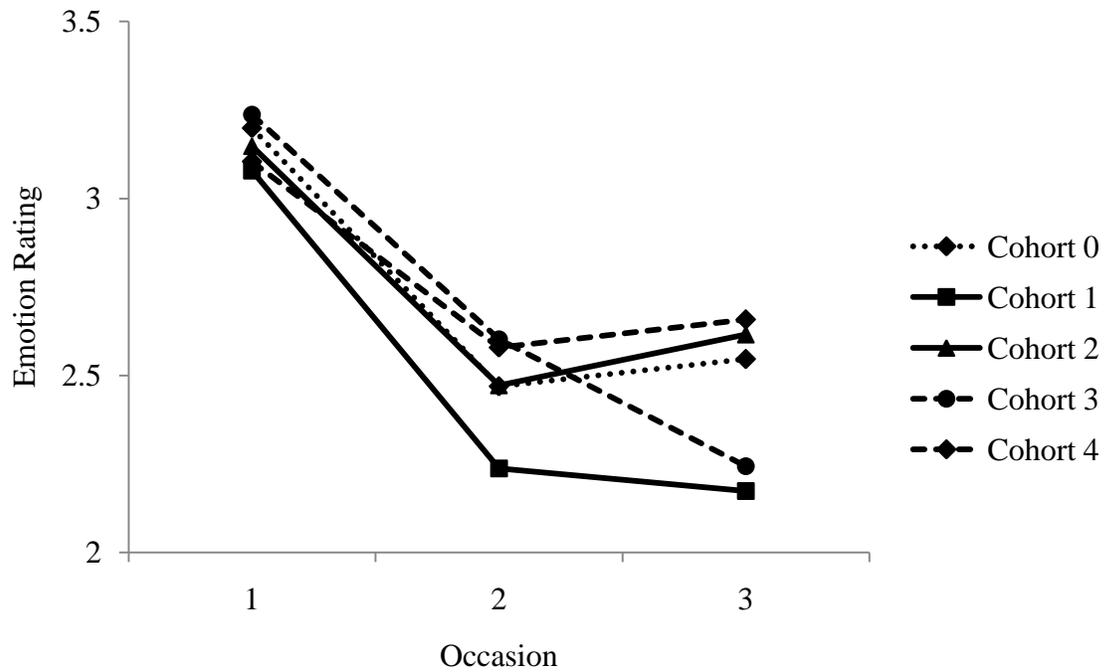


Figure 3c. Average change in Fear from Surveys 1 to 3. There is a main effect of Occasion, $F(2, 702) = 80.59, p < .0005$. While ratings from Surveys 1 and 2 are significantly different ($p < .0005$), Surveys 2 and 3 are not, $F(1, 351) = .02, p = .90$.

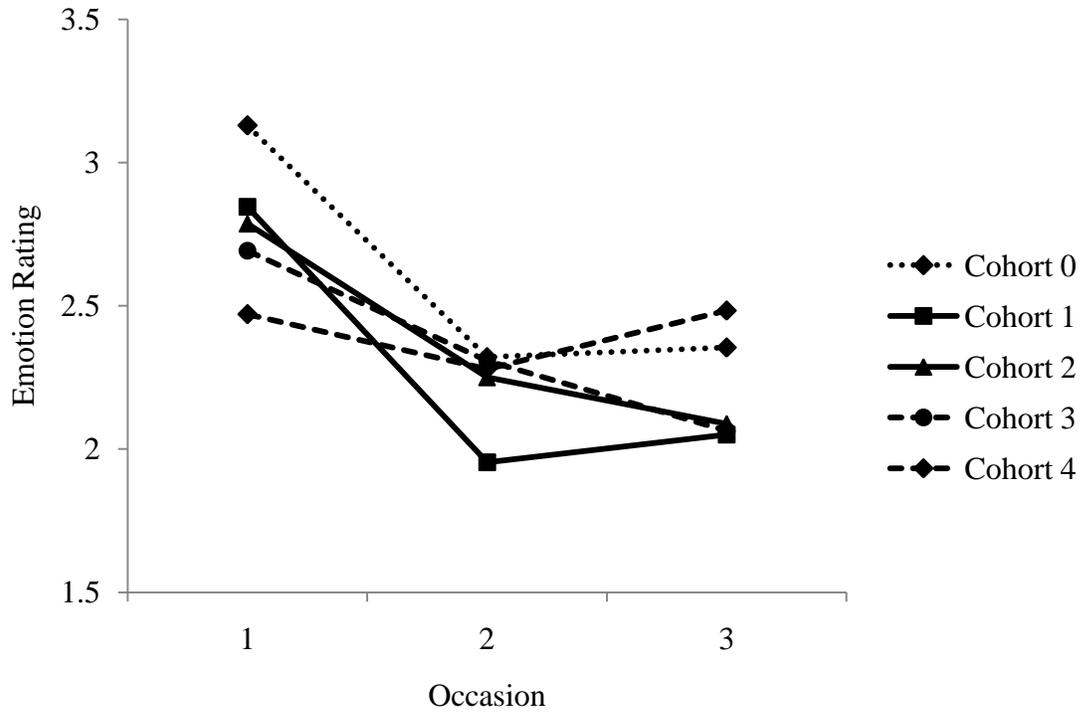


Figure 3d. Average change in Confusion from Surveys 1 to 3. There is a main effect of Occasion, $F(2, 702) = 53.66, p < .0005$. While ratings from Surveys 1 and 2 are significantly different ($p < .0005$), Surveys 2 and 3 are not, $F(1,351) = .14, p = .71$.

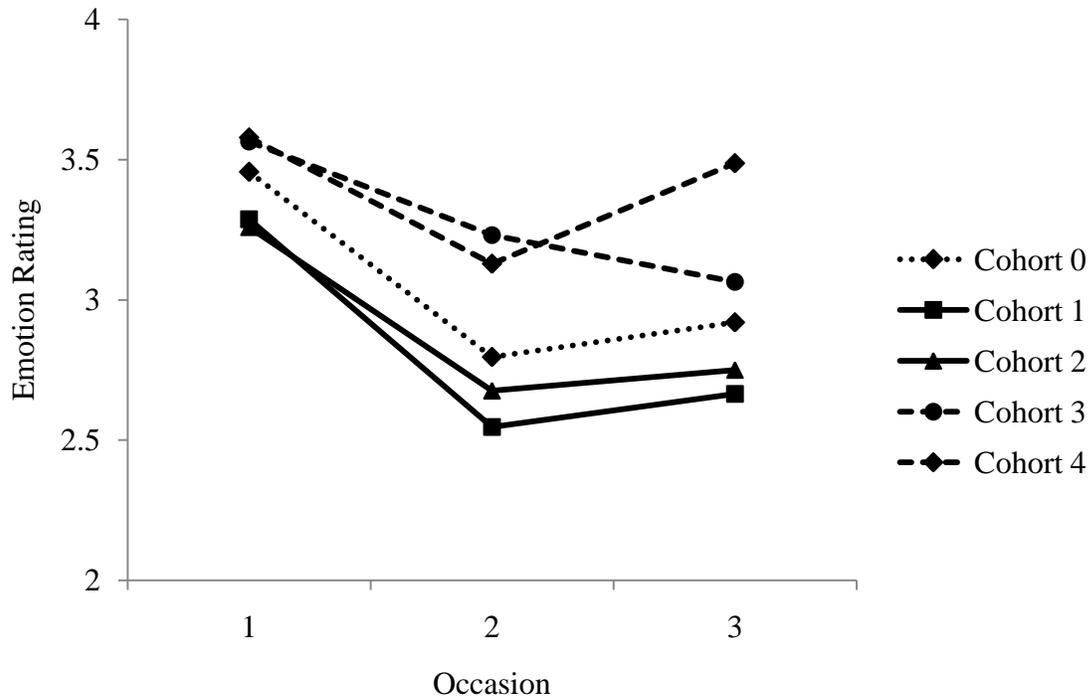


Figure 3e. Average change in Frustration from Surveys 1 to 3. There is a main effect of Occasion, $F(2, 702) = 34.72, p < .0005$. While ratings from Surveys 1 and 2 are significantly different ($p < .0005$), Surveys 2 and 3 are not, $F(1, 351) = 2.94, p = .09$.

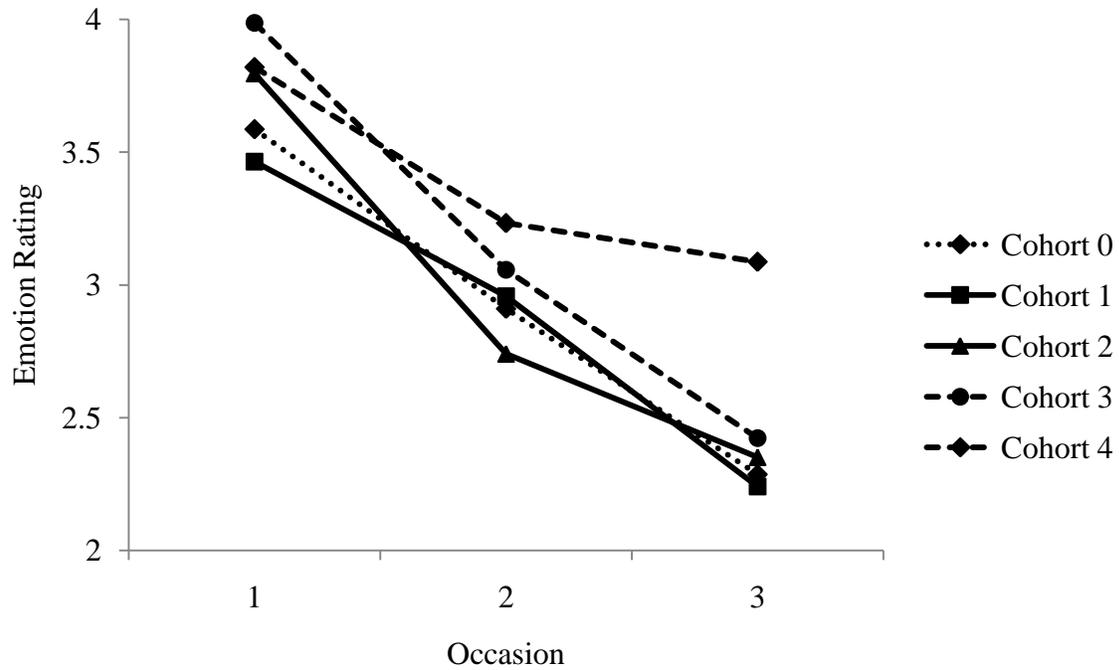


Figure 3f. Average change in Shock from Surveys 1 to 3. There is a main effect of Occasion, $F(2, 702) = 97.83, p < .0005$. Both Surveys 2 and 3 significantly differ from Survey 1, $p < .0005$; this is the only emotion that demonstrates this behavior.

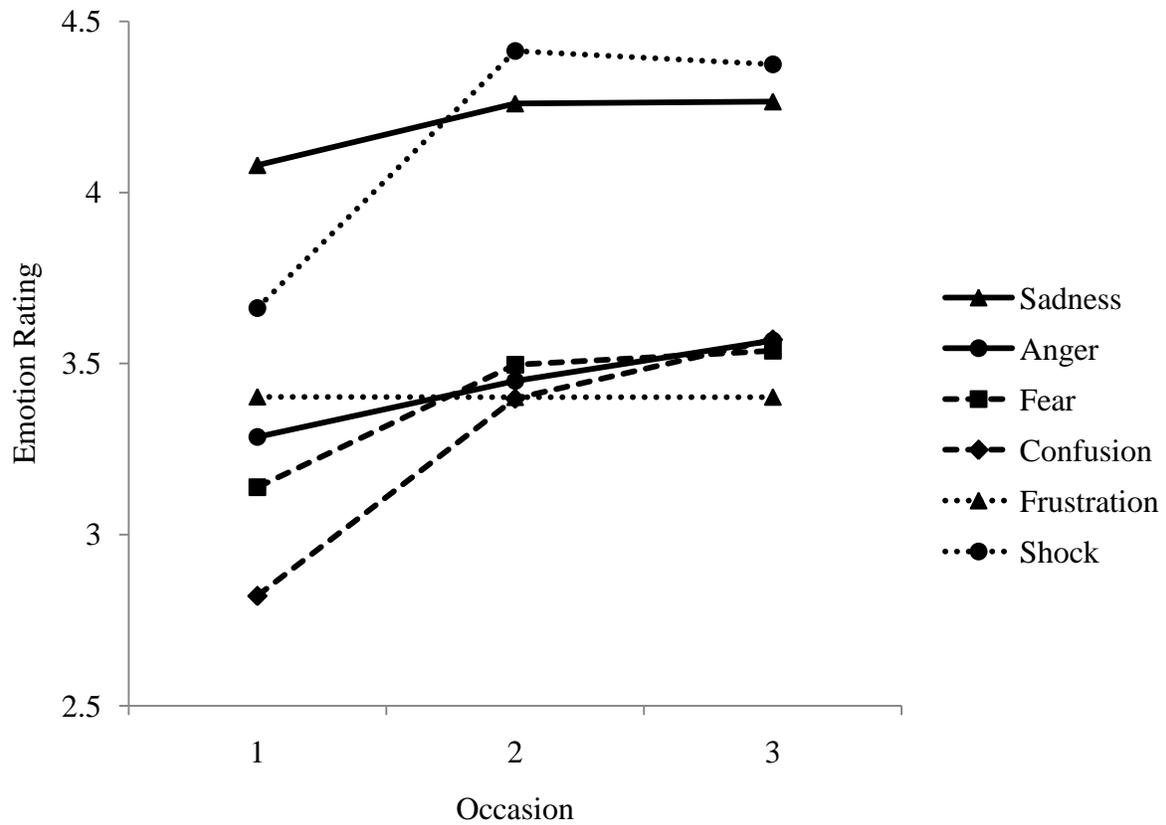


Figure 4. Accuracy of recalled emotional intensities from Surveys 2 and 3. Occasion 1 represents the intensity of participants' initial reactions, and Occasions 2 and 3 represent their memories of Occasion 1 intensity one and three years later.

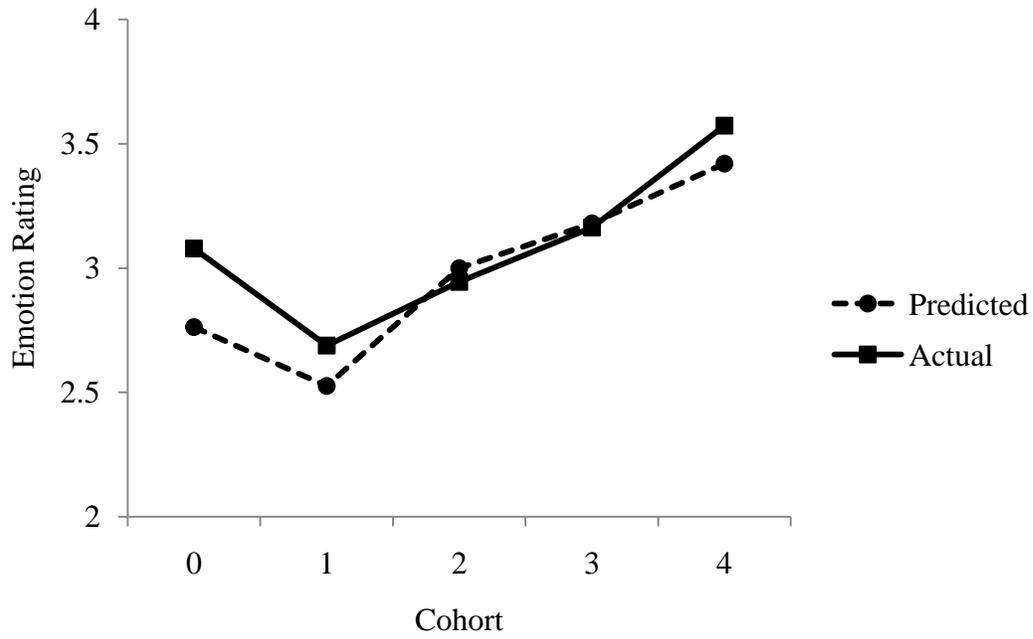


Figure 5a. Accuracy of predicted Anger by cohort (collapsed across occasions). The youngest cohort significantly underestimated their future anger, $F(1,80) = 12.29, p < .005$.

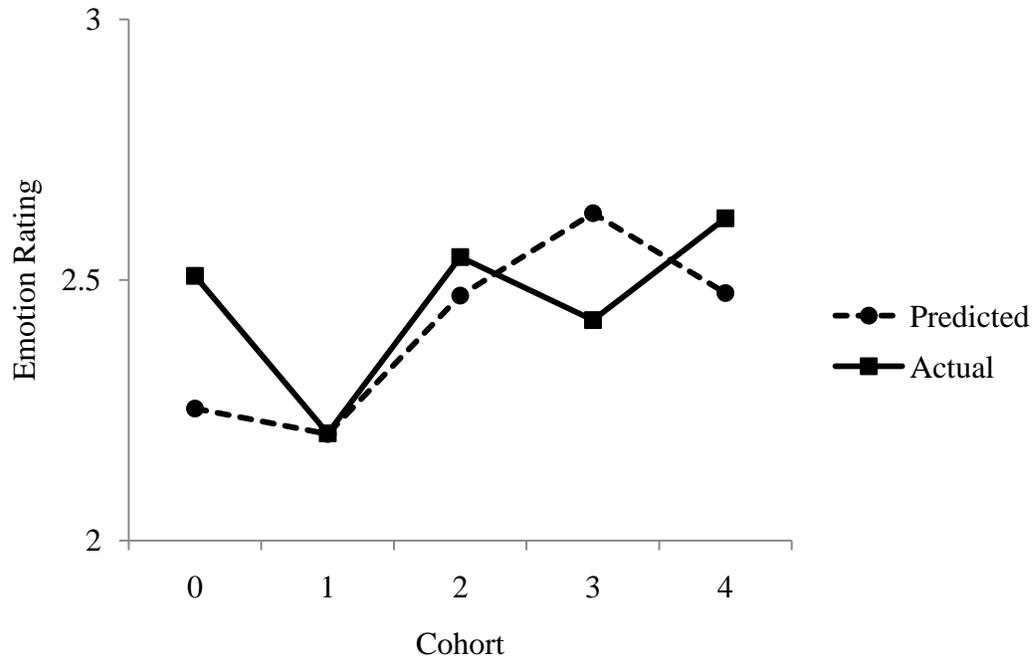


Figure 5b. Accuracy of predicted Fear by cohort (collapsed across occasions). The youngest cohort significantly underestimated their future fear, $F(1,80) = 8.52, p < .01$.

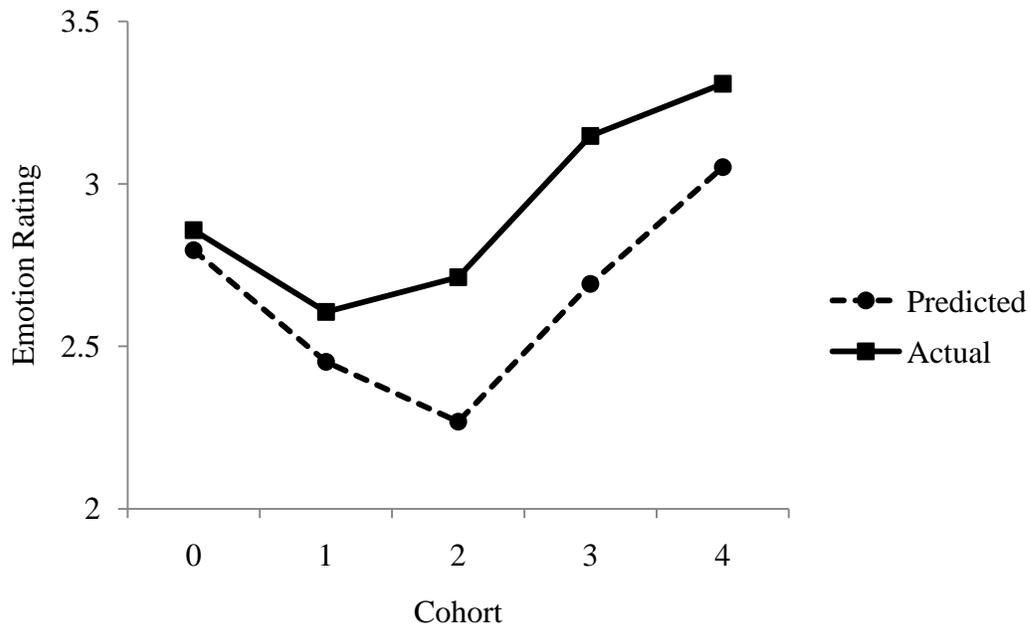


Figure 5c. Accuracy of predicted Frustration by cohort (collapsed across occasions). The youngest cohort was relatively accurate, $F < 1$; all other cohorts showed at least a trend towards underestimation, all $p < .08$.

Appendix A

Evaluation of Emotional Intensity

For the following questions, we'd like you to tell us about your **CURRENT FEELINGS CONCERNING THE ATTACK**. Please indicate your response by marking the appropriate point on the scales provided. Note that you may indicate partial numbers (e.g. 3.5)

1) At this moment, how strongly or intensely do you feel **sad** about the attack?

(low) 1-----2-----3-----4-----5 (high)

2) At this moment, how strongly or intensely do you feel **angry** about the attack?

(low) 1-----2-----3-----4-----5 (high)

3) At this moment, how strongly or intensely do you feel **fear** about the attack?

(low) 1-----2-----3-----4-----5 (high)

4) At this moment, how strongly or intensely do you feel **confusion** about the attack?

(low) 1-----2-----3-----4-----5 (high)

5) At this moment, how strongly or intensely do you feel **frustration** about the attack?

(low) 1-----2-----3-----4-----5 (high)

6) At this moment, how strongly or intensely do you feel **shock** about the attack?

(low) 1-----2-----3-----4-----5 (high)

Note. The same evaluation was used on all three surveys for current, recalled and predicted

emotions. For recalled emotions, “current feelings concerning the attack” was substituted for “feelings concerning the attack in the 2 weeks following the attack. For predicted emotions, “How do you think you’ll feel about the attack one year from now” was substituted on Survey 1 and “How do you think you’ll feel about the attack 2 years from now” was substituted on Survey 2.