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Memory for the 2008 Presidential election in healthy aging and Mild Cognitive Impairment

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Abstract

Objective—The present study examined memory accuracy and confidence for personal and public event details of the 2008 Presidential election in healthy older adults and those with Mild Cognitive Impairment (MCI).

Method—Participants completed phone interviews within a week after the election and after a 10-month delay.

Results—MCI patients and healthy older adults had comparable emotional reactions to learning the outcome of the election, with most people finding it to be a positive experience. After the delay period, details about the election were better remembered by all participants than a less

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Analyses comparing proportional responses for the phone call versus only the personal questions about election memory revealed the same pattern of results; there were no significant interactions with group.

emotionally arousing comparison event. However, MCI patients had more difficulty than healthy older adults correctly recalling details of public information about the election, although often the MCI patients could recognize the correct details.

Conclusion—This is the first study to show that MCI patients’ memory can benefit from emotionally arousing positive events, complementing the literature demonstrating similar effects for negative events.

Keywords

event memory; flashbulb memory; Mild Cognitive Impairment; MCI; aging; emotional memory

Highly emotional experiences in our lives can leave seemingly indelible memory traces. Although these memories are not truly photographic in nature, the vividness with which these emotional experiences are recollected occasionally leaves one with the feeling that the experience is being relived (Brown & Kulik, 1977). Shared, emotional public events present an excellent opportunity for studying these memories, because the time of the event can be documented, as can many of its details.

There has been a great deal of prior research exploring memory for emotional public events in young adults and healthy older adults (Berntsen & Thomsen, 2005; Bohn & Berntsen, 2007; Christianson, 1989; Davidson, Cook, & Glisky, 2006; Davidson & Glisky, 2002; Kensinger, Krendl, & Corkin, 2006; Kvavilashvili, Mirani, Schlagman, Erskine, & Kornbrot, 2010; Tekcan & Peynircioglu, 2002), but far less in patients with memory disorders like Alzheimer's disease (AD) or Mild Cognitive Impairment (MCI) (reviewed by (Broster, Blonder, & Jiang, 2012; Budson & Gold, 2009). The reported effects of AD on memory for these events are somewhat mixed, with some authors concluding that AD patients can form vivid, ‘flashbulb’ memories for these events (reviewed by (Broster et al., 2012) and others concluding that it is likely that AD patients no longer have the capacity to form flashbulb memories (reviewed by (Budson & Gold, 2009). Budson & Gold (2009) granted that although AD patients may not have the ability to encode highly emotional events so vividly as to create ‘flashbulb’ quality memories, most persons in mild to moderate stages of the disease can remember some personal and factual details of highly emotional (negative) public events. The limited study of flashbulb memory in MCI patients to date (reviewed by Budson & Gold, 2009) has suggested that flashbulb memory is maintained in MCI. However, only memory for the terrorist attacks of Sept. 11, 2001, an extremely negative high-arousal event, has been assessed in these patients (Budson et al., 2004, 2007).

There has been limited research drawing comparison between the accuracy and phenomenological characteristics (quantity, specificity, and vividness) of memories for emotionally positive versus negative public events, and the majority of those studies have only tested memory of young to middle-aged adults (reviewed by Paez, Bellelli, & Rime, 2009). Understanding the earliest effects of the Alzheimer pathophysiological process (AD-P) on memory can provide insights into the continuum between healthy aging and the profound memory loss that develops in AD (Sperling et al., 2011). (Throughout the text will use the term “AD-P” in reference to the physical changes in the brain, and refer to the

prevalent memory-impaired phenotype as “AD”). There have been no studies yet evaluating memory for highly emotional positive events in patients with MCI or AD, and only a handful in healthy older adults (Berntsen & Thomsen, 2005; Bluck, Levine, & Lahlhere, 1999; Bohn & Berntsen, 2007; Holland & Kensinger, 2012; Kensinger et al., 2006), despite evidence that older adults often remember positive information better than negative information (reviewed by (Mather & Carstensen, 2005).

Older adults increasingly draw upon frontal regions for processing and encoding of positive information (reviewed by (St. Jacques, Bessette-Symons, & Cabeza, 2009). In MCI and even early stages of AD, most frontal lobe regions are volumetrically relatively well preserved (Salat, Kaye, & Janowsky, 2001), and often recruited in a compensatory manner to aid task performance (Grady et al., 2003). In contrast to positive information, encoding of negative information predominantly recruits more posterior areas including medial and lateral temporal lobe regions (Kensinger, Garoff-Eaton, & Schacter, 2007), which suffer significant atrophy from AD-P (Apostolova & Thompson, 2008; Chow & Cummings, 2000; Shi, Liu, Zhou, Yu, & Jiang, 2009). This pattern of atrophy gives reason to believe that positive events would be remembered well in the face of developing AD-P. It remains to be tested whether MCI patients’ poor memory overall applies to details from a positive public event.

The present study evaluated memory accuracy for an emotionally salient public event and an everyday event with less emotional intensity to assess whether MCI patients and healthy older adults would receive a relative memory benefit for information from the emotional event. Older adults’ and MCI patients’ memory for the news-worthy, publicly recorded information of the 2008 Presidential election (e.g., who was the winning candidate or the location of acceptance speech) as well as personal, self-referential details were examined (e.g., the time and means of learning the outcome, similar to “reception context” [(Brown & Kulik, 1977). Examining MCI patients’ memory retention for major public events presents an opportunity to test memory for experiences that people find meaningful and relevant, and for which the event details can be verified. The Presidential election of 2008 provided an opportunity to test memory for a culturally important real-world event with personal relevance (Scheibe, Mata, & Carstensen, 2011), which was not as strongly negative or highly arousing as the public events selected for prior tests of MCI patient’s memories, e.g. terrorism of Sept. 11, 2001 (Budson et al., 2004, 2007).

Despite being a culturally significant and emotionally salient public event, the 2008 presidential election may not contain the ‘surprise’ feature necessary to identify it as an event likely to evoke a true flashbulb memory. A systematic evaluation of several models of flashbulb memory by Luminet (2009) determined that the key features of ‘flashbulb’ memories are that the memories must elicit a reaction of surprise to learning about original event (and thus have high novelty), have importance or consequentiality, elicit an intense emotional response, and undergo rehearsal (but see evidence of flashbulb memory for anticipated events in (Winograd & Killinger, 1983) . Although the outcome of the election could have been somewhat surprising, a presidential election is anticipated and the possible outcomes are apparent in advance. Participants also had expressed their interest in participating in a phone interview about the experience well in advance. For these reasons,

an election would not elicit the same degree of surprise as, for example, a natural disaster or terrorist act. However, the election shared many of the other features: personal importance, elicitation of an emotional response, and rehearsal. The occasion of the first American presidential election featuring an African-American candidate also imbued the 2008 election with greater novelty than previous elections. The phone interview itself served as a control event for comparison to the election because the experience would be uniform across participants, and the date, time, and details of the event were known with certainty.

The present study probed how MCI affects the experience of, and memory for, emotionally meaningful experiences compared to the effects of healthy aging. Analyses first assessed participants' emotional reaction upon first learning the outcome of the election. Comparisons were drawn between participants' memory for the newsworthy, publicly recorded information (e.g. who was the winning candidate, location of acceptance speech) and personal, self-referential details (e.g., what time and by what means one learned the outcome) to understand whether healthy aging and MCI would affect memory for these two types of information differently. Finally, memory for the election was compared to memory for a less emotionally arousing control event to examine whether MCI patients would receive a relative benefit to memory from a more arousing event, as has been found in healthy older adults.

Methods

Determination of sample size, all data exclusions, all manipulations, and all measures in the study are reported.

Participants

The study participants included 19 patients (13m, 6f) with a clinical diagnosis of mild cognitive impairment due to AD (note that although data were collected prior to 2011, at the time of enrollment all patients would have met the 2011 core criteria for MCI due to AD; (Albert et al., 2011) who were recruited from the Boston University Alzheimer's Disease Center, Boston, MA, Edith Nourse Rogers Memorial Veterans Hospital, Bedford, MA and The Memory Clinic, Bennington, VT. These patients were each assessed and diagnosed by a team of neurologists and neuropsychologists, and were otherwise healthy.

A control group consisted of 25 healthy community-dwelling older adult control participants (OACs, 11m, 14f) who were recruited by fliers and advertisement in the Boston area, were participants of other ongoing research studies, or were spouses of the MCI patient participants. Healthy older adults demonstrated normal cognition on an extensive battery of neuropsychological tests within the previous 2 years. All participants were screened for clinically significant depression, alcohol or drug abuse, previous stroke or traumatic brain damage. Verbal informed consent was obtained from all participants, and patients' caregivers (where appropriate). The Human Subjects Committees of the Edith Nourse Rogers Memorial Veterans Hospital and Boston College approved this study. Participants did not receive compensation for study participation.

Five MCI patients (1 phone number disconnected, 1 hearing impairment too advanced to allow phone conversation, 2 unavailable, 1 declined to participate at in the follow-up survey for reasons unrelated to memory) and 2 OACs were lost in the time between the initial survey and follow-up survey; in total 23 OACs and 14 MCI patients completed both the initial and follow-up surveys. Cognitive testing completed during another research study in the lab within 2 years after the follow-up survey was available for 19 OACs; one had clinically meaningful decline in cognitive testing and thus was excluded from all analyses. Demographic comparisons include 22 OACs and 14 MCI patients.

Univariate ANOVAs indicated there were no significant differences in years of education between OAC and MCI participant groups ($F(1,34)=1.59, p=.22, \eta_p^2=.05$; OAC years education $M=16.32, SD=2.92$, MCI years education $M=14.86, SD=4.03$), and that MCI patients were older than OACs ($F(1,34)=5.47, p=.03, \eta_p^2=.14$; OAC age $M=75.32, SD=5.79$; MCI age $M=80.14, SD=6.42$). There were no significant differences in reported partisanship between participant groups ($F(1,34) < 0.50$), and the sample generally identified as moderate Democrats (MCI $M=3.50, SD=2.68$, OAC $M=3.02, SD=2.31$, on scale where 1=strong Democrat, 4=Independent/neither, and 7=strong Republican).

MCI patients completed an MMSE (Folstein, Folstein, & McHugh, 1975) during participation in another research study within the prior year (MMSE $M=27.36$, range 26-30). OACs had either completed an MMSE during another research study within the prior year (MMSE $M=29.16$, range 26-30), or completed an abbreviated 20-question form of the MMSE administered over the phone (scores were 19, 20 and 20). MCI patients had significantly poorer scores on the MMSE than OACs ($F(1,31)=17.72, p<.0005, \eta_p^2=.36$; only the OACs who completed the full 30-question MMSE were included in this ANOVA).

Procedure

Participants were contacted by mail and invited to enroll in the study 6 weeks prior to the election; they were called to confirm interest and enrolled 2 weeks in advance of the election. The initial phone interview was conducted within a week (most within 4 days) after the election (T1), and the follow-up phone interview was given after a 10-month delay (T2). Participants were told at the time of enrollment and during the first survey that they would be contacted again for a follow-up interview. Each study participant was contacted by one of 4 experimenters at the two survey time points, who followed a uniform phone script and survey text. All MCI patients and half of the OACs were interviewed by the same experimenter at T1 and T2.

Survey administration—Participants completed an approximately one-hour phone survey assessing their memory for the 2008 Presidential election as well as a non-emotionally-arousing personal event of their own choosing that occurred within the prior week. They also answered questions that gathered information related to their circumstances at the time of the phone survey. The questions were based upon those previously used Hirst et al. (2009), Budson et al. (2004), and Kensinger and Schacter (2006) to assess memory for other emotionally-salient public events. The survey assessed memory for personal experience and reaction (e.g., Where were you when you learned the outcome of the

election? Was your reaction positive or negative? What was the intensity of your emotional reaction to the outcome of the election?) and public event details (e.g., Who was the Democratic vice-presidential candidate? Where was the winning candidate when he gave his acceptance speech?). Based on prior research (Budson et al., 2004; Kensinger & Schacter, 2006), these questions address the core features of an event, i.e., who, what, where, when, and how, as well as assessing one's emotional state and reaction at the time.

Experimenters recorded the responses item-by-item. Participants were first prompted to provide a free recall response; if they were unable to supply a response, the experimenter provided several likely options from which the participant could choose (i.e. recognition memory). For example, "How did you first learn about the outcome of the election? 1. Newspaper, 2. Radio, 3. Television, 4. Internet, 5. Person. (See Supplemental Tables 1 and 2 for questions and prompts provided). Response options for personal experience were modified from Budson et al. (2004) and Kensinger & Schacter (2006) as relevant for context. Public information recognition options included, for example, the names of current and previous candidates, or contextually appropriate options (e.g. surrounding calendar dates, days of the week). Personal experience questions for which the participant provided no response at T1 were not asked at T2 because there could be no comparison of responses.

After each response provided (regardless of its accuracy), participants were asked to indicate their confidence in the accuracy of that response on a 5 point scale where 1=not at all confident to 5= very confident (results of memory confidence are reported in Supplemental Materials). Participants were not informed of the accuracy of their responses at any point. Participants were also asked to select which feelings were generated in them upon learning the outcome of the election by responding "yes" or "no" to: inactive, energetic, gloomy, cheerful, excited, afraid, calm, confused, happy, distressed, anxious, enthusiastic, worried, angry, unpleasant, shocked, amused, pleasant, relaxed, interested, sad, nervous, aroused, and disappointed.

Memory for the election (the emotionally salient event) was compared to two non-emotionally-arousing control events, to take into account baseline memory ability for non-emotionally-arousing events. At T1, participants were asked to select a personal event that had happened to them within the previous week that was, "somewhat unique and not highly emotional", and given examples of a visit with family members, or a dinner party with friends. When interviewed at T2, nearly all of the MCI patients, as well as several healthy older adults, had no recollection of which 'other event' from their lives that week they had chosen to describe in the T1 survey, even when a cue was provided by the experimenter. MCI patients were less likely than OACs to remember their chosen event (chi squared = 6.28, $p=.01$). For this reason, at T2 it was not possible to ask questions about memory for the specific details of the chosen non-arousing event as a comparison to their more emotionally arousing memory of the election.

Due to inability to retrieve the identity of the chosen personal event from memory, the T1 phone survey itself acted as a comparative less emotionally arousing event; like the election, it was a unique event that was anticipated. At T1, the experimenters asked participants questions about their present location, thoughts, and feelings (see Supplemental Table 3).

Experimenters recorded the date and time of the call for subsequent comparison. Participants were also asked to rate confidence in their memory accuracy, as they had for the questions about the election.

Survey scoring—Two independent raters assessed the survey responses at both T1 and T2 for accuracy of the information remembered and the consistency between the responses given at the two time points. The very few discrepancies between scorers were reviewed and adjudicated by one of the authors (JW) to achieve consensus in scoring. Responses were coded as: consistently correct responses at T1 and T2, “correct memory”; did not give a response, “failure”; and “distortion” (for ‘public’ event information, distortion refers to incorrect memory at T2; for ‘personal’ information questions, refers to differing responses at T1 and T2; thus in both cases responses were distorted from the experience at T1). A response “failure” implies that the participant could not recall their memory and also would not make a guess from among the recognition response options provided.

Analyses

Analyses first compared emotional reactions of healthy older adults and MCI patients upon learning the outcome of the election. Reaction to the outcome of the election (positive or negative) depended upon one's preferred candidate. There was a skewed distribution among participants' emotional responses to hearing the outcome of the election, because very few participants in the sample viewed the election outcome as negative at T1 (1 MCI and 5 OACs had a negative interpretation of the outcome). There was inadequate power to conduct analyses contrasting memory of those who viewed the outcome as positive compared to negative, so those participants who had a negative response at T1 were excluded from further analyses. Thus, the analyses drew comparison between memories of the 17 OACs and 13 patients with MCI who did not find the outcome to be negatively valenced (OAC age $M=75.41$, range 63-86; MCI age $M=81.08$, range 72-94 [only one participant was over age 87]; OAC years education $M=16.00$, $SD=2.92$, MCI years education $M=15.39$ $SD=3.66$; OAC: 7m, 10 f; MCI: 8 m, 5 f). Including age as a covariate in multivariate analyses described below did not change interpretation of the results, so this factor will not be discussed further. There were no significant differences in reported partisanship between participant groups ($F(1,28) < 1$ $p=.33$, $\eta^2_p = .03$), and the sample generally identified as moderate Democrats (MCI $M=3.23$, $SD=2.59$; OAC $M=2.38$, $SD=2.07$, on scale where 1=strong Democrat, 4=Independent/neither, and 7=strong Republican).

The two participant groups' memories were compared for the personal experiences versus public events of Election Day. Lastly, memory for the election was contrasted with memory for a less emotionally arousing event, the phone interview. One MCI patient and two healthy older adults could not recall speaking with one of the experimenters to complete the T1 survey previously and another did not answer any questions about the phone call because he ended the survey early for reasons unrelated to memory ability; those participants were not included in analyses. Eleven MCI patients and 15 healthy older adults were included in analyses of memory for the phone call. Memory responses were tested for differences between the two events (election and phone call) and between participant groups. The presentation of results is separated into 3 sections addressing each of these considerations.

Results

Emotional Response, Evaluation of the Election at T1

First the perceived emotional response to learning the outcome of the elections was assessed at T1 in the days after the election and prior to the phone interview. A univariate ANOVA comparing emotional responses between groups confirmed there was no significant difference between participant groups' ratings of how positive or negative they found the outcome of the election to be ($F(1,28) < 1$). On average, people found the outcome of the election to be very positive (MCI $M=6.38$, $SD=1.19$; OAC $M=6.29$, $SD=1.21$, where the scale ranged from 1=very negative to 7=very positive). A univariate ANOVA comparing OACs to MCI patients showed that there were no significant differences between groups in intensity of their responses to learning the outcome of the election ($F(1,28) < 1$, $M=4.82$ where 1= no reaction to 7= very intense). There were also no significant differences in which specific feelings were generated by the event (list of feelings queried is provided in methods; $F_s(1,28) < 3.49$, $p_s > .07$, $\eta^2_p < .11$). There were also no significant differences between groups in their emotional experience or rehearsal (e.g. considering the news, speaking with others) of information related to learning the outcome of the election in the days immediately following. It is worth noting that the moderate level of rehearsal and media exposure (statistics reported in supplemental materials), which did not significantly differ between groups, suggests that these factors most likely did not substantially influence any group differences in the memory outcomes.

Memory for Personal Experience Versus Public Events of Election Day

Memory for the public event details of the election (e.g., 'What was the date of the election?' 'Where was the winning candidate when he gave his acceptance speech?') and for the personal experience and feelings upon learning the outcome (e.g. 'Where were you when you learned the outcome of the election?' 'Who were you with when you learned the outcome of the election?') was assessed to determine whether the newsworthy, publicly recorded information and personal, self-referential memories were recalled with similar accuracy. Responses to these questions at T2 were coded for accuracy and consistency relative to responses given at T1 (as described in methods).

Because the effects of interest were between OAC and MCI groups for each question type, a 2-way ANOVA with factors of question type (personal, public) and group (MCI patients, OAC) was conducted individually for 3 types of memory responses: memory distortions, failures, and correct memory. The ANOVA for memory distortions revealed a main effect of group ($F(1,28)=5.85$, $p=.02$, $\eta^2_p = .17$) because MCI patients had more distortions than OACs (MCI $M=3.65$, OAC $M=2.68$; See Figure 1A). The ANOVA for memory failures showed no significant main effects or interactions ($F_s(1,28) < 3.99$, $p_s > .06$, $\eta^2_p < .13$). The ANOVA for correct memory revealed main effects of question type ($F(1,28)=7.04$, $p=.01$, $\eta^2_p = .20$; personal $M=7.07$, public $M=6.15$) and group ($F(1,28)=10.32$, $p=.05$, $\eta^2_p = .13$; OAC $M=7.03$, MCI $M=6.19$), qualified by an interaction between question type and group ($F(1,28)=8.25$, $p=.01$, $\eta^2_p = .23$). This interaction reflected the MCI patients' impaired personal-detail memory, but preserved public-detail memory; see Figure 1A).

Correct Recall Versus Recognition Memory—The above analysis collapsed recall and recognition responses together (e.g., a “correct response” could be correct by recall or recognition). The origin for the interaction between question type and group was probed further by separately considering recall and recognition memory in OACs and MCI patients for personal and public event details.

For personal information, an ANOVA with factors of memory type (recall, recognition) and group (OAC, MCI) indicated that overall there was a greater number of correct recall than recognition responses (main effect of memory type: $F(1,28)= 335.39, p<.0005, \eta^2_p =.92$; recall $M= 6.90$, recognition $M= .17$) and also that overall OACs had greater correct memory than MCI patients (main effect of group: $F(1,28)= 12.55, p<.01, \eta^2_p=.24$; OAC $M=4.00$, MCI $M= 3.08$; see Figure 1B). There was no interaction between memory type and group.

A parallel ANOVA for public information indicated there was a main effect of memory type ($F(1,28)= 9.62, p<.005, \eta^2_p =.26$; recall $M= 4.14$; recognition $M= 2.00$). There was no main effect of group, but there was an interaction between memory type and group ($F(1,28)= 4.40, p<.05, \eta^2_p =.14$). Follow-up t-tests between correct public information recall and recognition responses for OACs and for MCI patients indicated that OACs had more correct recall than recognition responses ($t(16)=4.36, p<.0005$, Cohen's $d = 2.18$; OAC recall $M=4.82$, recognition $M= 1.24$), yet MCI patients had nearly as many recognition as recall responses ($t(12)<1.0$; MCI recall $M=3.46$, recognition $M=2.77$). In other words, although MCI patients and OACs remembered similar amounts of public details correctly, MCI patients more often relied upon prompts to correctly recognize that information than did OACs (see Figure 1C).

The Election Compared to a Less Emotionally Arousing Event

Reactions to the Election Compared to a Less Emotionally Arousing Phone Call—In order to understand how a highly emotionally salient real world event like the election affected MCI patients' memory relative to healthy older adults', the phone call for the T1 survey was used as a comparative less emotionally arousing event. An ANOVA on emotional reactions with factors of event (election, phone) and group (MCI patients, OACs) revealed a trending effect of event ($F(1,24)= 3.36, p=.08, \eta^2_p =.12$) because participants reported a higher intensity emotional reaction (i.e., greater emotional arousal) to learning the outcome of the election than their reaction to participating in the phone interview (election $M=5.37, SD=1.97$; phone interview $M=4.43, SD=1.60$ on a 7 point scale where 1=no reaction and 7=very intense). There was no main effect of group or interaction between group and event ($F_s(1,24)<0.5$, all $\eta^2_p < .01$), showing that MCI patients did not experience a significantly different level of intensity (i.e., arousal) of emotional experience from the OAC's responses to each event. An ANOVA examining the emotional valence of response, with factors of event (election, phone) and group (MCI patients, OACs), indicated no significant main effects or interaction between these factors ($F_s(1,24)<2.21, p_s>.15$ all $\eta^2_p < .08$). Both groups found the election and the phone interview to be highly positive experiences (election: MCI patients $M=6.45, SD=1.21$; OACs $M=6.20, SD= 1.26$. phone call: MCI patients $M=6.09, SD=1.22$; OACs $M=5.60, SD=1.35$, on scale of 1=very negative to 7=very positive). Thus, according to the participant self reports, the phone call was less

arousing, but matched on positive valence, to the election. There were no group differences in reactions to completing the T1 phone interview (statistics reported in supplemental materials).

Memory for the Election Compared to a Less Emotionally Arousing Phone

Call—First, memory accuracy for the circumstances of the phone call was assessed between participant groups. Univariate ANOVAs on memory of the phone call compared frequency of each response type (correct memory, failure, distortion) between groups. Results showed that there were no significant differences for any of the response types between MCI patients and OACs memory for the phone call at T1 ($F_s(1,24) < 1.50$, $p_s > .23$, all $\eta_p^2 < .06$).

Next, memory accuracy was compared for the election to the phone interview to directly compare whether there were group differences between MCI patients and healthy older adults. For ease of analysis, and because the distinction between personal and public event details was not relevant to the phone call, personal and public event details of the election were collapsed into one composite of memory for the election. There were differing numbers of questions about the elections (22 questions) and the phone call (8 questions), so proportional values of the total number of questions were used for comparative analyses between these events, rather than average counts. An ANOVA with factors of event (election, phone interview), response (correct memory, failure, distortion), and group (OAC, MCI patients) revealed a main effect of response ($F(2,23) = 33.56$, $p < .0005$, $\eta_p^2 = .75$), qualified by an interaction between event and response ($F(2,23) = 30.83$, $p < .0005$, $\eta_p^2 = .73$), as depicted in Figure 2¹. Follow-up paired-samples t-tests between memory for the election and phone interview for each type of response were performed to examine the interaction between event and response. Results revealed a greater proportion of correct memory for the election than phone interview ($t(25) = 8.21$, $p < .0005$, Cohen's $d = 3.28$ election $M = .64$, phone $M = .34$), and a greater proportion of memory failures for the phone interview than election ($t(25) = 4.68$, $p < .0005$, Cohen's $d = 1.87$; election $M = .05$, phone $M = .28$). There was no significant difference in proportion of memory distortions between events ($t(25) = 1.60$, $p > .12$, Cohen's $d = .64$; election $M = .31$, phone $M = .38$).

Discussion

The primary goal of the present study was to determine if MCI patients and healthy older adults would experience comparable memory enhancement for a culturally significant and emotionally salient public event. Results showed that MCI patients' memory could benefit from emotionally arousing positive events, but that their memories were sometimes less detailed than those of OACs. In particular, MCI patients were less able to freely recall public information about the election, more often relying upon recognition memory to achieve correct memory for these details. Yet MCI and OAC groups both had more correct responses, and fewer memory failures, for the election than for the phone call; there were no group differences in that pattern.

Emotional Response at T1

Although the progression of the AD-P is marked by severe losses in memory, emotional identification and reactivity are relatively well preserved in MCI, and even into the mild,

early stages of AD (Bucks & Radford, 2004; Hamann, Monarch, & Goldstein, 2000; Koff, Zaitchik, Montepare, & Albert, 1999; Shimokawa et al., 2000; Spoletini et al., 2008). Consistent with this preservation, the reported emotional experience and reactivity to hearing the outcome of the election were comparable across the OAC and MCI patient groups. These results suggest that MCI patients have normal emotional reaction and responsivity not only for highly arousing, extremely negative public events like the terrorist attacks on Sept. 11, 2001 (Budson et al., 2004), but also for less extreme but still emotionally salient positive real-world events like the election.

Memory for Personal Experience and Public Events of Election Day

Relative to OACs, MCI patients had reduced levels of correct memory for personal information related to learning the outcome of the election and more distortions, characteristic of their MCI group status (Sperling et al., 2011). While correct memory for personal information about the election was primarily generated from free recall in both OAC and MCI, correct memory for public information was supported by a combination of recall and recognition memory, especially for MCI patients. The disproportionate reliance on recognition of public information within the MCI group is consistent with prior evidence that forced-choice recognition is well maintained in MCI and early stages of AD, whereas memory recall declines more rapidly with developing AD-P (Anderson et al., 2008; Clark et al., 2012; Serra et al., 2010; Westerberg et al., 2006). Successful recall is thought to depend upon an intact sense of recollection (in contrast to familiarity) that is disrupted earlier in the course of AD-P than forced-choice recognition memory, which is sustained by a sense of familiarity (Clark et al., 2012; Rugg & Yonelinas, 2003). This may explain why recognition memory prompts can provide a scaffolding to allow MCI patients to retrieve information that is longer accessible by free recall.

Lastly, MCI patients and OACs have accurate perception of their memory reliability, and this relationship was observed both for personal and public information (reported in Supplemental Materials). Judgment of confidence was highly calibrated to accuracy for both participant groups. The results demonstrate that this type of meta-memory monitoring is intact into early stages of AD-P, at least for positive public events (discussed in more detail within Supplemental Materials).

Memory for Election Compared to a Less Emotionally Arousing Event

An advantage to the design of this study of flashbulb memory for the election was the inclusion of a comparative control event; most prior studies have not used a comparative control event (but see Ikeda et al., 1998; Talarico & Rubin, 2003). Although the information queried in each of the surveys was not identical, there were many items in common between the election and phone call surveys (e.g., what they were doing immediately before, date, time, location, who they were with, their clothing worn, and whether they were eating/drinking anything at the time of the event). The election surveys and the phone call survey probed memory for comparable information to the extent possible for the context. In the present study, contrasting memory for the election with the phone interview revealed that details of the election were proportionally better remembered by OACs and MCI patients than were the details of the phone interview, meaning that both groups showed a greater

subsequent memory benefit for the higher arousal than lower arousal positive event. If anything, the surveys about the election probed memory for more specific details than did the phone interview survey (i.e., more challenging), and yet memory was still proportionally greater for the election than the phone call, speaking to the more indelible nature of this event. The key findings of this research complement the existing literature by showing that MCI patients can encode emotional information from an event like the election that was both more positive in valence and also less arousing than the tragic event described in previous reports, i.e., Sept. 11 (Budson et al., 2004, 2007).

The participants' self-reported emotional responses to the election and phone call showed that the experiences were matched in valence, and the phone call evoked a lower level of arousal. However, arousal level is not the only characteristic that differs between the election and comparison events. There is perhaps greater novelty, distinctiveness, and opportunity for subsequent rehearsal and repeated exposure to the election details, which may provide further explanation for why the election was remembered better than the phone interview. It may be meaningful that at T2 nearly all MCI patients and the majority of OACs could not remember the identity of their chosen events described at T1, even when provided with a cue, but that participants did remember the election and phone interview. This memory failure may be attributable to participants selecting the most recent occurrence of a type of event (e.g., a medical appointment, a church meeting, an exercise class, or a meal with a certain friend or family member), which was likely to reoccur over the course of ten months, leading to interference that prevented retrieval of the specific event. The lengthy phone call for this research study and the election, by contrast, would have remained unique occurrences not subject to the same interference. Davidson et al. (2006) also found that, after an 11-13 month delay, participants were unable to remember 'the most interesting' event in their life in the few days before the flashbulb event, further suggesting a key role for the characteristics of novelty and distinctiveness, in addition to emotional arousal, in highly-memorable events.

Participants' ability to recall the election and phone interview, but not the chosen non-arousing 'other' event in the present study may also underscore the importance of novelty or distinctiveness to memory success after a delay of many months, in addition to the benefit of emotional arousal upon memory. The historic quality of electing the nation's first African-American President (as was often acknowledged in participants' free recall description of the election) may have imbued the 2008 election with novelty and distinctiveness that contributed to the memorability of that event for OACs and MCI patients.

It is also likely that, as a topic of regular news coverage, the election provided opportunity for subsequent rehearsal and repeated exposure to the event details, which did not occur for the phone call. It is worth noting that patients with biomarkers of AD-P often demonstrate abnormal neural responses to stimulus repetition for laboratory stimuli (Vannini et al., 2012). This raises the possibility that, although there were neither significant differences in reported amount of rehearsal and media exposure about the election results nor an interaction between the events (phone call and election) and group in memory results, MCI patients may have relied upon the repeated media exposure about the election to a greater extent than OACs to achieve comparable memory for the public election information.

Regardless of the specific factor that led to the greater memorability of the election than the phone call, the key finding is that the memory effects did not significantly differ between MCI patients and OACs.

Limitations

The greatest limitation of this study was the small sample size. However, in instances when results did not reach the threshold for significance, the effect sizes were small, so it is not likely that moderately increasing sample size would substantially change the interpretation of the results. Additionally, a formal assessment of memory at the follow-up would have permitted comparison between changes in cognitive status and event memory over time.

A larger, more politically diverse sample would also have allowed comparisons between memory accuracy of those participants who viewed the outcome as negative versus positive. It is possible that memory was poorer for the election when viewed in a positive light than it would have been for those who viewed the election outcome in a negative light (Bohn & Berntsen, 2007). There is evidence that negative events are remembered better than positive events in young adults (Berntsen, 2002), although that effect may interact with or be overridden by older adults' preference for remembering positive information relatively better than negative information (reviewed by Mather, 2006).

There is a possibility that some information recalled could have been drawn partially from remembering regular routines rather than a specific memory. For example, if participants generally watch TV in the evenings with their spouses, then it is likely that there were similar circumstances for watching the election returns on the evening of the election. However, this would not explain the group differences in memory for public event information on election day, nor the differences between memory for the election and the phone interview.

Conclusions

The current study showed that MCI patients' and healthy older adults' memories of the 2008 presidential election were more robust to forgetting than were memories for the less arousing experience of completing the phone survey. Despite memory deficits developing as a result of AD-P, emotionally arousing positive events may persist in memory somewhat longer, and with more detail, than more routine, less-arousing experiences. However, selective impairment in recall and increasing reliance upon recognition memory, especially for information lacking self-relevance, may be one of the earliest consequences of AD-P. These results provide the first evidence that MCI patients can experience a memory enhancement for positive emotionally arousing events, complementing the literature that has demonstrated similar effects for strongly negative events.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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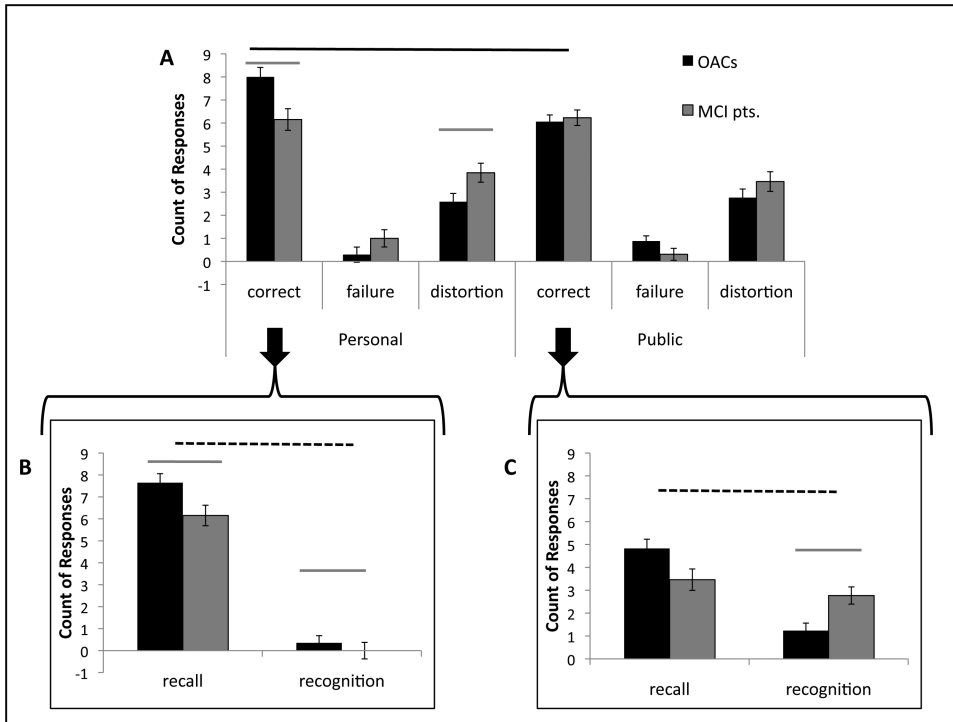


Figure 1. Accuracy of memory about the 2008 Presidential election

A. Memory accuracy of older adult controls (OACs) and patients with MCI (MCI pts.) in response to questions about personal details and publicly available information about the outcome of the 2008 Presidential election. There were also main effects of group for correct memory and distortions, $p < .05$. **B.** Breakdown of correct memory for personal information by memory type (recall and recognition). There was also a main effect of group, $p < .05$. **C.** Breakdown of correct memory for public information by memory type (recall and recognition). Horizontal solid black bars indicate significant differences between question types (i.e., between personal and public information). Solid horizontal grey bars indicate significant differences between groups. Dashed horizontal black bars indicate significant differences between memory type (recall, recognition). All bars indicate significance at $p < .05$. Responses are out of 11 possible each for personal and for public memory. Error bars represent standard error.

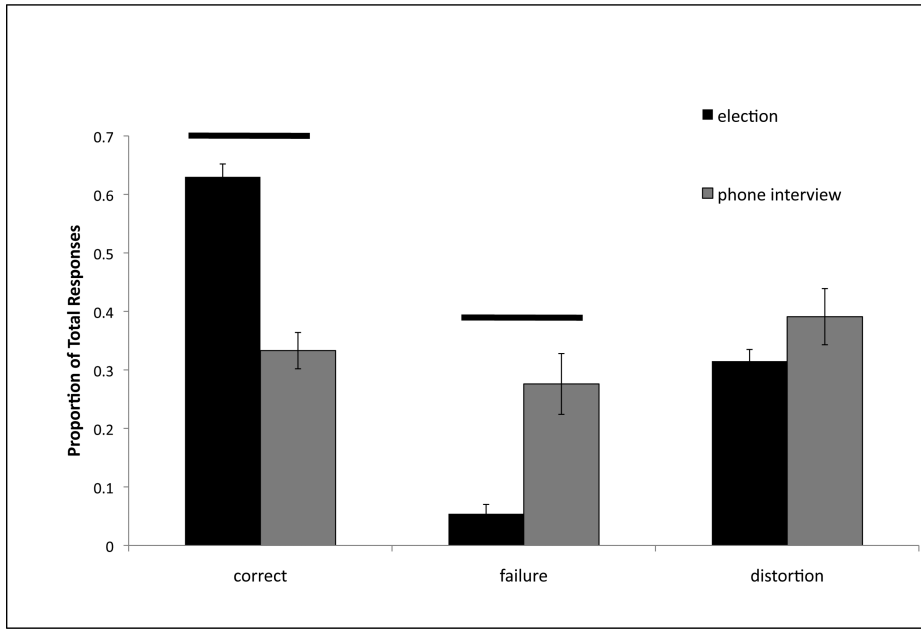


Figure 2. Proportion of Response Types by Event

Breakdown of the proportion of total responses comprised by each type of memory for the election and the phone interview. Values are reported as proportions because memory for the election was assessed with 22 questions and memory for the phone interview was assessed with 8 questions. There were no significant main effects or interactions with group (older adult controls, MCI patients), so results are collapsed across the groups. Horizontal black bars indicate significant differences between event types (i.e. between election and phone interview), $p < .001$. Error bars represent standard error.