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Young and Older Adults' Beliefs about Effective Ways to Mitigate Age-Related Memory Decline

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Abstract

This study investigated whether young and older adults vary in their beliefs about the impact of various mitigating factors on age-related memory decline. Eighty young (ages 18–23) and eighty older (ages 60–82) participants reported their beliefs about their own memory abilities and the strategies that they use in their everyday lives to attempt to control their memory. Participants also reported their beliefs about memory change with age for hypothetical target individuals who were described as using (or not using) various means to mitigate memory decline. There were no age differences in personal beliefs about control over current or future memory ability. However, the two age groups differed in the types of strategies they used in their everyday life to control their memory. Young adults were more likely to use internal memory strategies, whereas older adults were more likely to focus on cognitive exercise and maintaining physical health as ways to optimize their memory ability. There were no age differences in rated memory change across the life span in hypothetical individuals. Both young and older adults perceived strategies related to improving physical and cognitive health as effective means of mitigating memory loss with age, whereas internal memory strategies were perceived as less effective means for controlling age-related memory decline.

Keywords

memory beliefs; control; metacognition; aging; age differences

In Western societies, individuals of all ages hold negative beliefs about aging (Levy & Langer, 1994; Ryan, 1992). These negative beliefs are reported across a wide variety of cognitive variables, such as general competence (Kite & Johnson, 1988), receptive communication abilities (Hummert, Garstka, Shaner & Strahm, 1995), and memory (Ryan, 1992; Ryan & Kwong See, 1993),

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Individuals of all ages consistently report that memory tends to decline significantly with age (Ryan, 1992; Ryan & Kwong See, 1993) and that memory failures are expected of older adults (Erber & Prager, 1999). However, past research also suggests that memory beliefs are complex and vary depending on a variety of factors. Both young and older adults perceive certain types of memory abilities as declining at a more rapid rate than others. For example, people generally believe that memory for names declines more with age than memory for faces (Cohen & Faulkner, 1986; Lineweaver & Hertzog, 1998). They also believe that remembering recent events is more susceptible to age-related memory decline than remembering events from the remote past (Lineweaver & Hertzog, 1998). Research investigating the actual memory performances of older adults is often consistent with these beliefs. For instance, older adults do, at least under some experimental conditions, manifest increased retrieval difficulties for proper names (James, 2004). In general, although advancing age is associated with an overall decline in memory, the extent of this decline depends on the particular type of information being remembered (Old & Naveh-Benjamin, 2008).

Expectations about the degree and timing of memory change across the life span are also sensitive to individual characteristics of the aging adult. Recent work by Lineweaver, Berger & Hertzog (2009) suggests that people expect hypothetical individuals who fit positive versus negative stereotypes of old age (Hummert, 1990) to demonstrate different patterns of age-related memory loss. In that study, both young and older adults expected other people who fit positive stereotypes of aging to demonstrate better memory performance and to exhibit less memory decline with age than those who fit negative stereotypes. Young and older adults also discriminated between relevant and less relevant traits when forming their expectations about age-related memory change. For example, traits such as being active had a larger influence on memory expectations than traits such as being kind or supportive. Although the beliefs of young and older adults varied based on similar factors, older adults' beliefs were more sensitive to these attributes than were young adults' beliefs. That is, older adults showed greater differentiation in the memory profiles they generated for hypothetical individuals with positive versus negative characteristics or hypothetical individuals with relevant versus irrelevant traits than young adults did.

Although people generally believe that memory declines with age, they do not necessarily believe that these age-related memory changes are universal or inevitable. Whereas past research suggested that, when thinking about cognition, individuals hold implicit theories that can be categorized as either skill theories, i.e. memory is a skill that can be improved with practice, or entity theories, i.e. memory is an innate ability that inevitably declines with age (Dweck & Leggett, 1988; Elliott & Lachman, 1989), more recently, Hertzog, McGuire, Horhota & Jopp (2010) demonstrated that most individuals hold both viewpoints simultaneously. This suggests that individuals believe that, although some memory decline is inevitable, the extent of this decline can be minimized through the use of controllable strategies. In fact, although older adults are somewhat more likely to attribute their memory performance to factors beyond their control (Devolder & Pressley, 1992; Lachman, Steinberg & Trotter, 1987), both young and older adults report attempting to control declines in their personal memory abilities by employing a variety of different compensatory strategies (Dixon and de Frias, 2007; Garrett, Grady, & Hasher, 2010).

Hertzog et al. (2010) used an interview technique to examine the means of memory control that young and older adults spontaneously reported after they completed a memory task. Older adults were more likely to cite health and well-being practices as explanations for their memory abilities and were more likely to report engaging in "use it or lose it" strategies in their everyday lives. For example, older adults made statements such as, "If I just keep doing my daily crossword puzzles, I'll be able to maintain my memory longer."

Young adults were much more likely to report using strategies that were specific to the memory task, such as, “I tried to think of images associated with the words I was supposed to remember, and I remembered those images together as a coherent picture.” These examples reflect the use of strategies that individuals can control. Members of both age groups also reported that their memory was impacted by uncontrollable influences, such as heredity or task characteristics, however, controllable influences were more frequently reported overall (Hertzog et al., 2010).

Hertzog et al.’s (2010) examination of spontaneously reported control strategies also indicated that, although both young and older adults attempt to exert control over their memory, the particular ways in which they try to optimize their abilities differ. Young adults focus on strategies for managing their current memory performance in a specific context, whereas older adults attempt to influence their memory more generally and to minimize declines in their memory over time. This difference in approach may help to explain previous findings that young adults feel more in control of their current memory abilities than older adults, but that young and older adults feel equally confident in their ability to control what their memory will be like in the future (Lineweaver & Hertzog, 1998).

Although recent research has elucidated several factors that influence memory control strategies and beliefs, the current study addressed two questions that the literature has not yet examined. First, past studies have investigated the nature of the control theories that individuals hold, but research to date has not focused on the relationship between individuals’ personal sense of control over their current and future memory abilities and the specific means by which they attempt to optimize their own memory in their everyday lives. Because the previous literature suggests that young adults tend to focus on short term control whereas older adults focus on long term control over memory, we expected to see a match between the timeframe of the control and the particular types of strategies preferred by young versus older adults. More specifically, we expected young adults to utilize more task-related memory strategies, and we hypothesized that young adults’ use of these strategies would result in greater feelings of control over current memory outcomes. Conversely, we expected older adults to report greater implementation of cognitive health and physical health strategies, and we anticipated that, in this age group, individuals who utilized these strategies more frequently would report enhanced feelings of control over their future memory ability.

Second, no past studies have evaluated young and older adults’ beliefs about the differential impact of various control strategies on age-related memory change across the entire adult life span in the general population. Individuals of different ages may report using different strategies in their everyday lives because they perceive these particular strategies as differentially effective at specific developmental stages during adulthood. Therefore, we investigated the beliefs that young and older adults hold about the effectiveness of various memory control strategies for optimizing memory performance and mitigating age-related memory decline to determine whether the means of control that young versus older adults personally utilize reflect the control strategies that each age group views to be most effective overall. Given that past studies have demonstrated that individuals believe they can mitigate memory decline by engaging in various means of control (Dixon & de Frias, 2007; Garrett, Grady, & Hasher, 2010), we expected that adults of all ages would view controllable factors (e.g., practicing a skill) as exerting a stronger influence on typical age-related memory decline than uncontrollable factors (e.g., family history of disease), but that this difference would be larger for young adults than for older adults who also tend to recognize the potential influence of uncontrollable factors on memory functioning (Devolder & Pressley, 1992; Lachman, et al., 1987). We also expected that individuals would endorse the strategies that are most typically employed by members of their age group as the most effective means for mitigating memory decline across the life span. Thus, we hypothesized that young adults would view the use of internal memory strategies as having a larger influence over memory decline with age than older adults, whereas older adults would view cognitive health and physical health as having a greater effect on age-related memory change compared to young adults.

Method

Participants

A total of 160 adults participated in this study. The sample consisted of 80 young adults (ages 18 – 23, $M = 20.06$, $SD = 1.34$) recruited from undergraduate psychology classes at three different universities and 80 older adults (ages 60 – 82, $M = 71.01$, $SD = 5.49$) from Greenville, SC or Atlanta, GA recruited through flyers, newspaper advertisements and postcards. Participants in the young adult group (YA) received extra credit in their psychology course for participating in the study, and those in the older adult group (OA) received $10 in compensation for their time and travel expenses.

The two age groups were equivalent in their gender distribution, χ^2 (1, $N = 158$) < 1. As expected, the OA outperformed the YA on the Shipley-2 Vocabulary subtest, a measure of crystallized intelligence, t (126.28) = 7.11, $p < .01$, whereas the YA outperformed the OA on the Shipley-2 Abstraction subtest, a measure of fluid intelligence, t (136.36) = 8.36, $p < .01$ (Shipley, Gruber, Martin, & Klein, 2009). YA also exhibited better memory than OA on a memory test during which they had four minutes to study 40 non-categorizable words and two minutes to recall the words in writing, t (156) = 8.61, $p < .01$. See Table 1.

Materials

General Beliefs about Memory Instrument-Mitigating Factors Version—The General Beliefs about Memory Instrument (GBMI: Lineweaver & Hertzog, 1998) is a computerized questionnaire that measures beliefs about how memory changes with advancing age. An adapted version of the original GBMI (the General Beliefs about Memory Instrument-Mitigating Factors: GBMI-MF) assessed participants' views about how 15 different factors potentially affect typical memory change across the life span. Participants read a description of 15 different hypothetical adults and rated the memory of each at ages 20 to 90 by decade. Participants made their ratings on a vertical scale ranging from "Very Good" (corresponding to a score of 100) to "Very Poor" (corresponding to a score of 0) by using a mouse to move a slider along each scale. Figure 1 contains an example item from the GBMI-MF. The 15 items represented components of young or older adults' implicit theories about variables that potentially impact memory. The items were selected from a larger list generated in a previous study by Hertzog et al. (2010). The 15 items of the GBMI-MF embody: (1) controllable versus uncontrollable influences on memory, (2) positive versus negative influences on memory, and (3) memory influences focused on cognitive health, physical health, or utilizing memory strategies as delineated by the Memory Control Theory Classification Scheme Hertzog and colleagues proposed. Table 2 contains the content from the 15 GBMI-MF items and illustrates how they divide according to this classification scheme. To calculate subscale scores, the relevant items were averaged together separately for each target age. Participants responded to the 15 GBMI-MF items in a randomized order to prevent systematic order effects.

Personal Beliefs about Memory Instrument—The Personal Beliefs about Memory Instrument (PBMI: Lineweaver & Hertzog, 1998) is a computerized questionnaire that evaluates participants' beliefs about their own memory. The PBMI utilizes a vertical rating scale identical to that from the GBMI-MF. Participants responded to all 57 items of the

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original version, but only the 45 validated items from selected subscales pertained to the current study. Together, these subscales quantified participant's beliefs about their overall memory ability (Global Memory Self-Efficacy: MSE) and their ability to remember specific types of information (Specific MSE), changes in their own memory from past to present (Retrospective Change) or changes expected in the future (Prospective Change), and their capacity to control current memory outcomes (Control) or to control their memory ability in the future (Prospective Control) with their current actions. Internal consistency estimates from a past study have demonstrated the reliability of these subscales (Cronbach's α range = .90 to .97; Lineweaver & Hertzog, 1998). Each subscale was calculated by averaging responses to the relevant items, with possible subscale scores ranging from 0 to 100.

Personal Strategy Questionnaire—The Personal Strategy Questionnaire (PSQ) asked participants to indicate the frequency with which they use eight different memory control strategies in their everyday lives on a scale from 1 ("Never") to 7 ("Always"). The control strategies paralleled a subset of the items from the GBMI-MF and included factors related to Cognitive Health, Physical Health, Internal Memory Strategies, and External Memory Aids. See the Appendix for a reproduction of this questionnaire and details about how the PSQ items related to specific strategy types. Responses were averaged to create subscale scores ranging from 1 to 7. We created the items to have face validity based on past studies and to closely correspond with the GBMI-MF scales to foster comparison across the two measures. The internal reliability of the PSQ was moderate in size, Cronbach's α = .64. The reliability for the subscales varied. Internal Memory Strategies was strongest with a Cronbach's α = .77, whereas the Cognitive Health subscale had a Cronbach's α = .22. The Physical Health and External Memory strategies subscales consisted of a single item each.

Procedure

Participants completed a 50 to 60 minute test session individually or in small groups of four or fewer people. After giving informed consent, participants completed the GBMI-MF, the PBMI, and the PSQ. The Memory Recall task and Shipley tasks followed. At the conclusion of the session, each participant received oral and written debriefing about the nature and purpose of the study.

Results

We had two main goals for this study. Our first goal was to investigate the relationship between participants' personal sense of control and the specific means by which they attempt to exert control over memory in their everyday lives. Our second goal was to examine individuals' perceptions of the effectiveness of a variety of control strategies across the life span.

To address our first goal, we began by examining whether young and older adults differed in their personal control beliefs as measured by the PBMI. Based on past research, we expected young adults to report having more control over current memory outcomes compared to older adults, but we did not expect young and older adults to differ in the extent to which they believe they can control their future memory ability. Although the control subscales were of primary interest, a multivariate analysis of variance on all subscale scores from the PBMI evaluated age differences in personal memory beliefs more broadly. The multivariate analysis revealed a significant main effect of age group, F (8, 145) = 12.48, $p < .01$, $\eta_p^2 = .41$. However, no significant age group differences emerged on either the Control or the Prospective Control subscales of the PBMI. See Table 3 for the univariate descriptive and inferential statistics. This finding contradicted our expectations and indicated that young adults and older adults viewed themselves as having similar control over their current memory ability, as well as an equivalent ability to act now to control what their memory will be like in the future.

On other subscales of the PBMI (see Table 3), young adults viewed their memory more positively than older adults on the Global MSE item, but the two groups were similar in their self-rated ability to remember specific types of information on the Specific MSE subscale. Young adults' beliefs that their memory had improved across the last ten years (Retrospective Change) and would remain stable across the next ten years (Prospective Change) were significantly more positive than older adults' beliefs that their memory had remained stable across the last ten years and would decline slightly during the next ten years. Thus, both global memory self-efficacy and beliefs about change were sensitive to age differences, whereas self-perceived control was not.

Next, we examined whether age differences existed in the types of control strategies that individuals reported using in their daily lives. A multivariate analysis examined scores on the four subscales of the PSQ to examine whether older adults would report using cognitive health and physical health to optimize their memory more often than young adults and whether young adults would report using internal memory strategies more often than older adults. The multivariate analysis resulted in a significant main effect of age group, F (4, 151) = 19.61, $p < .01$, $\eta_p^2 = .34$. See Table 3 for a summary of the univariate descriptive and inferential statistics. The associated univariate analyses examining each subscale of the PSQ were consistent with the strategies spontaneously reported by participants in past research studies and supported our hypothesis that young and older adults would report using different types of strategies in their daily lives. More specifically, the findings matched our predictions that older adults endorsed significantly greater use of Cognitive Health strategies (i.e., playing games or completing crossword puzzles and maintaining a positive attitude) and Physical Health strategies (i.e., maintaining a healthy diet) than young adults. Furthermore, young adults reported using Internal Memory Strategies (i.e., drawing connections and making mental associations, using mental repetition, and concentrating) significantly more often than older adults. Young and older adults did not differ in their self-reported use of External Memory Strategies (i.e., asking people for help or using notes to aid memory).

Having established age differences in the control strategies used by adults in their daily lives, we next utilized two regression analyses to examine the relationship between personal strategy use as reported on the PSQ and personal memory control beliefs from the PBMI and to determine whether age moderated the relationship between these factors. We hypothesized that young adults would show greater feelings of control over current memory outcomes if they used task-related memory strategies, whereas older adults would report that cognitive and physical health strategies related to increased ability to control their memory in the future.

The outcome variable in the first analysis was participants' beliefs in personal control over their current memory abilities, and we examined the following factors as potential predictors of these beliefs: (1) age, (2) self-reported use of cognitive health, physical health, external memory strategies, and internal memory strategies, and (3) the interaction between age (effect coded) and self-reported use (raw scores) of each of the four types of approaches to memory control. Because of the exploratory nature of this analysis, all of the dependent factors were entered into the regression equation simultaneously to determine whether the particular strategies participants reported using in their everyday lives significantly predicted their beliefs about the extent to which they control their current memory abilities. The resulting regression model accounted for approximately 9% of the variance in personal control beliefs, F (9, 138) = 1.47, $p = .17$. Although the overall model was not statistically significant, self-reported use of internal memory strategies did emerge as a significant unique predictor of personal control beliefs, t (146) = 2.01, $p < .05$. Contrary to our expectations, this relationship was not dependent on age, as the age by internal strategy interaction did not reach significance, t (146) = .96, $p = .34$. Thus, both young and older adults who engage in task-related strategies also believe they have more control over their memory outcomes on an everyday basis than those adults who use task-related strategies less frequently. Age, physical health strategies, cognitive health strategies, external strategies, and the corresponding interaction effects did not significantly predict beliefs in personal control over current memory.

The second regression analysis predicted participants' beliefs in personal control over their future memory abilities based on the same factors. The resulting regression model accounted for approximately 8% of the variance in participants' beliefs in control over future memory functioning, but was not statistically significant, F (9, 138) = 1.40, $p = .20$. The only significant unique predictor in this analysis was the interaction between age and self-reported use of physical health strategies, t (146) = 2.08, $p < .05$. To further explore this interaction, we reran the regression analysis separately for young and older adults with the four types of self-reported memory strategies as predictors. As expected, for young adults, none of the self-reported memory strategies significantly predicted beliefs in control over future memory functioning, but for older adults, self-reported physical health strategies predicted their beliefs in the controllability of their future memory functioning, t (72) = 2.27, $p < .05$. Thus, consistent with our hypothesis, age moderated the relationship between self-reported memory strategies and beliefs about control over future memory abilities, although we did not find the relationship between cognitive health strategies and future control that we anticipated in our older adult participants.

The second major goal of this study was to investigate whether young and older adults hold different beliefs about the effectiveness of particular memory control strategies across the life span. We addressed this question in two ways, first by looking at the effect of the controllability of various mitigating factors on expected memory outcomes, and second by examining the perceived effectiveness of different strategy types for maintaining memory with advancing age.

A 2 (age group: YA versus OA) × [2 (controllability: controllable versus uncontrollable)] × [2 (valence: positive versus negative)] × [8 (target age: 20 to 90 by decade)] mixed model analysis of variance examined whether young and older adults view controllable factors as having a stronger impact on age-related memory decline than uncontrollable factors and whether this difference is more pronounced for young than for older adult participants. We expected that all participants would view controllable factors as exerting a stronger influence on typical age-related memory decline than uncontrollable factors, and this difference would be larger for young adults than older adults. We also hypothesized that both young and older participants would perceive positive factors as more influential than negative factors at mitigating memory decline. Although many effects reached statistical significance (see Table 4 for a complete summary of the results of this analysis), for brevity, only the highest order interaction for each set of variables in the analysis, which subsume all of the lower order effects, are included here.

Two three-way interactions reached significance in the mixed model analysis of variance, but the four-way interaction did not, F (7, 152) < 1. First, a significant age group × valence × target age interaction, F (7, 152) = 2.77, $p = .01$, $\eta_p^2 = .11$, indicated that the two age groups differed in their beliefs about how the positive and negative factors described on the GBMI-MF differentially mitigate memory change with age in typical adults. To further explore this interaction, we evaluated the valence × target age simple interaction effect separately for YA and OA participants. To prevent inflation of the type 1 error rate in these analyses, we applied a Bonferroni correction (adjusted $p = .05 / 2 = .025$). In addition, consistent with Lineweaver & Hertzog (1998), we focused our follow-up analyses on only the linear, quadratic, and cubic trends in target age to limit the degrees of freedom we were exploring and to reduce the likelihood that we would over interpret chance findings. As shown in Figure 2, both young and older participants expected less extensive memory decline and a later onset of memory decline in hypothetical target adults with positive factors than in hypothetical target adults with negative factors. However, older participants expected positive factors to mitigate memory decline to a greater degree (OA valence by target age: $\eta_p^2 = .82$) than young participants did (YA valence by target age: $\eta_p^2 = .72$). More specifically, YA viewed age-related memory change as following a steeper trajectory and a more linear pattern of decline in target adults with negative factors compared to targets with positive mitigating factors (YA valence by linear target age interaction: $p < .01$, $\eta_p^2 = .68$), and this belief was even more pronounced for OA (OA valence by linear target age interaction: $p < .01$, $\eta_p^2 = .78$). In addition, OA perceived positive versus negative factors as differentially affecting the age at which memory decline begins, with target adults who used positive mitigating factors maintaining fairly stable memory abilities into their fifth decade and target adults with negative factors declining fairly steadily from age 20 to 90 (OA valence by cubic target age interaction: $p = .013$, $\eta_p^2 = .08$).

The controllability × valence × target age interaction also reached significance, $F(7, 152) = 3.0$, $p <.01$, $\eta_p^2 = .12$. To further explore this three-way interaction, we calculated the simple interaction effects between controllability and target age separately for positive versus negative factors as well as the valence by target age interaction separately for controllable versus uncontrollable factors. We again applied a Bonferroni correction to control the type 1 error rate in the four follow-up analyses we conducted (adjusted $p = .05 / 4 = .0125$). The magnitude of the valence effect on expected age-related memory change was similar for controllable (valence × target age interaction: $\eta_p^2 = .67$) and uncontrollable (valence × target age interaction: $\eta_p^2 = .64$) factors. As shown in Figure 3, participants viewed the memory of typical adults with positive uncontrollable factors as being better overall than that of typical adults with positive controllable factors, controllability main effect: $F(1, 159) = 15.37$, $p < .01$, $\eta_p^2 = .09$; however, for positive factors, controllability did not influence the pattern of expected memory change across the life span, controllability × target age interaction: $F(7, 153) < 1$. In contrast, for negative factors, controllability affected both expected differences in memory overall, controllability main effect: $F(1, 159) = 13.04$, $p < .01$, $\eta_p^2 = .08$, and the pattern of expected memory change across the life span, controllability by target age interaction: $F(7, 153) = 4.67$, $p < .01$, $\eta_p^2 = .18$. Participants believed that typical older adults who engaged in controllable negative factors would show worse memory overall and a more linear trajectory of memory decline. Conversely, a more curvilinear pattern of memory decline with a later onset was expected of typical older adults with uncontrollable negative factors (negative factors controllability × quadratic target age interaction: $\eta_p^2 = .15$).

To examine whether young and older adults view certain types of control strategies as having a stronger impact on age-related memory decline in typical adults than other types of control strategies and whether age differences emerged in these beliefs, we ran a 2 (age group: young adult versus older adult) × [3 (type of mitigating factor: cognitive health, physical health, memory strategy)] × [2 (valence: positive versus negative)] × [8 (target age: 20 to 90 by decade)] mixed model analysis of variance. We expected that young adults would view the use of memory strategies as most effective for mitigating memory change, whereas older adults would view cognitive health and physical health as having a greater effect on age-related memory change across the life span. See Table 5 for a full summary of the results of this analysis. The four-way interaction failed to reach statistical significance, *F*

(14, 145) = 1.39, p = .16, η_p^2 = .12, but two three-way interactions emerged. As in the previous controllability analysis and as described in detail above, the age group × valence × target age interaction was significant.

In addition, the strategy × valence × target age interaction reached significance, F (14, 145) = 12.05, p < .01, η_p^2 = .54, indicating that participants viewed different types of mitigating factors as having a differential impact on age-related memory change in typical adults. However, contrary to our expectations, young and older adults did not differ in their perceptions of the effectiveness of the various strategies. Three follow-up analyses examined the valence × target age simple interaction effect separately for each type of memory strategy (Bonferroni adjusted p = .05 / 3 = .0167). All three types of factors had a significant impact on memory overall, with typical adults with positive memory strategies, cognitive health and physical health receiving consistently higher memory ratings than those with negative memory strategies, cognitive health, and physical health. The valence main effect was stronger for cognitive health (η_p^2 = .71) and physical health (η_p^2 = .71) than for memory strategies (η_p^2 = .60), suggesting that participants viewed cognitive health and physical health as being equally effective in influencing overall memory ability whereas memory strategies were viewed as having less impact on overall memory ability. The difference in the shapes of the memory change trajectories was also less dramatic for memory strategies (Memory Strategy valence × target age: η_p^2 = .20) compared to cognitive health (Cognitive Health valence × target age: η_p^2 = .76) or physical health (Physical Health valence × target age: η_p^2 = .68), with cognitive health appearing to have the greatest mitigating effect on the pattern of age-related memory change. As shown in Figure 4, although the two trends were fairly parallel, the memory trajectory of typical adults using positive memory strategies declined slightly less steeply than that of typical adults using negative memory strategies (Memory Strategies valence by linear target age interaction: η_p^2 = .17). Participants' ratings indicated that they expected the memory of adults in good physical health to begin declining later in the life span (Physical Health valence by quadratic target age interaction: η_p^2 = .03) and to decline less steeply (Physical Health valence by linear target age interaction: η_p^2 = .62) than the memory of typical adults in poor physical health. These effects were even stronger when comparing the expected trajectories of age-related memory change in typical adults with good versus poor cognitive health. Participants expected the memory ability of typical adults in poor cognitive health to decline much more steeply (Cognitive Health valence by linear target age interaction: η_p^2 = .74) than those in good cognitive health. Participants also believed that target adults with good cognitive health habits would maintain their memory abilities longer before exhibiting age-related memory decline (Cognitive Health valence by cubic target age interaction: η_p^2 = .07) and would exhibit a more curvilinear pattern of decline across the life span (Cognitive Health valence by quadratic target age interaction η_p^2 = .09) compared to target adults in poor cognitive health.

Discussion

We had two main objectives for this study. First, we assessed individuals' perceptions of personal control over both current memory outcomes and future memory ability and the means by which they attempt to exert this control. Our data supported the hypothesis that individuals of all ages believe that they can control their current and future memory ability but that young and older adults use different means of control to achieve this goal. Older adults reported implementing "use it or lose it" strategies aimed at improving cognitive and physical health, whereas young adults reported using more internal and task-related memory strategies. Both young adults' and older adults' utilization of task-related strategies predicted their feelings of control over their current memory, but only older adults demonstrated a relationship between their attempts to maintain their cognitive and physical health and the amount of control they perceived themselves as having over their future memory ability.

Our second goal was to investigate individuals' beliefs about factors that potentially mitigate age-related memory decline across the life span and to determine whether young and older adults differ in their expectations about the effectiveness of these memory control strategies. Adults of all ages viewed cognitive health as the most effective means of mitigating memory decline with age. Contrary to expectations, young adults and older adults did not differ in their perceptions of the effectiveness of particular types of memory control approaches or in their beliefs about the expected impact of controllable versus uncontrollable factors on age-related memory change. Age differences emerged for positive strategies compared to negative strategies; older adults viewed positive factors as more effective at mitigating decline in middle-age and as more effectually slowing the rate of decline later in life than young adults did.

Perceptions of Current and Prospective Control over Memory

In the present study, young and older adults did not differ in their beliefs about how much control they have over their current memory or their ability to control how good their memory will be in the future. Young and older adults' beliefs that they can engage in behaviors now to exercise some control over their future memory ability is consistent with findings in the literature that adults can mitigate future memory decline with approaches they adopt when young (Hertzog, Kramer, Wilson, & Lindenberger, 2009; Stine-Morrow, 2007; but see Salthouse, 2006). However, the lack of age differences in beliefs about control over current memory outcomes contrasts with a previous study (Lineweaver & Hertzog, 1998). This inconsistency may reflect differences in study methodology. In Lineweaver & Hertzog, participants completed the PBMI without any prior mention of control strategies; in the current study, the PBMI followed the GBMI-MF. Drawing older adults' attention to typical mitigating factors before asking them about their own memory control may have positively influenced their personal perceptions. Furthermore, the earlier study was conducted prior to widespread popularity of the "use it or lose it" theory. Our current findings may reflect a shift in cultural beliefs about methods to control current, as well as future, memory and an associated increase in older adults' attempts and feelings of success in their exercise of control over memory both in the immediate context and for the future (Hertzog et al., 2010).

The lack of age differences in self-reported control does not reflect a general absence of age differences in self-reported memory. On the PBMI global memory rating, young adults described themselves as having better memory overall than older adults did. On measures of retrospective and prospective change, young adults reported improvements in their memory in the past and expected their memory to remain stable across the next 10 years. This contrasted with the beliefs espoused by older adults who perceived their memory as having been stable across the past 10 years, but who also indicated that they expected to experience subtle decline in their memory in the future. These age differences in self-reported memory ability and expected memory change make the lack of age effects in self-perceived control even more notable. Older adults' positive views about their ability to control both their current and future memory suggests that they believe in and may be willing to engage in active strategies that they perceive as having both short term and long term benefits. This, in turn, may result in better memory abilities and less memory decline in later life for these older adults, further validating their memory control beliefs (Lachman, et al., 1987).

Strategies for Mitigating Memory Decline: Everyday Use and Relation to Personal Control

Consistent with our expectations, older adults reported using “use it or lose it” strategies aimed at maintaining cognitive and physical health to optimize their memory, whereas young adults reported using internal memory strategies as a memory aid more often than older adults. These results replicate the findings of Hertzog et al. (2010) using very different methodology. Whereas, in the Hertzog et al. study, young and older adults provided spontaneous explanations for their performance on a specific memory task, in our current study, participants indicated how frequently they use several different approaches to improve their everyday memory on a Likert scale self-report questionnaire. The similarity of findings across these two studies indicates that task-specific attributions may reflect general memory strategies utilized by individuals in everyday memory situations. In addition, it suggests that the age group differences documented by Hertzog et al. do not simply reflect a differential accessibility of specific factors that young versus older adults spontaneously retrieve when explaining their memory task performance. Most importantly, the consistency in findings between this study and Hertzog et al.’s suggests that the differences in the type of control strategies utilized by young and older adults are robust and paves the way for future studies to determine additional factors other than age that might influence the task-specific or the more general control beliefs held by aging adults.

The finding that age differences followed the expected pattern on the PSQ also lends some credence to the validity of the questionnaire. The PSQ was designed to be a brief measure of personal strategy use that mirrored several of the controllable mitigating factors represented on the GBMI-MF. Although its overall internal reliability was acceptable, some of the subscales consisted of very few items and had low reliability. For example, the physical health subscale was comprised of only one item and therefore could not capture the full range of potential health related strategies that individuals may use. Expanding the scope and type of approaches represented on this questionnaire is recommended in future studies that wish to utilize a similar self-report measure of everyday strategy use.

One of the primary goals of our study was to examine the link between the specific memory strategies that individuals report using in their everyday lives and the amount of control they believe they have over their memory. Despite the limitations inherent in our personal strategy use questionnaire, our results largely supported our hypotheses. Consistent with our expectations, young adults who reported using task-related memory strategies also believed that they have the ability to control their current memory outcomes. Unexpectedly, however, this relationship did not depend on age, suggesting that older adults who utilize task-related strategies also experience increased feelings of control over their current memory ability. When we examined control over future memory ability, as expected, older adults, but not young adults, showed a link between maintaining their physical health and the amount of control they felt they have over their future memory ability.

Contrary to our expectations, we did not find a relationship between older adults’ attempts to maintain their cognitive health and their beliefs about how much control they have over what their memory will be like in the future. We had expected that engaging in “use it or lose it” strategies would be viewed as a means of current and future control for older adults. Although some past studies have documented correlations between personal control beliefs and strategy use (Hertzog, Dunlosky, & Robinson, 2009; Lachman & Andreoletti, 2006), others have not (Hertzog et al., 2010), and the majority of these studies focused on specific memory strategies within the context of a particular memory task rather than probing general everyday memory control strategies. Perhaps the lack of relationships between cognitive health and control beliefs in older adults is explained by differences in what older adults believe they are capable of doing and what they actually choose to do in their everyday lives. Most older adults might recognize that they have the ability to control their current and future memory, but some may choose not to exercise that control for various reasons, resulting in small relationships between frequency of self-reported use of cognitive health strategies and beliefs in personal control over memory.

Strategies for Mitigating Memory Decline: Perceptions of Effectiveness

Our second primary goal was to investigate individuals' perceptions of various means of mitigating typical age-associated memory decline and whether young and older adults hold different expectations about how effective various factors are at controlling memory change across the life span. In particular, we wondered whether older adults would perceive "use it or lose it" strategies to be more effective over time compared to young adults and whether young adults would instead view internal memory strategies as more influential. We found differences in the rates of age-related memory decline associated with the various types of mitigating factors. This is consistent with previous work suggesting that young and older adults do not believe that age-related memory decline occurs equally in all contexts (Lineweaver & Hertzog, 1998; Lineweaver et al., 2009). However, we did not find age group differences in beliefs about the anticipated efficacy of the three types of mitigating factors (i.e., cognitive health, physical health, task-related memory strategies) that were included in the GBMI-MF measure. Instead, both young adults and older adults viewed cognitive health and physical health factors as more influential at mitigating memory decline across the life span compared to memory strategies. Previous work suggested young and older adults perceive the efficacy of the various strategies to vary (Hertzog et al., 2010). The primary difference between the present study and our earlier work is that in the prior study participants spontaneously reflected on memory strategies whereas in the current study the memory strategies were provided for evaluation. It may be the case that spontaneous reports reflect age differences in the chronic accessibility of memory beliefs (see Cavanaugh, Feldman, & Hertzog, 1998). Typically, young adult samples consist of current students who engage in internal memory strategies regularly in their daily lives (Zivian & Darjes, 1983). Thus, for young adults, the importance of memory strategies should be highly salient and should be viewed as effective means to enhance memory. Conversely, although young adults apparently endorse the efficacy of long-term compensatory effects of cognitive activity, they may not actively engage in such behaviors for the purpose of mitigating long-term change. In such cases, young adults would not spontaneously mention 'use it or lose it' activities as a means of achieving control over memory. Because older adults may be more keenly aware of the role of lifestyle factors in their daily lives, use it or lose it factors may be more easily accessible for them. When individuals are asked to spontaneously report which strategies are most effective they may list the most easily accessible memory strategies that come to mind. However, when asked to evaluate the effectiveness of a variety of memory strategies, age differences appear to be minimized.

The only age group differences that emerged in the general beliefs individuals hold about factors that mitigate typical age-related memory change were in the comparison between positive and negative factors. All participants believed that positive factors are more beneficial than negative factors; however, older adults perceived a greater difference in the efficacy of positive versus negative factors and believed that positive factors not only translate into better memory early in life, but also result in a later onset and less overall decline. These findings are consistent with the results of Lineweaver and colleagues (2009) who found that older adults expected a later onset and slower rate of decline for typical adults described using positive stereotypes compared to those described as fitting more negative stereotypes of aging.

The GBMI-MF measure was not without limitations. This measure did not have equal numbers of controllable/uncontrollable or positive/negative strategies. Therefore, some of the cells in our within-subject design were incomplete while others were represented by single items. Despite these limitations, the results were consistent with previous literature and suggest that young and older adults believe that individuals can mitigate memory decline across the life span through the use of controllable positive cognitive health and physical health strategies.

Conclusions

In summary, our results suggest that both young and older adults hold the belief that memory will inevitably decline with age, but that there are strategies that can be employed to minimize the extent of those declines. Although young and older adults differ in the strategies that they typically employ to achieve control in their everyday lives (young adults prefer to use internal task-related strategies and older adults prefer to engage in strategies focused on optimizing their cognitive and physical health), both young and older adults believe that they have control over their current and future memory and that a number of strategies are effective for mitigating age-related memory decline across the life span in typical aging adults. Consistent with much of the current literature suggesting that memory functioning can be influenced by personal lifestyle choices (Hertzog, Kramer et al., 2009), both young and older adults recognize that optimizing cognitive and physical health is an effective means to control memory change with age. These beliefs bode well for the cognitive aging of current and future older adults as they utilize these approaches in their everyday lives and thereby optimize their everyday memory abilities and maintain them better with age.

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Appendix

The Personal Strategy Use Questionnaire

How often do you use the following strategies to enhance your memory function?

	Always			Sometimes			never
a. play games that challenge your mental capability (i.e. crossword puzzles) [CH]	1	2	3	4	5	6	7

	Always			**Sometimes**			**never**
b. use internal dialogue to positively comment on your memory (i.e. I have good memory) [CH]	1	2	3	4	5	6	7
c. make mental connections or associate new information with former knowledge [IMS]	1	2	3	4	5	6	7
d. repeat items mentally that you want to remember [IMS]	1	2	3	4	5	6	7
e. concentrate on an item you want to remember [IMS]	1	2	3	4	5	6	7
f. request external sources such a people or notes to remind you of responsibilities [EMS]	1	2	3	4	5	6	7
g. obtain a healthy diet that enhances brain functioning (i.e. includes omega 3's) [PH]	1	2	3	4	5	6	7
h. keep a positive attitude about learning new ideas [CH]	1	2	3	4	5	6	7

Note: CH = cognitive health strategy, IMS = internal memory strategy, EMS = external memory strategy, PH = physical health strategy

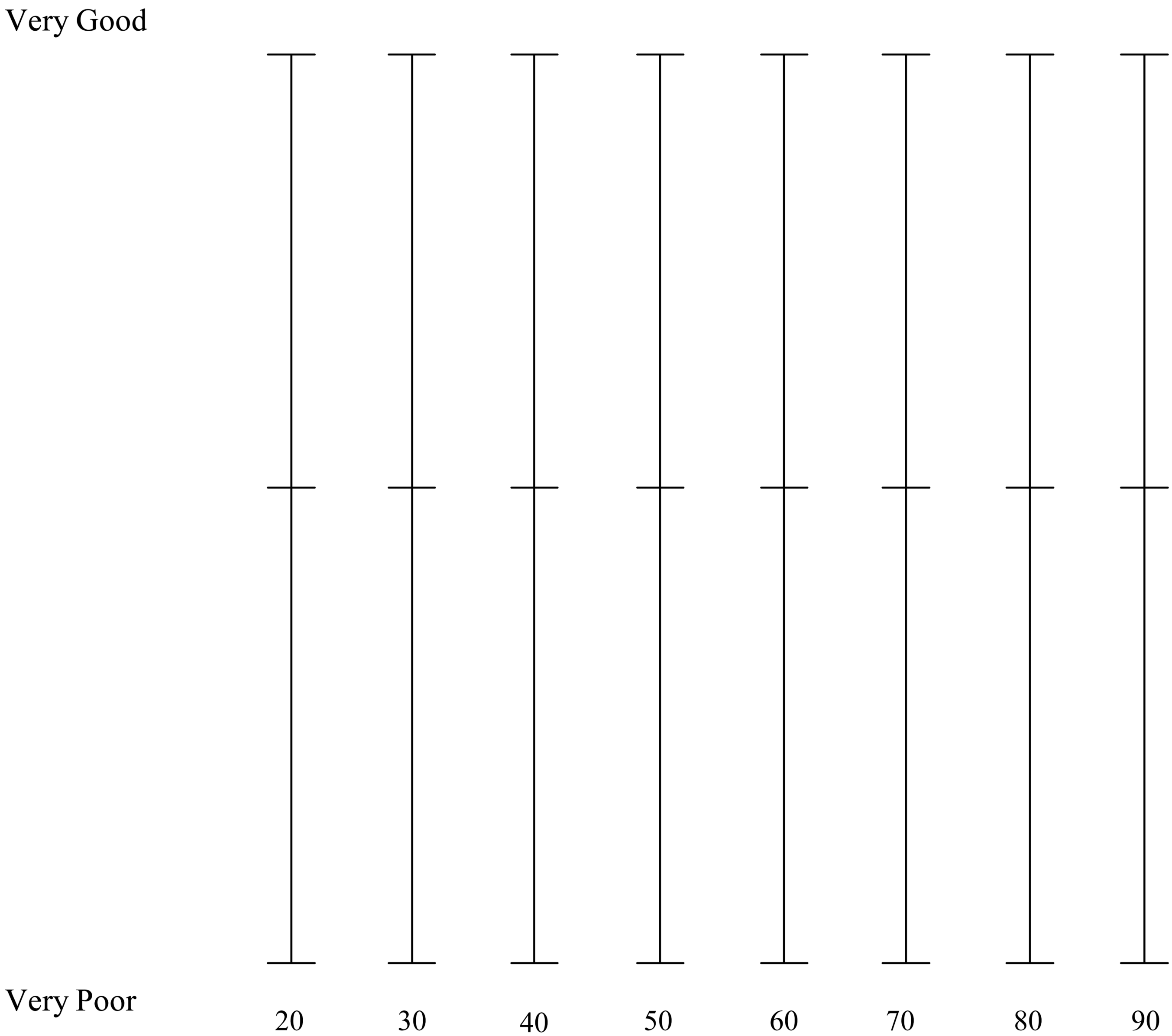

Figure 1. An Example Item from the GBMI-MF

Imagine an adult who completes crossword puzzles daily.

Now show how good you think the memory of this type of individual is at age 20, 30, 40, 50, 60, 70, 80, and 90. Mark your answers by clicking at the corresponding point on each of the rating lines below.

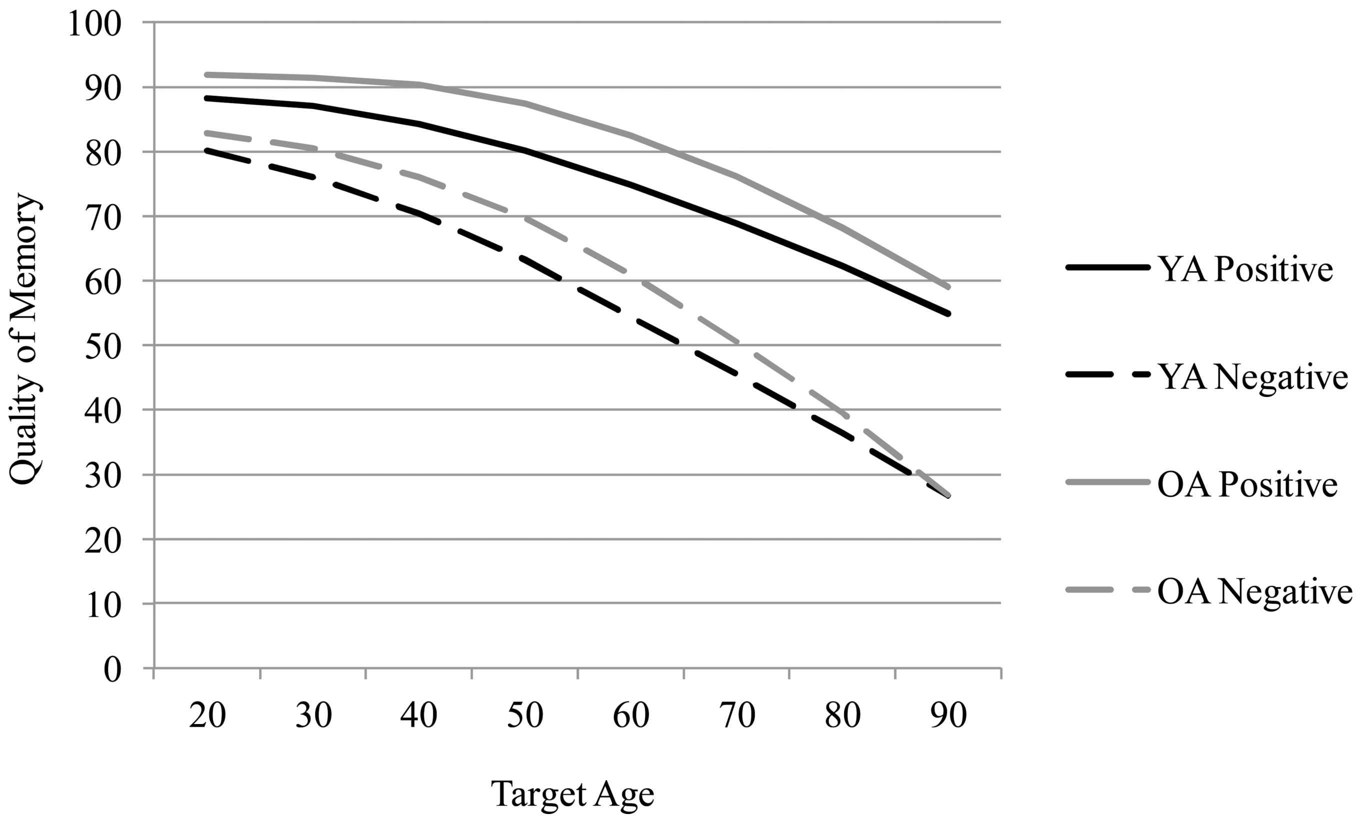

Figure 2.

Both young and older participants expected less extensive memory decline and a later onset of memory decline in hypothetical adults with positive mitigating factors than in hypothetical adults with negative mitigating factors. However, older participants expected positive factors to more effectively mitigate memory decline than young participants did as evidenced by the greater difference in the shape of the positive (solid lines) versus negative (hashed lines) memory trajectories generated by older participants (gray lines) than by young participants (black lines).

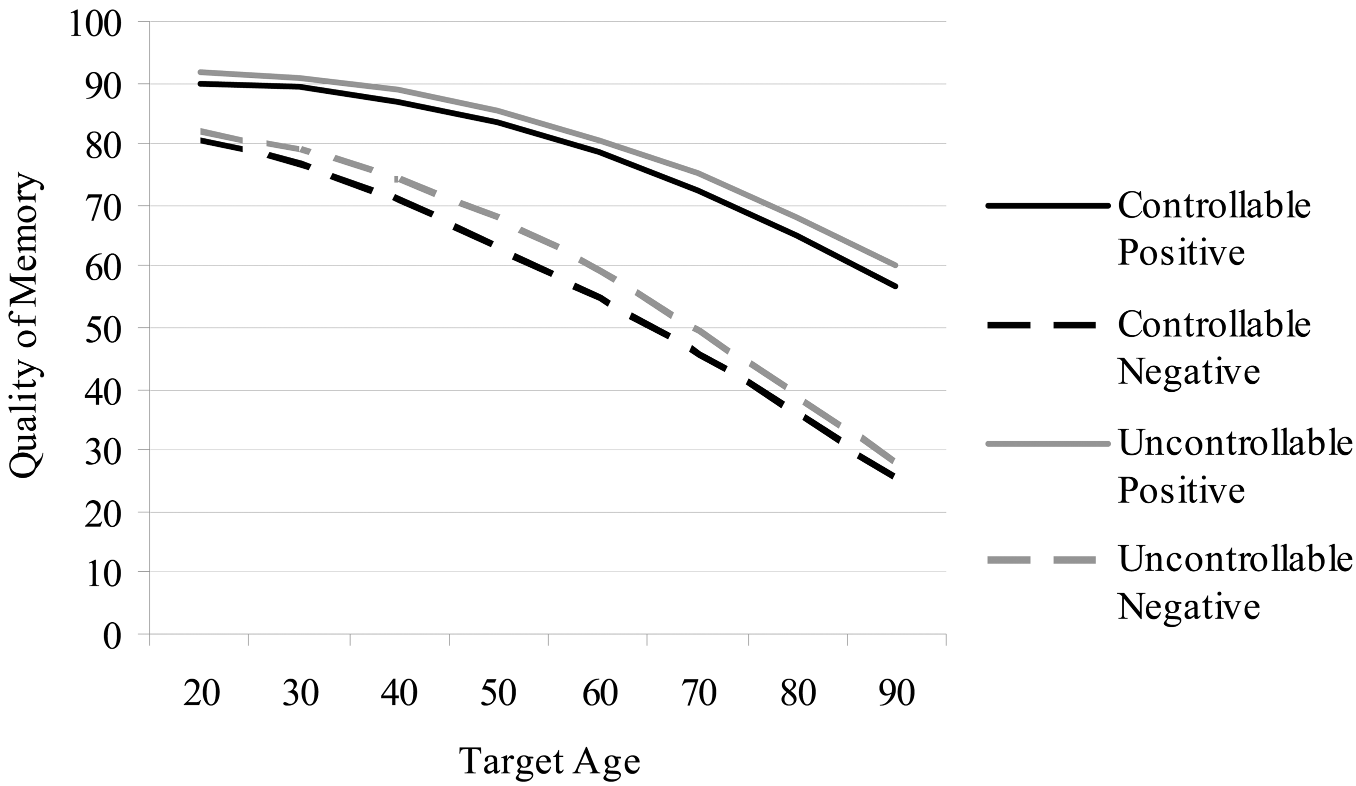

Figure 3.

Participants expected hypothetical adults with uncontrollable positive factors to have better memory overall than hypothetical adults with controllable positive factors, but only negative factors affected the anticipated pattern of memory decline expected across the life span. Controllable negative factors (black hashed line) were associated with a more linear pattern of memory decline beginning earlier in the life span, whereas uncontrollable negative factors resulted in expectations of a later onset and more curvilinear pattern of memory decline with advancing age (gray hashed line).

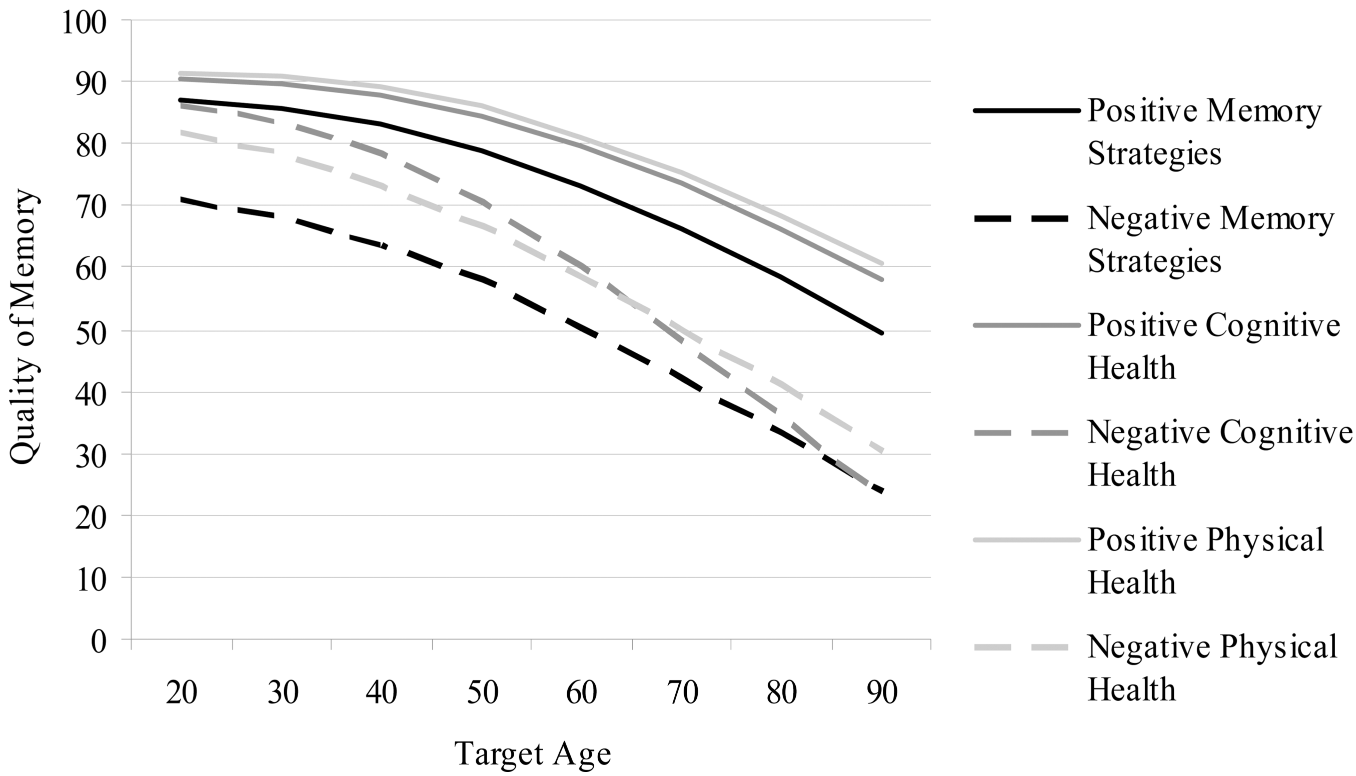

Figure 4.
As is apparent from the differences in the shapes of the memory trajectories associated with positive (solid lines) versus negative (hashed lines) mitigating factors, participants believed that all three types of mitigating factors affect age-related memory decline. Participants expected cognitive health (dark gray lines) to have the largest impact on both the degree and the timing of the onset of age-related memory change followed by physical health factors (light gray lines). Memory strategies (black lines) also influenced expected memory abilities across the life span, although the effect of these strategies on the pattern of memory decline with age was more subtle than it was for the other two types of mitigating factors.

Table 1

Demographic Characteristics of the Young and Older Adult Participants

	Young Adults (*n* = 80)	**Older Adults (*n* = 80)**
Age**	20.06 (1.34)	71.01 (5.49)
Gender (% female)	69%	64%
Vocabulary**	30.30 (5.14)	35.03 (2.93)
Abstraction**	17.31 (2.56)	13.06 (3.71)
Memory Test**	22.61 (5.35)	15.77 (4.60)

** $p < .01$, All values reported are Mean (SD) unless otherwise noted.

Table 2

Classification of the GBMI-MF Items: Controllable/Uncontrollable, Positive/Negative, and Three Types (Cognitive Health (CH), Physical Health (PH), and Memory Strategies (MS))

Controllable
Positive
Is active in the community, volunteering as a mentor at a local group home (CH)
Completes crossword puzzles daily (CH)
Writes notes, records appointments on a calendar or uses an alarm as a reminder (MS)
Practices a skill everyday in an effort to remember it (CH)
Maintains an active lifestyle, taking good care of both body and mind (PH)
Enjoys socializing with others and maintains many friendships (CH)
Uses mental rehearsal, associations, visual imagery or other memory techniques (MS)
Eats healthy food like leafy green vegetables and adheres to a low sodium diet (PH)
Negative
Has a negative outlook towards growing older and is not very motivated to learn new ideas (CH)
Is not physically active, but rather spends most of the day sitting and watching television (PH)
Uncontrollable
Positive
Has a family history of individuals living long, healthy lives (PH)
Negative
Has declining physical health (PH)
Has a family history of Alzheimer's disease (CH)
Has difficulty concentrating when trying to learn new information (MS)
Experiences difficulties reading small print and hearing in noisy environments (PH)

Table 3

Young and Older Adults' Beliefs About Their Own Memory and Self-Reported Use of Various Types of Memory Strategies

	Young Adults ***M (SD)***	**Older Adults** ***M (SD)***	***F***	***p***	η_p^2
Personal Beliefs About Memory (PBMI) Subscales					
Global MSE	84.87 (13.15)	78.07 (16.59)	7.96	<.01	.05
Specific MSE	79.93 (10.80)	80.51 (12.08)	< 1	.76	<.01
Retrospective Change	73.30 (17.35)	50.95 (14.21)	76.52	<.01	.34
Prospective Change	54.49 (12.85)	42.18 (13.16)	34.50	<.01	.19
Control	87.81 (10.54)	86.94 (12.05)	< 1	.64	< .01
Prospective Control	76.56 (15.39)	79.84 (16.34)	1.65	.20	.01
Personal Strategy Questionnaire (PSQ) Subscales					
Cognitive Health	4.48 (.93)	5.01 (1.04)	11.34	<.01	.07
Physical Health	4.09 (1.56)	5.64 (1.45)	40.94	<.01	.21
Internal Memory Strategies	5.84 (1.02)	5.44 (.92)	6.76	<.05	.04
External Memory Aids	5.12 (1.60)	5.48 (1.48)	2.09	=.15	.01

Note: Data were missing for three young adults (n = 77) and three older adults (n = 77) on the PBMI and for four older adults (n = 76) on the PSQ. F represents the univariate effect of age group on each subscale of the PBMI (df = 1, 152) and the PSQ (df = 1, 154).

Table 4

Results of the Mixed Model Analysis of Variance Examining the Effect of Controllability and Valence of Mitigating Factors on Young and Older Adults' Expectations of Typical Age-Related Memory Change

Effect	F	df	dferror	p	ηp2
Control	25.08	1	158	<.01	.14
Valence	485.20	1	158	<.01	.75
Target Age	138.60	7	152	<.01	.87
Age Group	9.56	1	158	<.01	.06
Control × Age Group	2.81	1	158	=.10	.02
Valence × Age Group	1.43	1	158	=.23	.01
Target Age × Age Group	4.03	7	152	<.01	.16
Control × Valence	< 1.0	1	158	=.41	.00
Control × Target Age	3.35	7	152	<.01	.13
Valence × Target Age	57.88	7	152	<.01	.73
Control × Valence × Age Group	1.98	1	158	=.16	.01
Control × Target Age × Age Group	1.43	7	152	=.20	.06
Valence × Target Age × Age Group	2.77	7	152	<.05	.11
Control × Valence × Target Age	3.00	7	152	<.01	.12
Control × Valence × Target Age × Age Group	<1.0	7	152	=.46	.04

Table 5

Results of the Mixed Model Analysis of Variance Examining the Effect of Three Different Types and the Valence of Mitigating Factors on Young and Older Adults' Expectations of Typical Age-Related Memory Change

Effect	F	df	dferror	p	ηp2
Strategy	63.09	2	157	<.01	.45
Valence	503.00	1	158	<.01	.76
Target Age	151.90	7	152	<.01	.88
Age Group	12.02	1	158	<.01	.07
Strategy × Age Group	1.69	2	157	=.19	.02
Valence × Age Group	< 1.0	1	158	=.43	.00
Target Age × Age Group	3.61	7	152	<.01	.14
Strategy × Valence	4.17	2	157	<.05	.05
Strategy × Target Age	9.34	14	145	<.01	.47
Valence × Target Age	58.34	7	152	<.01	.73
Strategy × Valence × Age Group	< 1.0	2	157	=.67	.01
Strategy × Target Age × Age Group	1.30	14	145	=.21	.11
Valence × Target Age × Age Group	2.16	7	152	<.05	.09
Strategy × Valence × Target Age	12.05	14	145	<.01	.54
Strategy × Valence × Target Age × Age Group	1.39	14	145	=.16	.12