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Aging 5 Years in 5 Minutes: The Effect of Taking a Memory Test on Older Adults' Subjective Age

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Abstract

How old one feels—one's subjective age—has been shown to predict important psychological and health outcomes. The current studies examined the effect of taking a standard memory test on older adults' subjective age. Study 1 showed that older adults felt older after taking a standard neuropsychological screening test and participating in a free-recall experiment than they felt at baseline. Study 2 showed that the effect was selective to older adults: Younger adults' subjective age was not affected by participating in the memory experiment. Study 3 showed that the subjective-aging effect was specific to memory, as taking a vocabulary test for a similar amount of time did not affect older adults' subjective age. Finally, Study 4 showed that simply expecting to take a memory test subjectively aged older adults. The results indicate that being in a memory-testing context affects older adults' self-perception by making them feel older.

Keywords

aging, memory, subjective age, context, stereotypes

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How old one feels, or one's subjective age, has been shown to be an important and reliable construct in research on life-span development (see Barak & Stern, 1986; Baum & Boxley, 1983; Kastenbaum, Derbin, Sabatini, & Artt, 1972; Montepare, 2009). Having a younger subjective age is associated with greater psychological well-being, various positive health characteristics and outcomes (Barrett, 2003; Boehmer, 2007; Linn & Hunter, 1979; Markides & Boldt, 1983; Stephan, Caudroit, & Chalabaev, 2011; Stephan, Chalabaev, Kotter-Grühn, & Jaconelli, 2013; Westerhof & Barrett, 2005), and a lower mortality rate (Kotter-Grühn, Kleinspehn-Ammerlahn, Gerstorf, & Smith, 2009). Indeed, several studies have shown that subjective age can be a better predictor of health and well-being than is chronological age.

Although the vast majority of research on subjective age has been correlational, recent experimental work with middle-age and older adults has shown that subjective age can be affected by recent laboratory testing experiences. One study showed that older adults who were led to believe that they had performed better than their peers on a strength-based test (the positive-feedback group) reported feeling younger after the test, relative to baseline and relative to a group of older adults who performed the same test with no feedback (Stephan et al., 2013). Moreover, when asked to perform the physical test again, participants in the positive-feedback group showed greater strength than those in the no-feedback group. In addition, negative feedback on a cognitive task can increase subjective age (Eibach, Mock, & Courtney, 2010). In this study, older adults who attempted to read blurry text and received no explanation for the blurriness reported feeling older than those who were told the text was blurry because of a printing error and those who read clear text. In addition, the subjective-aging manipulation affected older adults' feelings about themselves particularly when negative aging stereotypes were highlighted: When participants had unexplained reading difficulty, they felt worse about themselves after being primed with negative age-related words than after being primed with positive age-related words. Together, these

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experimental studies demonstrate that subjective age is affected by older adults' beliefs about their performance on physical and cognitive laboratory tests.

The current studies examined the effect of simply participating in an age-relevant cognitive task, such as a memory test, on subjective age. Would participating in a memory experiment "age" older adults? There are many reasons to predict that it would. For example, research shows that younger and older adults hold negative stereotypes about older adults' mental abilities (see Heckhausen, Dixon, & Baltes, 1989; Hertzog, Lineweaver, & McGuire, 1999; Levy & Langer, 1994; Ryan, 1992; Ryan & See, 1993) and that older adults expect to perform poorly on memory tests. Indeed, when older adults hold negative age-related stereotypes or when these stereotypes are highlighted, older adults' performance on memory tests declines (Hess, Auman, Colcombe, & Rahhal, 2003; Hess & Hinson, 2006; Hess, Hinson, & Hodges, 2009; Hess, Hinson, & Statham, 2004; Levy, 1996; Levy, Zonderman, Slade, & Ferrucci, 2012; Stein, Blanchard-Fields, & Hertzog, 2002; see also Horton, Baker, Pearce, & Deakin, 2008, for a review). Likely, these age-related stereotypes are activated by the simple processes of participating in a memory experiment.

Consider a typical procedure for testing the memory abilities of older adults. They are invited to the laboratory to participate in a memory study (typically on a college campus where they are surrounded by younger adults). They are asked to read and complete a consent form that often mentions that their memory will be tested and that their performance will be compared with that of younger adults. Next, the older adults are usually given a demographic questionnaire that asks them to indicate their age, education, and health status, among other things. Following the demographic questionnaire, they are given a standardized test of general cognitive functioning, such as the Mini-Mental State Exam (MMSE; Folstein, Folstein, & McHugh, 1975), which includes simple questions about time and place, as well as other cognitive indicators. Next, in the memory portion of the experimental session, older adults are given a list of items to study and then a memory test. One could argue that each phase of this procedure provides cues to older participants about their age classification and stereotypes regarding their age group. Thus, one might predict that simply participating in a standard memory experiment would subjectively age older adults.

The current studies were designed to test this hypothesis. In four studies, we examined whether participating in a standard memory experiment (Studies 1–3) or expecting to participate in one (Study 4) would lead older adults to feel older. In each study, we examined older adults' subjective age at baseline and after participating in or being given instructions to participate in a memory experiment.

Study 1

In Study 1, we examined the effect of participating in a typical memory experiment on older adults' subjective age. We hypothesized that older adults would feel older after participating in a memory experiment than they did at baseline.

Method

Participants. Twenty-three older adults (ages 65–85) from the community surrounding Texas A&M University participated in this study and received a small honorarium. All participants were given the MMSE (Folstein et al., 1975), a brief test that assesses cognitive functioning, including orientation to time and place, memory, language, and praxis. One participant scored lower than 27 out of a possible 30 points on the MMSE; following standard practice, we did not include the data from this participant in further analyses. This left 22 participants (9 female, 13 male) with a mean age of 75.05 years (SD = 5.86) and a mean education of 16.30 years (SD = 4.08).

Procedure. After giving consent, participants completed a short demographic questionnaire that included a question about their subjective age (baseline subjective age). They were asked to indicate how old they generally felt by drawing a tick mark on a line that was 120 mm long. The line contained no markings other than two endpoint age labels ("0" on the far left and "120" on the far right). Subjective age was determined by measuring the distance between the left end and the participant's tick mark in millimeters (1 mm = 1 year). We used an unmarked scale instead of having participants write down a number to prevent them from simply relying on their memory for their baseline response when making their second subjective-age judgment. Following the demographic questionnaire, participants were given the MMSE. Immediately after completing the MMSE, they were given a list of 30 categorizable nouns to study for an upcoming memory test. The memory portion of the experiment lasted approximately 5 min; participants had 2 min to study the list of words and were then given a blank sheet of paper and asked to recall as many of the words as possible in any order for 3 min. After this recall test, participants again rated their subjective age. They were asked to indicate how old they felt at the present moment, in accordance with prior research (Stephan et al., 2013). Again, they were given a line with marked endpoints ("0" and "120") and were asked to indicate their subjective age by placing a mark anywhere along the line.

Results and discussion

As in previous work (e.g., Kastenbaum et al., 1972; Montepare & Lachman, 1989; Rubin & Berntsen, 2006),

older adults reported feeling younger than their chronological age at baseline. On average, participants were 75.05 years old (*SD* = 5.86), but they reported feeling 58.59 years old (*SD* = 13.36) at baseline; the difference was significant, $t(21) = 6.36$, *SE* = 2.59; $d = 2.25$, 95% confidence interval (CI) = [1.45, 3.04].[1]

We now turn to the question of interest: What effect did taking the neuropsychological and memory tests have on participants' subjective age? As predicted, participants reported feeling significantly older after completing the MMSE and the memory experiment than they had at baseline, $t(21) = 2.22$, *SE* = 2.05; $d = 0.67$, 95% CI = [0.20, 1.13]. At baseline, they reported feeling 58.59 years old, but after taking the tests, they reported feeling 63.14 years old (*SD* = 12.26)—almost 5 years older (see the top left panel of Fig. 1). Participants showed typical recall performance, recalling 43% of the categorized words (*SD* = 13%). Of note, though, are the subjective-age data. These data demonstrate that participating in a typical memory experiment is sufficient to make older adults feel older.

Study 2

Study 2 was conducted to determine if the results from Study 1 were replicable and to determine if the effect was specific to older adults. Thus, we compared results from older adults with results from a group of younger adults. We made two additional changes. First, we collected the data online using Amazon's Mechanical Turk; second, we examined the effect of participating in a free-recall experiment alone (without the MMSE) on subjective age. We

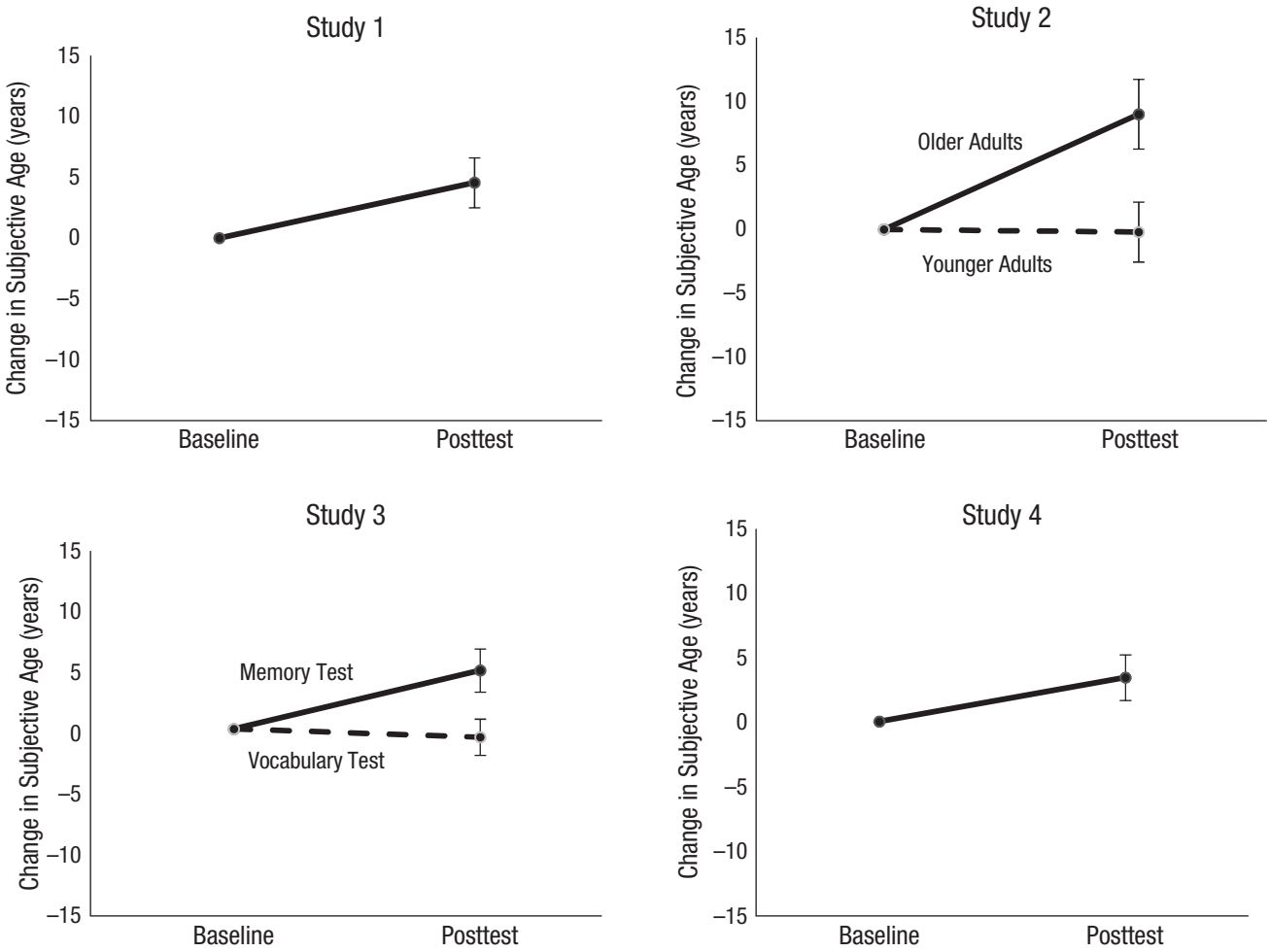

Fig. 1. Results from Studies 1 through 4: participants' subjective age at baseline and posttest. Baseline subjective age was set to zero for each study, and posttest subjective age is plotted as the difference from baseline. In Study 1, older adults took a memory test; in Study 2, older and younger adults took a memory test; in Study 3, older adults took either a memory test or a vocabulary test; and in Study 4, older adults were given instructions for a memory test and reported their subjective age before taking the test. Error bars represent ±1 *SE*.

predicted that participating in a memory experiment would make older adults feel older, but would have no effect on younger adults' subjective age.

Method

Participants. Twenty-five older adults (ages 55–71; 15 female, 10 male) and 25 younger adults (ages 18–29; 11 female, 14 male) participated in this study via Amazon's Mechanical Turk. All participants were located in the United States and were compensated for their participation. The older adults had a mean age of 60.72 years (SD = 4.86) and a mean education of 14.96 years (SD = 2.52). The younger adults had a mean age of 23.80 years (SD = 3.69) and a mean education of 14.72 years (SD = 1.79).

Procedure. The experimental procedure was the same as in Study 1 except as follows. All instructions were presented on the computer screen, and participants were not given the MMSE prior to the memory test. The subjective-age scale was also adapted. Participants were again shown a line with only the endpoints labeled ("0" and "120"). However, in the online version, a lever appeared on the far left side of the scale, and participants were required to use this lever to indicate their subjective age. They were required to click the lever (they could leave it on 0 or slide it along the scale) to advance to the next screen. Although participants did not see numbers along the scale, their placements of the lever corresponded to equally spaced numbers that we had access to in scoring the data.

Results and discussion

As in Study 1, older adults reported feeling younger at baseline than they were (baseline subjective age = 51.48 years, SD = 11.57; chronological age = 60.72, SD = 4.86), $t(24) = 4.49$, $SE = 2.05$; $d = 1.53$, 95% CI = [0.94, 2.11]. In contrast, younger adults reported feeling older at baseline than they were (baseline subjective age = 28.96 years, SD = 11.45; chronological age = 23.80 years, SD = 3.69), $t(24) = 2.13$, $SE = 2.43$; $d = 0.67$, 95% CI = [0.23, 1.10]. This pattern of data is consistent with prior research (Rubin & Berntsen, 2006) showing that younger adults tend to report feeling older than their age and older adults tend to report feeling younger than their age.

Of interest was how participating in the memory experiment affected younger and older adults' subjective age. We examined the effect of chronological age group (younger vs. older adults) and time of report (baseline vs. posttest) on subjective age using a 2 × 2 mixed analysis of variance. There was a main effect of time of report, $F(1, 48) = 6.37$, $MSE = 76.74$, $\eta_p^2 = .12$; overall, participants reported feeling older after the memory experiment (M = 44.64 years) than at baseline (M = 40.22 years). There was also a main effect of age group, $F(1, 48) = 71.85$, $MSE = 256.30$, $\eta_p^2 = .60$; older adults reported a higher subjective age (M = 56.00 years) than younger adults did (M = 28.86 years). Furthermore, there was an interaction between age group and time of report, $F(1, 48) = 6.95$, $MSE = 76.74$, $\eta_p^2 = .13$ (see the top right panel of Fig. 1). Planned comparisons revealed that older adults reported a higher subjective age after the memory test (M = 60.52 years, SD = 16.73) than at baseline (M = 51.48 years), $t(24) = 3.31$, $SE = 2.73$; $d = 0.99$, 95% CI = [0.50, 1.46]. However, younger adults' subjective age did not change from baseline (M = 28.96 years) to posttest (M = 28.76 years, SD = 11.02), $t < 1$. Younger adults recalled more words (M = 54%, SD = 19%) than older adults did (M = 48%, SD = 16%), but the difference was not significant, $t(48) = 1.07$, $SE = 1.50$, $p = .29$; $d = 0.31$, 95% CI = [–0.25, 0.87].

The results from Study 2 replicated those from Study 1, showing that participating in a memory experiment made older adults feel older. Study 2 further demonstrated that this effect was age-specific, as participating in a memory experiment subjectively aged older adults only. It had no effect on younger adults' subjective age.

Study 3

Given the results from Studies 1 and 2, one might wonder whether taking any kind of test is sufficient to make older adults feel subjectively older. To examine this issue, in Study 3 we compared the effect of taking a memory test with that of taking a vocabulary test. We predicted that we would again find that participating in a memory experiment subjectively ages older adults. In contrast, because vocabulary knowledge is not associated with stereotypical age-related cognitive declines, we predicted that taking a vocabulary test would not affect older adults' subjective age. We also changed the way the subjective-age questions were worded. In Studies 1 and 2, as in previous studies in which researchers explored changes in subjective age within an experimental session (Stephan et al., 2013), participants were asked different questions at baseline and after the manipulation (i.e., how old they generally felt and how old they felt at the present time). Perhaps older adults feel younger in general relative to how old they feel at the moment, in which case the wording of the questions could partly explain our results. To ensure that the subjective-age results from Studies 1 and 2 were not due to changes in wording from baseline to posttest, in Study 3 we used the same wording at both time points.

Method

Participants. Fifty-seven older adults (ages 55–70; 36 female, 21 male) completed this online study via Amazon's Mechanical Turk. All participants were located in the United States and received compensation for their participation. Participants had a mean age of 59.31 years (*SD* = 4.09) and a mean education of 15.19 years (*SD* = 1.98). Approximately half of the participants took the memory test (n = 28), whereas the other half took the vocabulary test (n = 29).

Procedure. The experimental procedure was identical to that of Study 2 except as follows. In Study 3, half of the participants were given a vocabulary test instead of a memory test. The vocabulary test took the same amount of time as the memory test (approximately 5 min). In addition, the same subjective-age question was asked at baseline and posttest: "How old do you feel?"

Results and discussion

Data from 3 participants in the vocabulary-test condition were excluded. One participant was an outlier on the subjective-age measure (defined as ≥ ±3 *SD*s from the mean), and 2 participants failed to complete the vocabulary test.

Again, older adults reported feeling younger at baseline (*M* = 51.72 years, *SD* = 13.35) than they actually were (*M* = 59.31 years, *SD* = 4.09), $t(53) = 4.20$, *SE* = 1.81; d = 0.95, 95% CI = [0.63, 1.23]. The memory- and vocabulary-test groups did not differ in chronological age (memory group: *M* = 58.69 years, *SD* = 3.91; vocabulary group: *M* = 60.00 years, *SD* = 4.25), $t(52) = 1.19$, *SE* = 1.11, p = .24; d = 0.33, 95% CI = [–0.21, 0.86]. They also did not differ in baseline subjective age (memory group: *M* = 50.04 years, *SD* = 13.80; vocabulary group: *M* = 53.54 years, *SD* = 12.87), $t(52) < 1$.

Next, we examined the question of interest: How did taking the memory and vocabulary tests affect older adults' subjective age? Subjective-age data were analyzed using a 2 (test type: memory vs. vocabulary) × 2 (time of report: baseline vs. posttest) mixed analysis of variance. There was no main effect of test type, $F < 1$. The effect of time of report approached significance, $F(1, 52) = 3.17$, *MSE* = 35.72, η_p^2 = .06, p = .08; overall, participants reported feeling older after taking a test, relative to baseline. However, this near-significant main effect was qualified by a significant interaction between test type and time of report, $F(1, 52) = 5.51$, *MSE* = 35.72, η_p^2 = .10 (see the bottom left panel of Fig. 1). Planned t tests showed that this interaction was driven by the memory-test condition. Participants felt older after taking a memory test (*M* = 54.79 years, *SD* = 16.79) than at baseline (*M* = 50.04 years, *SD* = 13.80), $t(27) = 2.71$, *SE* = 1.75; d = 0.76, 95% CI = [0.33, 1.18]. They did not feel older after taking the vocabulary test (*M* = 52.88 years, *SD* = 14.13) than at baseline (*M* = 53.54 years, *SD* = 12.87), $t < 1$. Memory performance (*M* recall = 50%, *SD* = 20%) and vocabulary scores (*M* = 90%, *SD* = 8%) were both typical for this age group.

Thus, the subjective-aging effect observed in Studies 1 and 2 was replicated in Study 3, which used a constant wording of the subjective-age question. Again, older adults felt older after taking a memory test. However, they did not feel older after taking a vocabulary test. The fact that subjective age was almost exactly the same at baseline and after the vocabulary test suggests that the nature of the memory test is what "aged" older adults in Studies 1 through 3.

Study 4

Study 4 examined whether simply expecting to participate in a memory test would be sufficient to make older adults feel older. The procedure for this study was identical to that for Study 2, with the exception that we collected the second subjective-age judgment immediately following the instructions for the memory test (i.e., prior to study of the word list). Thus, participants had no actual experience studying for or taking the memory test when they made this judgment.

Method

Participants. Thirty older adults (ages 55–67; 20 female, 10 male) participated in this study online via Amazon's Mechanical Turk. The mean age of this sample was 60.03 years (*SD* = 3.39), and the mean level of education was 14.97 years (*SD* = 2.22).

Procedure. The experimental procedure was the same as the procedure used in Study 2, with the exception that the second subjective-age question was presented after the memory-task instructions were given but prior to presentation of the study list.

Results and discussion

Again, on average, older adults reported feeling younger at baseline (*M* = 51.47 years, *SD* = 21.46) than they actually were (*M* = 60.03 years, *SD* = 3.39), $t(29) = 2.26$, *SE* = 3.79; d = 0.81, 95% CI = [0.39, 1.22]. Next, we examined the effect of the memory-task instructions on subjective age. Results showed that older adults reported feeling older after reading these instructions (*M* = 54.87 years, *SD* = 20.29) than at baseline (*M* = 51.47 years, *SD* = 21.46), $t(29) = 1.93$, *SE* = 1.76; d = 0.50, 95% CI = [0.12, 0.88],

although this difference was just shy of significance, $p = .06$ (see the bottom right panel of Fig. 1). Participants recalled, on average, 48% of the categorized words ($SD = 12\%$)—a level of performance similar to that of the older adults in the previous three studies. Of note, though, are the subjective-age data, which demonstrate that simply expecting to participate in a memory study increased older adults' subjective age.

General Discussion

In these four studies, older adults felt older after taking, or when simply expecting to take, a standard memory test. This subjective-aging effect was specific to older adults, as younger adults did not report feeling older after taking a memory test. Further, the effect was specific to memory, as older adults felt older only after taking a memory test and not after taking a vocabulary test. Thus, simply participating in or expecting to participate in a memory experiment selectively "aged" older adults.

The findings are generally consistent with recent research showing that older adults' subjective age can be influenced by their perceived performance on cognitive and physical tests that relate to age-related abilities (Eibach et al., 2010; Stephan et al., 2013). The current studies suggest that older adults' perception of their ability—rather than their actual ability—affected their subjective age. Using pooled recall data from the older adults in Studies 1 through 3, we found that there was no relationship between actual performance on the memory test and change in subjective age, $r(73) = -.06$, 95% CI = [−.29, .17]. Therefore, current (and perhaps prior) poor memory performance was not associated with increased subjective aging for older adults following a memory test.

In addition, we found that subjective aging occurred even without actual participation in a memory experiment. In Study 4, older adults felt older after simply receiving instructions for a memory test. Thus, it appears that being in a memory-testing context was sufficient to make older adults feel older. We hypothesize that this is because a memory test is an age-relevant test. It assesses a cognitive ability (memory) that older adults expect to have difficulty with because of their age. Encountering a memory test may activate the age-related stereotype that one is expected to have memory problems because of aging. This thought may lead older adults to identify with an older age than they would if they were not having their memory tested. Indeed, when older adults were given a vocabulary test, they did not feel older, arguably because this test assesses a cognitive ability that is not expected to decline with age. Identifying the exact mechanism behind this memory-related subjective-aging effect awaits future investigation. For now, the results simply demonstrate that taking or expecting to take a memory test increases older adults' subjective age.

Our baseline subjective-age results are also consistent with findings showing that older adults generally report feeling younger than their chronological age (e.g., Kastenbaum et al., 1972; Montepare & Lachman, 1989; Rubin & Berntsen, 2006). As other researchers have found, older adults in the current studies reported feeling approximately 8 to 15 years younger than their chronological age at baseline. Thus, participating in a memory experiment reduced this bias and made older adults feel more their age.

Some readers might wonder whether including a baseline measure of subjective age could have made age identity a particularly salient aspect of our testing situation and thus increased the accessibility of stereotypes that associate aging with declining memory performance. Although this scenario is possible, it is unlikely to explain the pattern of our results. If having participants indicate their subjective age at the beginning of each study increased the salience of their age identity, then subjective age should have been unlikely to change significantly over the course of the study. Yet we found significant increases in subjective age in the memory-testing contexts, relative to baseline. Also, age identity was likely not more salient in our studies than it is in most memory studies with older adults. Most researchers routinely include procedures that make age identity a salient feature of the context, such as asking about chronological age or informing participants that their performance will be compared with that of younger adults. Thus, even without a baseline measure of subjective age, age identity is likely to be salient under standard testing conditions.

Across four studies, we found that a 5-min memory test was sufficient to subjectively age older adults an average of about 5 years. What effect would repeated memory testing have on older adults' subjective age? Would they continue to feel older? Future research might examine the long-term and cumulative effects of taking memory tests on subjective age. Also, future research might examine whether there are other cognitive tests that measure age-stereotyped abilities, such as working memory tests, that might make older adults feel older. Conversely, it would be important to determine whether there are some types of tasks that make older adults feel younger. If so, what are the functional outcomes of feeling younger or older? The answers to these questions would be of great practical importance for older adults and would help elucidate the effect of context on self-perceptions of aging.

Finally, the results have implications for research on memory and aging in general. The majority of memory research with younger and older adults uses procedures

similar to the ones used in the current studies. We found that these procedures were sufficient to increase older adults' subjective age. Thus, the current results would seem to suggest that most memory experiments are themselves "aging" older adults.

Author Contributions

L. Geraci developed the study concept. All authors contributed to the study design. Testing and data collection were performed by M. L. Hughes and R. L. De Forrest. M. L. Hughes performed the data analysis and interpretation under the supervision of L. Geraci. M. L. Hughes drafted the manuscript, and L. Geraci provided critical revisions. All authors approved the final version of the manuscript for submission.

Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

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Note

1. All results reported in this article were significant at the .05 level unless otherwise specified.

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